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ABSTRACT

The International Conference on Informatics Education Research (ICIER 2002) sponsored by the International Academy for Information Management (IAIM) provides a forum in which educators, researchers and practitioners in information systems can exchange ideas, techniques, and applications of pedagogy and can react to issues with significant pedagogical implications. Topics of papers include: internship experiences; educating IS professionals; skills needed by e-commerce systems developers; students' expectations of technology use in nonprofit organizations; e-business education; opportunities and challenges for MIS faculty; team-based student projects in information technology; teaching requirements analysis; strategic philanthropy on university campuses; teaching business policy/strategy and MIS strategy; electronic B2B commerce; use of real projects for advanced database applications; online learning effectiveness; Internet-enabled audio communication; online distance education for undergraduates; comparing learning in different instructional environments; concept maps for assessing students' understanding of telecommunications; modern decision analysis at the MBA level; peer instruction interventions; improving use of intermediate student projects; team projects in e-commerce courses; collaborative technologies to facilitate team projects; distance learning environments and model categorization; telecommuting; principles of e-learning; enterprise and e-business concepts in the classroom; curriculum models and accreditation in undergraduate IS education; teaching case studies; incorporating online testing into face-to-face IS courses; determinants of group performance in IS project teams; innovations in business education; integrating strategic management with IS core content; partnerships in education; teaching object-oriented design; problem based learning and action project learning in IS education; cross-disciplinary teams in IS development; use of myths and metaphors in online education; demography and IT/IS students; CIS exam administration; course assessment; managing MIS student expectations; case tool adoption for IT curricula; and undergraduate IS model curriculum. (AEF)

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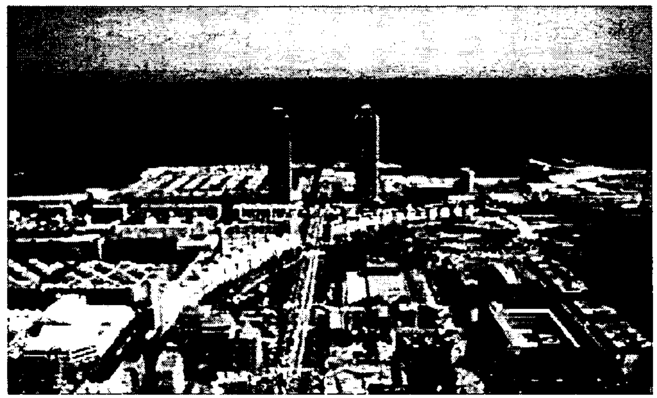
2002

International Conference on Informatics Education Research



December 13-15, 2002
Barcelona, Spain

ICIER 2002
is sponsored by the International Academy for Information Management

2002 International Conference on Informatics Education Research   Barcelona, Spain -- December 13-15, 2002

Friday, December 13

Registration (5:00 – 9:00 p.m.) Lobby   Welcome Reception (6:30 – 9:00)

Saturday, December 14

Registration (8:00 – 5:30) Lobby

Sessions 1A-1D (9:00 - 10:00)

1A – Pedagogical Issues I (Ambassador I)
SESSION CHAIR: Thomas P. Schambach (Illinois State University)

"Student Perceptions of Internship Experiences"
Thomas P. Schambach (Illinois State University), Jim Dirks (Illinois State University)

"Impact of New Economy on IS Education: A Case of UNSW"
Meliha Handzic (University of New South Wales) Paul Scifleet (University of New South Wales)

1B – Curriculum Issues I (Ambassador II)
SESSION CHAIR: Betty Kleen (Nicholls State University)

"An Exploratory Investigation of Requisite Skills Needed by Developers of e-Commerce Systems"
Adel M. Aladwani (Kuwait University)

"Do Accounting Students Have Realistic Expectations of Information Technology Usage in Nonprofit Organizations?" Karen M. Foust (Nicholls State University), Betty A. Kleen (Nicholls State University)
L. Wayne Shell (Nicholls State University)

1C – Research in Progress I (Dover)
SESSION CHAIR: James E. Novitzki (Johns Hopkins University)

"E-Business Education: A Quantitative Review of Program Attributes and Offerings"
James E. Novitzki (Johns Hopkins University)

"Issues and Concerns in the Planning and Development of a Distance Education E-Learning Programme for Technology Managers"
Chris Barry (National University of Ireland Galway), Thomas Acton (National University of Ireland Galway), Patricia Lavin (National University of Ireland Galway)

1D – Panel Presentation (Madison)
SESSION CHAIR: Susan K. Lippert (Drexel University)

"Research and Curricular Issues For the New Millennium: Opportunities and Challenges for MIS Faculty"
**Susan K. Lippert (Drexel University), O. Maxie Burns (Georgia Southern University)
Thomas L. Case (Georgia Southern University), Geoffrey N. Dick (University of New South Wales)
Mary J. Granger (George Washington University**

Sessions 2A-2D (10:30 – 11:30)

2A – Pedagogical Issues II (Ambassador I)
SESSION CHAIR: Annette Lerine Steenkamp (Lawrence Technological University)

"A Standards-Based Approach to Team-Based Student Projects in an Information Technology Curriculum" Annette Lerine Steenkamp (Lawrence Technological University)

"Teaching the Process of Requirements Analysis: Using Comparative Experiments to Inform Teaching Practice"
Robert L. Leitheiser (University of Wisconsin-Whitewater)
Michele Bowring (The University of Manitoba)

2B – Curriculum Issues II (Ambassador II)
SESSION CHAIR: Mary Brabston (The University of Manitoba)

"Strategic Philanthropy on University Campuses: How does it affect Curriculum?"
Camille Françoise Rogers (Georgia Southern University)
Thomas Case (Georgia Southern University)

"Integration and Boundary Fluctuation:Teaching Business Policy/Strategy and MIS Strategy"
Mary Brabston (The University of Manitoba)

2C – Research in Progress II (Dover)
SESSION CHAIR: Thomas Pencek (Meredith College)

"Electronic B2B Commerce: Reasons Adoption was Slower than Forecast"
P. Candace Deans (University of Richmond)
James W.W. Strachan (Global Sources)

"Benefits and Difficulties in Use of Real Projects for Advanced Database Applications"
Lisa M. MacLean (Wentworth Institutute of Technology)
Thomas Pencek (Meredith College)

2D – Panel Presentation (Madison)
SESSION CHAIR: Marianne J. D'Onofrio (Central Connecticut State University)

"Online Learning: Evaluating its Effectiveness"
**Marianne J. D'Onofrio (Central Connecticut State University),
Raymond Papp (University of Tampa), Lance Revenaugh (Cedarville University)**

Luncheon & Annual Meeting (12:00 – 1:00)
(Crillon Room)

Keynote Address (1:00 – 2:00)
(Crillon Room)
"Success and Failure Factors"
Dr. Joey F. George
Professor & Thomas L. Williams Jr. Eminent Scholar in Information Systems
College of Business
Florida State University

Sessions 3A-3D (2:30 – 3:30)

3A – Pedagogical Issues II (Ambassador I)
SESSION CHAIR: Raymond Papp (University of Tampa)

"*Internet-Enabled Audio Communication: A Richer Medium for Students Feedback?*"
Roy D. Johnson (Georgia State University)
Mark Keil (Georgia State University)

"*Is on-line distance education a viable alternative for undergraduates?*"
Geoffrey Dick (University of New South Wales)
Mark Hanna (Georgia Southern University)

3B – Curriculum Issues II (Ambassador II)
SESSION CHAIR: Mary J. Granger (The George Washington University)

"*An Evaluation Methodology Comparing Learning In Different Instructional Environments*"
Katia Passerini (The George Washington University)
Mary J. Granger (The George Washington University)

"*Concept Maps as an Alternative Technique for Assessing Students' Understanding of Telecommunications*"
Lee A. Freeman (The University of Michigan, Dearborn)
Andrew Urbaczewski (Washington State University)

3C – Research in Progress II (Dover)
SESSION CHAIR: Ali Jenzarli, University of Tampa

"*Making the Case for Requiring Modern Decision Analysis at the MBA level*"
Ali Jenzarli (University of Tampa)

"*Continuing Improvements in Team Process: Software Engineering Approaches & Peer Instruction Interventions*"
Martha E. Myers (Kennesaw State University)
Charlotte S. Stephens (Louisiana Tech University)

3D – Panel Presentation (Madison)
SESSION CHAIR: David W. Erbach (Purdue University),

"*In Search of Better Projects: An Open Forum*"
David W. Erbach (Purdue University)
Brian Dobing (Lethbridge University)

Sessions 4A-4D (4:00 – 5:00)

4A – Pedagogical Issues IV (Ambassador I)
SESSION CHAIR: Cynthia LeRouge, (University of South Florida)

"*Teaching Team Projects in E-commerce Development Courses: Design, Management and Assessment Issues*"
Susy S. Chan (DePaul University)

"*The Other Semi-Virtual Team: Using Collaborative Technologies to Facilitate Student Team Projects*"

Cynthia LeRouge, (University of South Florida),
Ellis Blanton (University of South Florida)
Marcy Kittner (University of Tampa)

4B – Curriculum Issues II (Ambassador II)
SESSION CHAIR: Carlos J. Navarrete (California State Polytechnic University, Pomona)

"*Exploring Distance Learning Environments: a proposal for model categorization*"
Eduardo Martins Morgado (UNESP - State University of Sao Paulo at Bauru)
Wilson Yonezawa (UNESP - State University of Sao Paulo at Bauru)
Nicolau Reinhard (FEA/USP - Faculdade de Economia e Administração)

"*Telecommuting: Experiences for Two Samples in Mexico and the United States*"
Carlos J. Navarrete (California State Polytechnic University, Pomona)
Alicia M. Iriberri (Claremont Graduate University)
James B. Pick (University of Redlands)

4C – Research in Progress II (Dover)
SESSION CHAIR: Chris Procter (University of Salford)

"*Proportion, Pedagogy and Processes: The Three P's of E-learning*"
Chris Procter (University of Salford)

"*Bringing Enterprise and E-Business Concepts to the Classroom: The Case of 240co*"
Catherine Hajnal (Carleton University)
Robert Riordan (Carleton University)

4D – Panel Presentation (Madison)
SESSION CHAIR: Beverly K. Kahn (Suffolk University)

"*Navigating through the Maze of Curriculum Models and Accreditation in Undergraduate Information-Systems Education*"
Beverly K. Kahn (Suffolk University)
Nimal Jayaratna (Curtin University)
Nava Pliskin (Ben-Gurian University)
Diane Strong (Worcester Polytechnic Institute)

Sunday, December 15

Registration (8:00 – 11:00 p.m.) Lobby

Sessions 5A-5D (9:00 – 10:00)

5A – Pedagogical Issues V (Ambassador I)
SESSION CHAIR: Nina McGarry (George Washington University)

"Teaching Case Studies: A Collaborative Approach"
James R. Buffington (Indiana State University)
Jeffrey S. Harper (Indiana State University)

"Incorporating On-Line Testing into Face-to-Face Traditional Information Systems Courses"
Nina McGarry (George Washington University)
Mary J. Granger (George Washington University)

5B – Curriculum Issues V (Ambassador II)
SESSION CHAIR: Stephanie Huneycutt (Christopher Newport University)

"Determinants of Group Performance in Information Systems Project Teams: An Empirical Study"
Bouchaib Bahli (Concordia University)
Meral Büyükkurt (Concordia University)

"Trials and Tribulations in the Design and Delivery of an Innovative Business Course in Enterprise Resource Planning in Australia"
Ravi Seethamraju (The University of Sydney)

5C – Research in Progress V (Dover)
SESSION CHAIR: Richard T. Grenci (John Carroll University)

"Integrating Strategic Management with Information Systems Core Content"
Richard T. Grenci (John Carroll University)

"Learning from teaching in information management"
Rik Maes (University of Amsterdam)
Toon Abcouwer (University of Amsterdam)

5D – Research in Progress VI (Madison)
SESSION CHAIR: Charlotte S. Stephens (Louisiana Tech University)

"A Win-Win Proposition for Telecommuter Centers: A Successful Academic and Corporate Partnership for Rural Telecommuting in New England"
Charlotte S. Stephens (Louisiana Tech University)

"A Methodology for Teaching Object Oriented Design and a Preliminary Evaluation"
Han Reichgelt (Georgia Southern University)
Hsiang-Jui Kung (Georgia Southern University)

Sessions 6A-6C (10:30 – 11:45)

6A – Pedagogical Issues V (Ambassador I)
SESSION CHAIR: Willie Yip (The Hong Kong Polytechnic University)

"Application of PBL and APL Strategies in Teaching of Information Systems Courses in Two Countries"
Willie Yip (The Hong Kong Polytechnic University)
Ahmad Ghafarian (North Georgia College & State University)

"Information Systems Development: Using Cross-Disciplinary Teams"
Kathleen Wright (Salisbury University)
Karen Papke-Shields (Salisbury University)
Maty Granger (George Washington University)

"IT meets the Bauhaus: Studio-based teaching and learning in information technology"
Kathy Lynch (Monash University)

6B – Curriculum Issues V (Ambassador II)
SESSION CHAIR: Cindy Randall (Georgia Southern University)

"Demography and IT/IS Students: Is this Digital Divide Widening?"
Cindy Randall (Georgia Southern University)
B. Price (Georgia Southern University)
H. Reichgeld (Georgia Southern University)

"Unearthing Hidden Assumptions Regarding On-Line Education: The Use of Myths and Metaphors"
Jennifer Nicholson (Washington State University)
Suprateek Sarker (Washington State University)

6C – Research in Progress VII (Dover)
SESSION CHAIR: Doris Duncan (California State University, Hayward)

"CIS Exam Administration: Open vs. Closed Notes"
Doris Duncan (California State University, Hayward)

"Course Assessment of an Interdisciplinary, Integrative Team-Taught E-Commerce Course"
Elaine Crable (Xavier University)
Candace Gunnarsson (Xavier University)
Maty Walker (Xavier University)

6D – Research in Progress VIII (Madison)
SESSION CHAIR: Aileen Cater-Steel (University of Southern Queensland)

"Understanding and managing the expectations of foundation MIS students"
Ee Kuan Low (University of Southern Queensland)
Rohan Genrich (University of Southern Queensland)
Aileen Cater-Steel (University of Southern Queensland)
Dave Roberts (University of Southern Queensland)

"A Model of CASE Tool Adoption and Use for Information Technology Curricula"
Kevin P. Gallagher (Florida State University)
Kate M. Kaiser (Marquette University)

Session 7 (1:00 – 2:00)

7 – Joint IAIM/ICIS Curriculum Presentation (Princesa Sofia Hotel – ICIS conference hotel)
SESSION CHAIR: John T. Gorgone, Bentley College

"IS 2002 – Final Report of the Undergraduate Information Systems Model Curriculum"
John T. Gorgone (Bentley College)
Joe Valacich (University of Washington)
Heikki Topi (Bentley College)
Herbert E. Longenecker, Jr. (University of South Alabama)
David L. Feinstein (University of South Alabama)
Gordon B. Davis (University of Minnesota)

STUDENT PERCEPTIONS OF INTERNSHIP EXPERIENCES

Thomas P. Schambach
Illinois State University

Jim Dirks
Illinois State University

ABSTRACT

Internships are often omitted from or put-off until late in some students' programs of study. Furthermore, some academics are reluctant to accept the academic legitimacy of applied work programs, thus cooperative education programs are not offered or encouraged in some curriculums. This study invited students finishing their internship experiences to reflect on the legitimacy of internships as a method to enhance their educational experience and to prepare students for careers as computing professionals. The student subjects in this research were all computing majors (Computer Science, Information Systems, Telecommunications). Results reported in this study are based on two data collection methods. Fixed format scaled responses from a small sample (N=70) were used to gather and analyze description statistics of graduating interns' perceptions. In addition, open format responses were evaluated, coded and summarized from a corresponding sample. Student responses were strongly favorable concerning their internship experiences. Most students described the internship as a great experience that had a major impact on their learning and on their understanding of real world issues and environments. Respondents overwhelmingly recommended that other students get involved in cooperative education opportunities, preferably early within their major program of study.

INTRODUCTION

Businesses need a diverse, well-educated workforce in order to successfully adapt to rapidly changing technology-enabled practices. Thus, to ensure ongoing competitiveness organizations and nations must continually develop their human capital, understanding that the educational system represents the pipeline to enable future success. Ensuring that graduates acquire appropriate competencies before entering the workforce is a joint responsibility of students, educational institutions, and potential employers.

Internships (Co-operative Education) further the social and economic development of society using education programs that expand the learning experience of students by combining academic studies with work experience. Although variations exist, internships typically involve paid, full-time, temporary employment in a structured setting where the student works in a job role related to their degree focus. Internships typically include at least one full-time term (quarter, semester) of employment and sometimes require two terms. Students receive academic credit for their internship and often have assignments requiring them to reflect on the parallels between workplace experiences and the concepts learned in coursework. This experiential learning approach entails a different yet complimentary learning process relative to traditional classroom based educational setting. While an internship experience has some relatively obvious advantages for the student, it also provides significant advantages to the sponsoring firm, to the educational institution, and to workforce preparedness of the nation at large.

Large employers increasingly demand work experience when recruiting new hires, including new graduates. Cooperative education based industrial internship programs provide students an opportunity to gain practical work experience in their area of professional study. Supported by theories of experiential learning, experiential education can increase the motivation of the learner, improve long-term retention, and lead to a greater sense of personal accomplishment (Palmer, 1987; Cross, 1994). Furthermore, an internship demonstrates that the student is both informed and serious about his or her career direction. The significant impact of real-world experience is supported by the report that over 90% of recruiters say internship experience is viewed as an important factor in screening job applicants' resumes (Wilson 1997). Internship programs potentially provide benefits to the student intern, to the sponsoring organization, and to the academic department facilitating the cooperative education relationship.

POTENTIAL BENEFITS OF INTERNSHIPS

As mentioned previously, cooperative education (internships) potentially benefits the student, the employing firm, the associated educational institution, and more generally the preparedness of the national workforce. Benefits to the participating student include increased motivation of the learner, improved long-term retention of material, and a greater sense of personal accomplishment. The intern receives an extended opportunity to apply previously learned conceptual knowledge in a real organizational setting. Such settings are generally more complex than can be simulated in classroom based exercises or case studies. This real-world encounter reinforces conceptual learning, makes it more visible, and emphasizes task importance. Moreover, working in organizational settings makes the intern more aware of the importance of 'soft skills' such as effective communication, social interaction, teamwork, and ability to problem-solve in environments where defining the problem is a major part of the overall job. Other benefits for the intern include clarification of career goals, awareness of organizational settings, clarification of valuable competencies, increased relevance of learning, establishing self-confidence, financial assistance for educational expenses, contacts with and previews of potential employers, exposure to working role models (potential mentors), and an increase in marketable job skills that often positively impact employability and starting salary. Importantly, internships grant an opportunity to verify career interest and desire to pursue a career in a given profession or specialty area; the opportunity to become more aware of the skills most valued by industry; the opportunity to select courses and steer their remaining course-work based on enhanced perspectives gained during their internships. In addition, student interns reinforce previous course-work and better understand course topics by framing the academic concepts in terms of analogies and perspectives gained during real work experiences.

In return for their mentoring investment, sponsoring corporations obtain relatively inexpensive professional labor while concurrently conducting a pro-longed interview as a basis for hiring decisions. Moreover, a mutually successful internship experience enables an advantageous personal relationship that facilitates recruitment of the student following graduation (Tobias, 1996). Importantly, intern employers engage a cost-effective, low-risk means of evaluating potential future employees. When hired, interns tend to demonstrate high retention based on realistic expectations. Moreover, in tight labor markets firms may experience few graduate applicants if they forego the chance to recruit early in the students' career preparation, since many interns receive offers from their internship employer. Furthermore, the organization may gain new perspectives or practices based on new technologies and techniques that the student intern transfers from their university experiences. Often the students can offer new ideas (based on classroom exposure to new concepts or technologies) and new perspectives. Some internships result in ongoing joint research relationships between the firm, student, and sponsoring university, and provide organizations with opportunities to influence curriculum design and content.

For the associated educational institution internships enable an additional route for communication with the business community. Such liaison enables feedback concerning the relevancy and quality of academic programs. Thus, academic departments' might benefit by strengthening their relationship with industrial partners, while also obtaining feedback (via intern assessment) concerning the quality of their academic product (valued student/graduates). Moreover, feedback from both the sponsoring organization and the student interns provide insights to the skills being sought in industry. These insights assist the department's ongoing efforts in curriculum development and refinement. Such feedback, through direct communication with employers, and intern feedback about competencies used enable educators to adjust course offerings and course content to meet evolving needs of society.

Furthermore, upon returning to the classroom interns often demonstrate more confidence and more responsibility, and through sharing their field experience help to enliven discussion of academic concepts via examples of practical application, thus helping the entire class to better envision the relevancy of conceptual topics.

DEVELOPING THE RESEARCH FOCUS

Although several sources indicate students gain value from the internship experience (Tobias 1996; Wilson 1995), the evidence to support benefit claims is largely anecdotal. For example, the Association for Computing Machinery (ACM) career consultant, Jack Wilson, says it is extremely important in today's business environment to show evidence of relevant work experience. When university graduates are competing for top jobs at top companies they should expect to face tough competition from other academically qualified candidates. According to Wilson, "when you are competing for employment with other great students from good schools, with good grades and skills, your relevant work experience can make a big difference."

While the benefits proposed seem relevant and realistic; it is not evident that everyone concludes the benefits are real or warrant educational consideration. Although encouraged by some academics, experiential learning has skeptics who question the ability of workplace activities to assist in achieving academic goals (Gore and Nelson, 1984); opponents believe experience alone doesn't warrant the awarding of academic credit or academic resources (Whitaker, 1989). Lacking evidence of academic value, college faculty grant relatively limited commitment and support toward experiential learning programs, such as co-ops and internships (Gore and Nelson, 1984). Although experiential learning seems particularly relevant within applied disciplines (Cross, 1994), there is a scarcity of research concerning the success of internships within the realm of information systems education.

In the Applied Computer Science (ACS) programs at Illinois State University students are highly encouraged (semi-mandated) to participate in a relevant computing related internship. While a large proportion of ACS students seem eager to gain an internship experience, others are less enthusiastic, and some are skeptical about delaying their entrance into the real job (permanent employment) market, especially in an era (1998-2000) when jobs were plentiful. A few even voiced the opinion that the internship program is a university supported industrial conspiracy to co-opt talented professional labor at below market wage rates.

RESEARCH QUESTIONS

The purpose of the current study is to analyze data that empirically examines claims related to benefits incurred by student interns. The research questions being evaluated are summarized in Table 1. We anticipate these findings will be meaningful to future students, to curriculum planners, to the faculty supporting the internship program, and to our many industrial partners who continue to demonstrate interest in sponsoring internship contracts and hiring graduates with internship experience.

METHODOLOGY

Graduating internship students are used as the data source of this study in order to obtain credible results from the perspective of prospective internship students. Graduating internship students are defined here as students who have successfully completed an internship experience; however, these students normally have additional course-work to complete before they'll graduate from ACS degree programs. The analysis of survey data was conducted in two ways. First we conducted an analysis of previous student comments concerning internship experiences. This included parsing, coding, categorizing, and summarizing student comments regarding their internship experiences. These comment categorizations were then used in conjunction with a literature review to construct a Likert-type scaled survey instrument. The closed-format survey used a five point scale ranging from 1 = Strongly Agree to 5 = Strongly Disagree.

The scaled survey instrument was completed by a subset of Summer 1997 and Summer 1999 student interns. The scaled survey subset is composed of students who returned their standard internship evaluation forms during regular office hours and thus could be requested to complete this supplemental survey. Statistical results reported in this study are based on 70 scaled-survey responses along with a representative sample of student comments from a larger respondent sample who submitted a standard internship evaluation used by our cooperative education office. Open format narrative responses were culled from optional student replies to the question "What would you tell other young ACS majors trying to decide whether or not to become

TABLE 1
RESEARCH QUESTIONS

The following research questions are based on the perceptions of graduating internship students.	
1.	To what extent did the internship provide an opportunity to gain real-world work experience that seems to be valued by industry/recruiters.
2.	To what extent did the internship provide you an opportunity to verify whether to pursue a career in the I/S profession.
3.	To what extent did the internship provide an opportunity to learn more about a potential employer.
4.	To what extent did the internship provided an opportunity to gain confidence in professional skills and capabilities.
5.	To what extent did the internship provide an opportunity to learn valuable skills that would be difficult to learn in a classroom.
6.	To what extent did the internship provide the background to better understand course-work by comparing course concepts to real world computing experience.
7.	To what extent did the internship provide an opportunity to gain awareness of what skills are used and valued in the workplace.
8.	To what extent did the internship enable improved interpersonal communication skills.
9.	To what extent did the internship enable improved technical skills.
10.	To what extent did the internship provide an opportunity to redirect computing studies toward specific areas of interest.
11.	To what extent did the internship provide an opportunity to select future courses based on a more informed perspective.
12.	Overall, how enjoyable was the coop/internship experience?
13.	Overall, how valuable was the coop/internship experience?
14.	Financial compensation received was good (fair market value).
15.	Would you recommend that other students participate in a coop/internship experience?

involved in the Cooperative Education Program?" Narrative responses were parsed into 145 comments that were then coded for classification. These open format narrative comments are used to add richness and to supplement the descriptive statistical analysis.

RESULTS

Student responses provide strong evidence that the internship experience is worthwhile and valuable. Table 2 illustrates the percent of respondents who agreed or strongly agreed (item response=1), the mean score for the item on a five-point scale, and the standard deviation. The survey items' number reflects the research question from Table 1.

Responses to the first research question show near unanimous agreement that student interns perceive the experience gained to be valuable in terms of industry recruitment. Sixty-seven of seventy respondents believe the internship provided a valuable real-world experience. Eighteen parsed comments relative to this question included several declaring job offers, others noting prospects for future employment with their coop

TABLE 2
DESCRIPTIVE STATISTICS REGARDING INTERNSHIP EXPERIENCE

Survey Item	% Agree or StronglyAgree	Mean Score	Standard Deviation
Item 1: valuable real-world experience	95.7	1.34	.56
Item 2: verify decision on I/S career path	78.6	1.80	.93
Item 3: learn more about a potential employer	87.1	1.66	.90
Item 4: gained confidence in my skills, capabilities	88.6	1.57	.69
Item 5: learned skills difficult to learn in classroom	88.6	1.49	.81
Item 6: background to better understand course-work	84.3	1.76	.81
Item 7: gained awareness of valued skills in workplace	97.1	1.53	.56
Item 8: improved my interpersonal skill	90.0	1.70	.69
Item 9: improved my technical skills	87.1	1.60	.75
Item 10: helped re-direct my studies to area of interest	78.6	1.77	.89
Item 11: enables course selection from more informed basis	68.6	2.10	1.01
Item 12: Overall, how enjoyable was the coop experience	95.7	1.51	.63
Item 13: Overall, how valuable was the coop experience	95.7	1.46	.63
Item 14: Financial compensation received was good (fair market value)	47.1	2.34	1.43
Item 15: Recommend that other students participate in a coop/internship experience (Yes/No item)	97.1		

sponsor, and others declaring valuable experiences that would help build their resume.

Response to the second research question shows strong agreement that the internship helped to verify their desire to pursue a career in the computing profession. While most respondents agreed (79%) only three indicated disagreement with the statement. Coop experience allows students to get a taste of the real-world and thus to verify whether their targeted career area is in fact something they really want to do. For example, "Coop is a great experience—I got a taste of what my future job/career will be like" was reported by one student. In some cases real-world experience can also help confirm areas in which the person does not want to work. For example, one student commented "my coop helped me realize I don't want a career in COBOL coding."

Item 3 three responses demonstrate widespread agreement (87%) that the internship provided the opportunity to learn more about a potential future employer. Limited response variance is reflected in the low standard deviations and seems to reflect widespread respondent agreement concerning the benefits associated with their internship experience. Although the intern program is not intended to lead directly to job offers, several students reported via the free-format evaluation responses that they had accepted jobs with the internship sponsor. This corresponds with verbal comments received from many near-graduation seniors that they intend to start work with their internship sponsor. In addition to "firm" job offers for more senior students, several less advanced students commented on the internship as "a great way to get your foot-in-the-door with a good company" by building a network of business contacts.

Responses to research question four and five demonstrate that approximately 89% of students perceived the internship experience to have increased their professional self-confidence while also providing an opportunity to learn valuable skills that would be difficult to learn in a classroom environment. Student comments indicate learning to work cooperatively in large project teams, and to gain awareness of business etiquette, politics, and ambiguity. In addition, students learned that they can be successful in the semi-structured context of the real world and that there is value to the skills and knowledge they have been gaining from coursework. For example, one student commented that "coop builds confidence in your abilities and the value of what your learning (in class)."

Responses to research question six indicates 84.3% of the respondents believe their internship will improve and benefit their understanding of course concepts by providing real-world experience for comparison and analogy. Narrative responses note the internship was valuable not only for learning new things but also for reinforcing skills learned in the classroom.

Responses to research question seven showed almost all students (97.1%) agree their internship gave them a better awareness of what skills were used and valued in the workplace. Narrative comments suggest benefits in viewing new technologies in use and witnessing emerging technological trends through the eyes of mentors and other professionals.

Responses to research question eight and nine demonstrate that internship enabled students to enhance both their interpersonal communication (90%) and technical skills (87.1%). Many respondents commented that more learning occurs during the coop than in most classes. This tendency was especially salient in regard to soft skills, teamwork, and an appreciation for organizational environments and the realization of uncertainty. Importantly, only one student disagreed that their interpersonal communications skills were improved by their internship. "Soft skill" enhancement was also supported by narrative comments.

Responses to research question ten and eleven display wide-ranging agreement concerning the value of internships to enable more informed direction and decisions concerning the targeting of personal academic programs and courses toward specific career interest areas. Nearly 79% of student respondents agree the coop experience helps in targeting programs of study while approximately 69% believe it will enable selection of courses from a more informed perspective. Analysis of free-form comments indicate that for some students the internship experience came too late in their degree program because their few remaining courses were pre-determined by degree requirements. Other comments noted that the internship experience reinforced existing course-of-study plans rather than enabling new decisions. For example, one student declared "I only became more convinced that I want to take a course involving the design and implementation of web pages." Another student noted that "coop is a good idea; early in curriculum it can reshape your education." Another advantage of an early curriculum internship experience is that it allows for multiple coop experiences in varied work settings. As noted by one aspiring coop enthusiast "Coop is a great experience—I plan to do it again!"

Responses to research question twelve informed us that almost all (96%) respondents found their internship to be enjoyable. Only one respondent disagreed. Moreover, response to research question thirteen demonstrates the students' collectively (96%) perceived value of participation in an internship assignment. Again, only one of seventy respondents disagreed that the internship experience was valuable. Student comments, such as, "the intern experience is invaluable" leave little doubt as to the perceived value of time and efforts devoted to the internship program. In the words of another student "Do it! Coop is a great experience, plus you get paid!"

The only survey item receiving wide variability in response related to the fairness of compensation. Forty-seven percent rated compensation as "good" and nearly 39% rated compensation as "fair" while approximately 14% rated the compensation as poor.

Given that some students delay their internship until the final semester of their senior year it is understandable that some senior students would view internships as a delay in their procuring a real-job at real-job compensation rates (which averaged about $40,000 per year for new IS graduates at the time of the study). Nonetheless, practical experience is required for graduation and so all ACS students must participate in a full term internship or demonstrate an alternative method by which they gained practical IS work (project) experience.

Responses to research question fifteen strongly support the wisdom of "Just Do It". Item fourteen asked for a simple Yes/No answer to the question "Would you recommend that other students participate in a coop/internship experience?" Nearly unanimous (97%) agreement to this question indicates that internship experienced students overwhelming support the merit of cooperative education programs. While many narrative responses encouraged future students to take advantage of internship opportunities, several stronger comments declared the coop experience "should be absolutely required."

DISCUSSION AND LIMITATIONS

Strong agreement, such as demonstrated above for item fifteen, is potentially in-part an artifact of the limited sample used for analysis of scaled responses on a survey distributed by the department's coop coordinator. Nonetheless, respondents were provided with the 'cloak of anonymity' and thus were under no personal threat or influence regarding their responses. Furthermore, the free-format responses received from a larger sample were also nearly unanimous in supporting the value of internship experiences. Even the few negative comments received did not contradict the learning or professional value of a coop experience. The few negative comments received focused on either paying fees for internship course credit, or a feeling that the student had been placed in a non-challenging or unpleasant work context. For example, one student protested "I don't see why we are required to pay ISU for internship hours—I found the job myself and used no ISU resources!" In contrast to this complaint other students noted "it's great that working got me school credit" and that the coop office made finding a placement easy. Another less enthusiastic student noted "it wasn't the experience I was hoping for but now I have a better perspective on the real world." This last, somewhat negative, commentary suggests the student had in fact actually valued (if not enjoyed) the internship experience.

In summary, a vast majority scaled survey responses show coop graduates' perceived multiple benefits and value in their internship experience. Furthermore, approximately 98% of 145 parsed comments were favorable regarding the internship program. Moreover, the fact that intern graduates were willing to voluntarily spend time preparing comments to share perceptions about their internship experience is further evidence of their enthusiastic interest level regarding the coop/internship program.

The following student comments capture the essence of perspectives gathered from student comments. From one pragmatic student we heard "It's a great deal. You get course credit, work experience, and you get paid." A more learning focused comment proclaims, "the amount of knowledge you gain through a coop is incredible" while another proclaims "my work experience complemented my school studies, topics that were unclear in class suddenly made sense when I had the opportunity to work through the issues with a hands-on approach rather than just reading about them." Furthermore, a student providing counsel for new computing majors stated, "I would definitely encourage other students to participate in an internship. The internship provided me with a real sense of how the business world operates and enabled me to apply the knowledge I learned in the classroom to a real world situation." Finally, a senior student claimed the most pragmatic of benefits, "Great news! I will begin full-time employment with CAT in August."

In conclusion, students who have completed internship experiences highly recommend that other students invest in the opportunity to participate in cooperative education programs. The benefits perceived and reported by students include recruitment advantages, an excellent method of learning, better understanding of organizations and career focus, as well as reinforcement of course learned skills and enhanced confidence in their own professional capabilities. For institutions that are interested in serving the needs and values of their student stakeholder this research sends a clear message that students strongly value internship experiences. Institutions, faculty, curriculum planners, future students, and parents need to be aware of the very positive findings concerning participation in cooperative education workplace experiences.

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IMPACT OF NEW ECONOMY ON IS EDUCATION: A CASE OF UNSW

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ABSTRACT

The growing importance of information technology and innovation in the market place brings with it a need for the better management of professional knowledge for knowledge workers in the New Economy. This paper illustrates some major steps underway at the University of New South Wales, Australia towards building an educational system for IS professionals that can meet the requirements of the Knowledge Economy. The paper describes new multidisciplinary curriculum initiatives and instructional learning developments considered or implemented at the School of Information Systems, Technology and Management.

INTRODUCTION

The changing economic landscape, particularly the growing importance of innovations for economic growth and competitive advantage in the New Economy, suggests the need for better management of professional knowledge of future knowledge workers in the field of IS. New-age workers are expected to be skilled at creating, acquiring and transferring knowledge and modifying their behaviour accordingly (Garvin, 1998). They are anticipated to be capable of continually expanding their capacity to create desired results, nurture new thinking patterns, set free collective aspirations and learn how to learn together (Senge, 1990). It is also suggested that inventing new knowledge should be a modern worker's way of behaving or being (Nonaka, 1998).

Organisations' increasing demand for new skills and capabilities for future IS professionals necessitates a corresponding response from the Education sector. In general, these demands have not been adequately addressed (Seufert and Seufert, 1999). Major criticisms are directed at content that does not reflect the cross-disciplinary nature of the field, has no base in reality and does not cultivate creativity and problem solving skills and instructional methods that largely impart knowledge rather than allow constructing it through experience.

The purpose of this paper is to illustrate some major steps made by the University of New South Wales, Australia towards building an educational system for IS professionals that can meet the requirements of the Knowledge Economy. In particular, the paper will describe new multidisciplinary curriculum and instructional/learning developments considered or implemented at the School of Information Systems, Technology and Management.

CONVERGING DISCPLINES

During 1999 the School of Information Systems and the School of Library, Archives and Information Studies at the University of New South Wales joined together to form one new school, the School of Information Systems, Technology and Management (SISTM).[1]

The success of this merger is evident within the teaching programs of the School, which is now able to offer a program of study to students who can select from a range of Information Systems and Information Management courses. At Graduate level the School offers a Masters of Commerce in both Information Systems and Information Management. At Undergraduate level it is possible to undertake a dual major in both Information Systems and Information Management.

It should not be surprising to learn that many students are in fact taking up this opportunity and combining courses as diverse as *Systems Analysis and Design* (IS) with *Information, Knowledge and Society* (IM). Yet for many it will be surprising. Despite the inherent similarities between the disciplines of Information Systems and Librarianship until recent times there had been remarkably little interaction between the practitioners.

With a 'traditional' focus on Management Information Systems (MIS) and formal computer based services that meet organizational and operational needs, the strategic significance of Information Systems to business has seen Information Systems aligned with faculties of Business, Commerce and Economics. Librarianship and information science, with its focus on the management of material artifacts, has traditionally been aligned with the Social Sciences and Arts faculties (Buckland, 1999).

The international landscape shifted considerably in the late 1990s when Schools of both Information Systems and the Information Sciences began to change the focus of their curriculums to reflect requirements driven by the internet, networked telecommunications and the new paradigm of knowledge management (Davis et al., 2001). At the School of Information Systems, Technology and Management accounting for change in the New Economy has resulted in the development of new programmes and new courses that reflect a convergence in the way we think about, and teach, digital technology, information content and business management. The case study at the conclusion of this paper reports on this change through the example of one course: *IMGT2703 Electronic Records Systems*.

MULTIDISCIPLINARY CURRICULUM DEVELOPMENTS

During 2000, a special working party, consisting of representatives from the School of Information Systems, Technology and Management and interested parties from other relevant university schools, developed a new stream of multidisciplinary graduate programmes of study. These programmes are articulated to provide a cross disciplinary perspective on E-Business Management, Knowledge Management and Services Management. The following sections present specific details of each new programme as outlined in their respective proposal documents.

E-Business Management

The first special working party report (Special Postgraduate Coursework Programs: E-Business Management, 2000) describes E-Business in terms of 'doing business electronically,' and differently. It recognises that E-Business involves the use of electronic technologies and the internet together to design, produce, and deliver goods and services—at speed, and globally. It also notes that E-Business operates through new business models, where agility is the key to success and organisational strategies, processes, competencies and cultures are fundamentally changed. Another important aspect of E-Business mentioned is that it blurs the distinction between organisations, customers and suppliers in value chains, and alters the meaning of working in, or for a business. The report further identifies that E-Business involves the gaining and sustaining of competitive advantage against a background of industry and institutional transformation—where competitive advantage is to be found through industry recreation, extending the 'reach' of organisations across space and time, the ongoing enrichment of customers, the application of economic principles in new ways, the development and use of new types of law, the use of new forms of cultural affiliation, the inventive application of technology, and new forms of management.

Although the report clearly states that E-Business depends upon technological expertise, ingenuity, and innovation, it also warns that these competencies will be insufficient to drive business success. It suggests that business success will flow from the design, use and redesign of appropriate and effective business models built around the use of e-technologies, and their management in the midst of profound change. Thus, technology, business models, and management are implicated together in creating successful and sustained E-Business outcomes.

Following this discussion, the report proposes a series of Special Programs in E-Business Management that provide multi-disciplinary perspectives on the conditions and drivers of E-Business success. They explore: alterations to work, organisations and management to accommodate and capitalise on E-

Business technologies; shifts in institutional frameworks which facilitate or condition E-Business—globalisation, communication and information technologies, and economic and legal institutions; transformations in the nature of change, in terms of speed, space, time, interdependencies, and heightened levels of ambiguity; trends, social impacts, long-term effects related to E-Business, and progressive shifts in the nature of E-Business itself.

Knowledge Management

The second special working party report (Special Postgraduate Coursework Programs: Knowledge Management, 2000) provides the following justification for introducing programmes of study in knowledge management. First, the report views *knowledge management* is an emergent response to a 'third wave,' digital or *knowledge economy* that is replacing the industrial society that has prevailed for the last two hundred years or so. Second, the report endorses Drucker's (1993) argument that 'in a knowledge economy the only thing that increasingly will matter in national as well as international economics is management's performance in making knowledge productive.'

Furthermore, it recognises that organisations in the knowledge economy increasingly will inhabit environments that are *chaotic*—where the link between cause and effect becomes difficult to discern, small changes can be amplified beyond comprehension, and the future eludes prediction. The report notes that in this environment, organisations live with an inherent ambiguity, whilst competing on the edge of stability and instability. Only two things are believed to be certain for such organisations—their own decomposition as product/service life cycles rapidly change, and the impossibility of focusing organisational futures around known strategic portfolios. The report argues that survival depends on ceaseless innovation, and a capability to find opportunities for the exercise of new strategies.

The report also argues that, in the knowledge economy, the intellect or knowledge of people will be the primary resource that is accumulated, developed and enhanced in the battle for competitive advantage. It predicts that success will accrue to organisations which can: offer ongoing, enriching service to individual customers, who perceive these offerings not as products but as solutions to their particular problems or needs; establish themselves as integral parts of diverse but relevant value chains that permit the leveraging of resource use, whilst capitalising on their own distinctive capabilities; establish flexible, responsive, proactive—but directed—organisational processes that thrive on change and uncertainty, as means of exploiting market and competitive opportunities routinely and profitably; capitalise on knowledge resources available inside and outside the organisation, through the effective use of technology, diverse cultures, and modes of management that are visionary, change oriented, and inclusive; and mobilise a 'strategic intelligence' that is sufficient to sustain organisational identity and capabilities, whilst negotiating the ongoing, radical change driven by new service offerings.

Finally, the report describes knowledge management as an organisational phenomenon that involves: appreciating differences in types of knowledge and ways of knowing, and their personal, public and cultural manifestations; understanding the underlying economics of knowledge development and use, including the effects of rapid dissemination and the possibility of increasing returns on knowledge resources; accessing forms of legal right and remedy that protect proprietary or user advantages in knowledge resources; appreciating the nature of 'knowledge work,' and the needs and expectations of 'knowledge workers'; appreciating relationships between knowledge, learning and innovation in, and by organisations; designing and negotiating systems for recognising and valuing the knowledge creation and utilisation capabilities of organisations; designing knowledge management architectures, systems and processes in organisations; impacting processes by which knowledge is mobilised, conserved, leveraged and enhanced within organisations; negotiating knowledge creation, diffusion and use within and across organisations and cultures, and in relationships with customers, suppliers and other stakeholders; managing knowledge strategically, in generating new service offerings and enhanced organisational capabilities.

Accordingly, a series of Special Programs in Knowledge Management are proposed and designed to: provide multi-disciplinary perspectives on knowledge management as an emergent organisational phenomenon; provide an orientation to working and managing in contexts where knowledge is a central capability and a driver of organisational success; and provide choice in adapting study programs to academic or work backgrounds and career aspirations or needs.

Services Management

The third working party report (Proposed Special Programs in Services Management, 2001) deals with yet another emerging and ICT based economic development. According to this report, in most Western economies, more than half of the Gross National Product is produced by the 'services sector.' In Australia, the 'services sector' accounts for more than sixty-five percent of Gross National Product, and employs close to seventy percent of the workforce; moreover, it is the fastest growing sector of the economy, and the most resilient during recessions.

The report further notes that so pervasive and important is the services sector becoming that reference is now being made to a services economy as a new 'economic order' or business and management 'paradigm' that will characterise the early twenty first century. However, the report warns that these statistics or characterisations tend to understate the nature of the transformation that is taking place. It reveals that the distinction between goods and services is blurring, both in the minds of customers and in the strategic orientation of organisations. Most products sold not only embody an implicit service (how they will be used); they also are accompanied by a range of ancillary services—to the point where the provision of goods or products is seen simply as part of the provision of services to customers. In this sense, most firms are in the services economy, competing through their differentiated service offerings. According to the report, services thus become the central focus of relationships between any organisation and its customers, and the central focus of organisational strategies and operations.

The report identifies that the critical issue for service oriented organisations is customer satisfaction and enrichment, as assessed in many 'moments of truth.' Consequently, it is being recognised that the *capability* of all those who come into contact with the customer directly or who affect customer experiences in manifold 'moments of truth' is critical to success. For most service oriented organisations this involves the entire workforce. The workforce needs to be *empowered* to represent the organisation in pursuing customer enrichment, and *entrusted* to secure customer satisfaction. It also needs to be *enabled* to pursue such outcomes, in terms of access to information and possession of requisite knowledge, skills and attitudes; such enablement will involve thinking as well as doing, ongoing learning, and capacities for innovation.

The report also suggests that the workforce needs to be seen as the vehicle through which the guiding *strategic intelligence* of the organisation is deployed and realised, as it focuses its endeavours in best representing the organisation. Thus, the workforce needs to understand and embrace the strategic intelligence which guides the organisation. *Location* of the workforce within facilitative structures, work processes and cultures, so that it is capable of generating customer enrichment on an ongoing basis. The report recognises that it is becoming progressively *virtual*—a resource that alters in construction as service offerings vary, and which is increasingly casualised, contract based and mobile.

With respect to managing service oriented organisations the report calls for a new role for management, together with revised approaches to managing. The key role for management will be to leverage the value of the organisation, by creating and re-creating (with all that this entails): A service-orientation; A capable workforce; A guiding form of strategic intelligence; An organisation that is both virtual and agile. This will require new approaches to individual, organisational, and inter-organisational development—as well as new approaches to structuring work, securing commitment, and retaining control.

Consistent with the above discussion, The Special Programs in Services Management are proposed and designed to: provide multi-disciplinary perspectives on Services Management as a social and commercial phenomenon; provide an orientation to working and managing in service oriented environments; and provide choice in adapting study programs to academic or work backgrounds and career aspirations or needs.

INNOVATIVE TEACHING AND LEARNING

One of the major criticisms directed at current IS education is that a large amount of knowledge is imparted to the learner. Another noticeable weakness lies in the neglect of process oriented learning, that is, making the learning and thought process visible in order to develop the learners' metacognition (Joyce and Weil, 1986). There is a call for better balance between the imparting of knowledge to the learner and the learner's own construction of it. A suggestion is made that the quantity of material to be learnt by telling should be reduced to a minimum and that the lesson time should instead be devoted to the cultivation of such qualities as problem-solving, decision making and creativity through self-directed and collaborative learning. The complexities of learning and the large number of interacting factors which affect individual and group learning present many challenges. The following sections provide an overview of the latest innovative approaches proposed and considered for the use at the UNSW's School of Information Systems, Technology and Management in a series of discussion documents.

Technology-Mediated Teaching and Learning

The Discussion Paper on Technology–Mediated Teaching and Learning (2001) states that the design of quality learning draws on the full range of digital and analogue media for its purposes. Currently, the Internet and other networked technologies attract the most interest. The document looks to technology to provide mechanisms and media to support learning strategies in three main modes: Adjunct—in which the technology supplements a course of study offered principally face-to-face; Mixed—in which technology partly replaces elements of traditional class interaction; and Online—in which all the content and processes of interaction are supported by technology.

The document identifies the following as desirable ways in which online technology is used for the three modes of learning described. *Access to a well-structured knowledge base*: Using universal Internet standards, the student can access quality learning materials on demand, which are superior to those available or manageable in face-to-face settings; *Active engagement with content:* On the Internet, this is supported through the setting of tasks that may be published to the group or privately to the teacher via email or a student website. Other active engagement may be achieved through the development of pre-programmed interactive components or simulations that are made accessible through computer labs, face-to-face classrooms or online; *Interaction with the teacher*: Online discussion and dialogue may be held both synchronously through 'chat' sessions or more commonly through asynchronous discussions and bulletin boards. In a fully online course, this is the principal channel of communication within the group, but also in mixed and adjunct modes, it can facilitate interaction over and above that possible within the constraints of a face-to-face class. *Opportunities for interaction with other learners:* The online discussion group also enables student-to-student interaction that may be informal and initiated by the learners or a formal group task set by the teacher; *Individual reflection on learning:* Online learning incorporates explicit instances for reflection and reporting on cognition. Teachers also require ways to look back on the learning process and adjust strategies and activities to redress misconceptions; *Feedback and formative assessment:* Online groups offer an achievable and retrievable record of class interactions as a forum for formative feedback. Individual and confidential feedback may be provided via private threads or email.

Furthemore, the document recommends that these processes within the School should be enabled through *Support for development* and adequate *infrastructure. For teachers*, the recommended support is in the form of: Guidelines regarding minimum standards for course development, design, and delivery; Processes and criteria by which learning materials are to be reviewed; Workshops and individual support in educational design in response to the specific needs of courses offered within a discipline. Technical assistance for staff in content design and interactive media production; Assistance in the transition from classroom to online learning processes, and in the development of adjunct materials through the modeling of best practice; Provision of feedback, in the form of reports from the learning system, on issues arising from student use of mediated learning material; Opportunities to share and discuss practice within the School through the formation of a learning community. *For Students*, the recommended support is in the form of: Specific information about the mediated learning and its use in each course, in addition to the basic *Course Outline* requirements; Training and information to equitably access courseware and other UNSW online resources; Access to technical assistance throughout the duration of a course/program; Prompt and accurate response to inquiries, which will be logged and recorded for later analysis; Opportunities to evaluate and comment on the teaching and learning process throughout a course.

The document also suggests that the School needs to provide necessary infrastructure for the mediated teaching and learning purposes. This infrastructure includes: a technology plan that includes electronic security measures (i.e., password protection, encryption, back-up) to ensure quality standards and the integrity and validity of information held within the online teaching system; a local intranet, accessible to staff and students to enable high-speed access to email, courseware servers and teaching spaces; high-capacity local servers, to store and structure repositories of media content for courses; high speed connection with the external internet, to enable access to the resources and connectivity of this global resource; modem connections for students to access School courses and course repositories from off campus; access to, and support for the software necessary to enable discipline discourse for both on and off campus groups; technical support for commonly used computer platforms and software, which is reviewed annually in the light of new technologies; templates for commonly used educational strategies, student and course web pages to minimise preparation time.

Interactive Teaching and Learning

The promotion of interactive teaching and learning within the School by The Discussion Paper on Interactive Teaching and Learning (2001) reflects recent research into student learning, serves to build a community of practice which values and accommodates student diversity in learning, and is likely to improve the quality of learning experiences and satisfaction with the outcomes. Both staff and students are supported in various ways, to make the most of opportunities for interactive learning and to develop their own skills in interaction. A commitment to moving towards more interactive teaching practices is expected to enhance the quality of learning in the School.

In this discussion paper, learning is recognised not only a process of cognitive development for the individual but also a social process of engagement with others within the learning environment. Recent constructivist theories of learning, place the individual as an active participant in her/his environment, rather than a passive recipient of stimuli. Learning is seen as a process in which the student constructs new knowledge, skills and understandings in response to her/his environment, continually integrating new experiences and information into existing cognitive structures and ultimately transferring that knowledge to new situations. The emphasis is on the *processes of learning*, rather than curriculum content. Principles of so-called deep learning also encourage active engagement with both content and other learners, along with opportunities to reflect on, and consolidate new knowledge into an existing knowledge base. The document supports Vygotsky's description of the ideal as a 'zone of proximal development' in which the individual learner can continually expand knowledge, skills and talents within a supportive framework or scaffold provided by the teacher and institution. Eventually, the ideal graduate becomes an independent learner who can maintain the process of knowledge construction outside of the safety of the institution.

Furthermore, the document suggests three main reasons to teach interactively. First, interactive teaching offers some insight into what students actually know. This is its *summative* function, as it leads to testing and measuring student knowledge and understandings through questions, tests and exams. Second, interactive teaching is *formative.* The teacher seeks to direct students' cognitive processing along particular paths through conversations or dialogue. The resulting cognitive experience of the students will move them towards accepted conceptions of the topic within the discipline. Third, interactive teaching is *motivational.* A teacher has a responsibility to keep students interested, and this is more easily done when the student is actively involved. When teachers ask students to work in small groups on a case study or problem, the resulting discussion not only serves to build new knowledge, it also serves to motivate students. The anticipation of feedback from their peers or the teacher is a strong incentive. Interactive teaching methods can address each of these issues. Through well-designed learning processes, new material can be integrated into a student's existing set of knowledge constructs in a way that provides for a deeper level of understanding to occur.

The document notes that the following five skill-sets of teachers are seen to be associated with effective interactive learning by students: Using and Developing Professional Knowledge and Values; Communicating, Interacting and Working with Students and Others; Planning and Managing the Teaching and Learning Process; Monitoring and Assessing Student Progress and Learning Outcomes; and Reflecting, Evaluating and Planning for Continuous Improvement. In order to promote, maintain or develop these skill-sets by its academic staff, the School provides: opportunities for staff to discuss and evaluate interactive teaching; regular dissemination of current developments related to interactive teaching of disciplines of the School; technical resources, teaching spaces and infrastructure necessary for the conduct of a variety of desirable modes of active and interactive learning; staff development activities, such as workshops, seminars and individual coaching to build these skill-sets; time release for the planning and coordination of interactive teaching strategies across Courses and Programs.

In addition, the document recognises that students also need specific competencies, guidance and support if they are to maximise their opportunities to learn interactively. Such opportunities are enhanced by:

Explicit statements by the School of expectations for student participation in learning. These statements should be communicated in advance of study through orientation and induction programs, and ideally should become an sign of the learning culture of the School; Skills in written and spoken communication sufficient for active learning by individuals and positive contributions to the learning of others; A level of metacognition by students regarding their own learning styles and preferences, and an appreciation of the role that culture and upbringing play in determining cognitive frameworks and learning; Self-management skills in identifying goals, setting priorities and independently managing time and resources towards meeting the expectations of a course; Sufficient levels of technological literacy to access the learning materials and processes offered by staff. Support mechanisms, both educational and social, to address skills deficits or other impediments to participation and learning; Mechanisms by which students can provide evaluative feedback to staff in order to improve the design of learning processes.

Cross-Cultural Teaching and Learning

The Discussion Paper on Cross-Cultural Teaching and Learning (2001) reflects the commitment of staff and students to the development of effective cross-cultural learning in the school. This document is part of an ongoing discourse about the kinds of students we have enrolled in our School and the ways in which we wish approach their education.

The document defines culture broadly as a set of values and beliefs shared by a group of people. Membership of such groups may be determined by birth, by choice or life circumstances. Cultural values and beliefs may be anchored by ethnicity, gender, religion, nationality and language. Students and staff in the School of School of Information Systems, Technology and Management have a range of cultural backgrounds and affiliations. In particular, the cultural diversity of students is striking. This diversity poses a number of critical issues for teaching and learning in the School.

In order to help both teachers and students become more culturally aware of themselves and others, and to manage cultural diversity in the School, the document proposes the following eight principles:

1. *Be Consistent.* We need to start by creating an environment in which the rules of interaction are apparent. Rather than trying to second-guess the competing expectations or prejudices of all, create a new 'culture of the classroom' as a model for managing diversity and use this to mirror the global workplace. People respond to clear direction, especially in socially and culturally sensitive contexts or in processes in which they are unsure. A teacher may spend some time during the introductory weeks of a course negotiating what is expected and acceptable to the group regarding interaction, group work, questions and respect. Staff and students should be confident that the general expectations are consistent across Programs and reflect those of the professional world.

2. *Provide Information.* Wherever possible, be aware that miscommunication is the greatest impediment to learning and seek to provide information to all in accessible ways. Course content and assessment details, for instance, can be communicated in the Course Outline, on a website, in class and in individual consultations. Especially in the beginning, take the time to ensure that students have time to become familiar with the class culture and its expectations, and provide information in multiple forms.

3. *Encourage Communication.* As communication is the essential process whereby learning occurs, foster opportunities for students to express themselves. This will involve the use of questioning, discussion, debate class presentations and open invitations to contribute personal experience to cases studies. In class, allow 'wait time' in all interactions to encourage some individuals to overcome their desire to avoid participation. Ask if students know of other ways of approaching issues. Confirm and validate contributions with recognition and thanks. Give notice of a request for participation—don't spring a surprise on an unprepared student.

4. *Avoid Stereotyping.* Stereotyping is how novice learners first sort and process different phenomena. They create large, easily managed categories that make sense of unfamiliar information. However, as expertise grows, learners modify these categories to differentiate the detail found in individuals.

Eventually, we become intellectually aware of individuals differences and can appreciate the dangers of generalisation. If stereotypes are used, for instance, in case studies, recognise this and explain why. Look beyond immediate physical and language differences to seek understandings of intention.

5. *Avoid Ethnocentrism.* Appreciate that there are many views of the world. Avoid deficit models in which we suggest that other cultures simply lack some qualities that we value. Asian students consistently display higher scores on deep approaches and lower scores on surface approaches to learning despite the conception that they want to 'rote' learn content. Promote equitable participation by all, rather than dominance by a few.

6. *Involve Others in Your Development.* To see ourselves as others do is difficult. Check your perceptions with colleagues, and invite peer review of your style of teaching and interaction. Ask others to help monitor your language and interpersonal dynamics. Ask peers to suggest and share techniques for motivating classroom interaction.

7. *Be an Example.* Model inclusive language and behaviour where possible. Carry this through to the handouts, notes and OHTs used in class. Also, admit to uncertainties and ask others to suggest strategies in difficult situations. Seek to use global examples and analogies when illustrating a point. Avoid jargon or colloquialisms and model active listening.

8. *Structure Group Work to Manage Diversity.* Make the team dynamic and its management a part of the assessment. Allow members to contribute in writing as well as verbally. Provide planning sessions to allocate responsibilities and follow-up with support. Make sure each member can access the information necessary for their component of the task—some overseas students do not have the same networks and resources as local students. Don't force representational membership of groups, allow students with a common culture to work together.

CASE STUDY

IMGT2703: Electronic Record Systems

Background

When the School of Information, Library and Archives study joined with Information Systems in 1999 it brought with it the core subjects of an established programme in Information Management. The programme is accredited with the Australian Library and Information Association, Australia's profession organization for the library and information services sector. Among the core courses was provision for a course in *Organisational Recordkeeping: Rights & Responsibilities*. This course had previously been taught as part of an Archives and Recordkeeping programme which has not been continued within the new School.

Although the Archives and Recordkeeping programme was not continued the importance of electronic records, document management and digital content management in networked information systems was widely accepted and provision made in 2001 for the continuation of the course.

During 2000-2001, the School reviewed national and international curriculum developments in the field of electronic records and document management. The result of the review was the development of the course as it now stands. The current curriculum was taught for the first time during Second Semester 2001 and it is being taught again for Second Semester 2002.

Course Description

IMGT2703 provides an introduction to best practice in the management of electronic records. Issues that impact on electronic records management are the focus of the course. These include legal requirements, accountability and the role record management systems play in managing documents as strategic resources. The course covers current approaches concerning electronic records management, the records continuum and strategic organisational planning for information systems infrastructure.

It examines methodologies and technologies for managing electronic records within the context of networked content management. It addresses the role of Metadata, Extensible Markup Language and Electronic Document Management Systems in managing recorded information as corporate assets.

Cohort

The course has demonstrated a broad appeal to undergraduate students from diverse fields of study. Enrolments for the first two years have included students from Accountancy, Computer Science and Software Engineering, with the majority of students attending the course enrolled in the double major of Information Systems and Information Management. Although numbers are still small, with a total enrolment 20 students for Second Semester 2002, what has been surprising is that over a quarter of these students are enrolled in Computer Science or Software Engineering Degrees.

E Business Management

The course empahsises an awareness of the impact of technologies on documenting business activities. A focus is placed on corporate accountability and the legal requirements for evidence of business transactions. Understanding the relationship of these requirements to the design and implementation of electronic record systems is a key objective of the course. Document design and metadata requirements for recording online transactions are examined.

Knowledge Management

The focus of the course is on managing information as a corporate asset. Indexing, metadata and information retrieval concepts from archival science and librarianship provide a foundation for managing records as an information resource. The role records play in corporate memory and organisational knowledge management are examined. The cultural, community and social contexts of recorded information are also investigated and students show a keen interest in exploring topics in this area, e.g. vital records and records of national significance, freedom of information & privacy, corporate accountability, as part of their research project.

Service Management

The course addresses recommendations proposed by Special programs in Services Management, focusing on digital library service models and digital content management models for publishing and managing electronic documents. Requirements for managing electronic records systems have structural similarity to the digital library and content management service models.

Innovative Teaching & Learning

The appeal of the course to computer science and software engineering students was not anticipated. During discussions with the class, students have indicated that this appeal is derived from two aspects of the course:

1. An emphasis on an analysis of the digital object itself (electronic records and documents)

2. The course's emphasis on the use of information technologies in instruction

Document Design and Metadata Laboratories

Using the Extreme programming model of *programming partners* as its reference frame, students 'team-up' in pairs for the course's computer laboratories. During the labs they follow self-directed tutorials designed to introduce SGML/XML and metadata. The labs focus on concepts of logical document design and descriptive metadata and are supported by group sessions (a design workshop) where the relationship of the document and its internal structure to information systems is modeled and discussed. During the second half of semester students gain experience with TRIM, a commercial electronic document management system.

Online Discussion Forum

This year, for the first time, an online discussion forum has been added to the course. The discussion forum, which is structured around formal coursework has been an extremely successful interactive learning activity.

During the semester students are presented with three discussion topics. Each forum is structured around a problem statement or an issue derived from a course reading.

After reading the article for a topic students select to either champion or challenge the discussion topic. Each topic continues for a period of three weeks during which time each student is required to make at least two contributions to the forum. Most students are posting at least three comments to each forum with many students posting four or five times on a topic.

Although students are encouraged to keep postings informal and brief the average posting tends to be about 150-200 words in length. Many postings include references to readings that students identify through their own research and a healthy debate around new and unexpected points often ensues.

The course has a large number of students for whom English is a second language; for these students the forum is proving to be a successful cross-cultural leaning environment. All students are encouraged to express themselves in natural language: text messaging abbreviations (SMS style) and emoticons are welcome.

As time progresses students are beginning to use the forum to discuss the course in a wider context and are using the space to help each other with research.

ENDNOTE

1. The merger is not unique; other examples include the formation of the *School of Information Management and Systems* at Monash University, Victoria, Australia & the *Graduate School of Information Management and Systems*, UCLA, Berkeley.

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AN EXPLORATORY INVESTIGATION OF REQUISITE SKILLS NEEDED BY DEVELOPERS OF E-COMMERCE SYSTEMS

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ABSTRACT

The aim of this exploratory study is to identify the skills needed by developers of Electronic Commerce (e-Commerce) systems. The paper proposes a framework pertaining to three categories of e-Commerce development knowledge: technical, human, and organizational. The initial findings reveal that there are some 16 possible e-Commerce skills tapping the three areas of e-Commerce knowledge. The results also reveal that there are similarities and differences among the perceptions of Information Technology managers and researchers with regard to (1) the relative usefulness of the 16 skills, and (2) the extent to which new graduates of Information Technology programs are equipped with these skills.

INTRODUCTION AND BACKGROUND

No academic institution would argue against the fact that there is a compelling need to produce graduates with sufficient Electronic Commerce (e-Commerce) skills and knowledge to meet today's market needs. The demand of public and private organizations worldwide for professionals with appropriate e-Commerce skills is currently in the increase. e-Commerce development expertise now ranks as the most sought-after skill in the Information Technology community, according to a recent Computerworld survey (Dash 2000).

Despite all of this, to date little research had been carried out to address the issue of e-Commerce skills. Most of available investigations have been carried out in a non e-Commerce context. Ang and Jiwahhasuchin (1998), for example, discussed traditional Information Technology education in Thailand. Tafti and Shirani (1997) examined a model of traditional hierarchy of needs in an end-user-computing environment consisting of users' information-, system-, and technical support-related needs. Gupta et al. (1994) developed two questionnaires to assess a set of specific Information Technology areas and skills, university-industry collaboration activities, and training requirements for Information Technology graduates. Trauth et al. (1993) conducted a study to identify the key skills and knowledge areas that will be required of future Information Technology professionals. Nelson (1991) performed an assessment of educational needs that examined the deficiencies of both Information Technology and end-user personnel. All these studies were conducted in a non e-Commerce environment.

The objective of this study is to fill part of this gap in the Information Technology literature. To achieve this goal, our paper, based on the work of Nelson (1991), Lee et al. (1995), Trauth et al. (1993), and Rada (1999), proposes a three-dimensional proficiency space for identifying the requisite skills needed by developers of e-Commerce systems that covers three sets of knowledge areas: technical, human, and organizational.

INSTRUMENT DEVELOPMENT, DATA COLLECTION, AND RESULTS

To develop the research instrument, we first interviewed the Information Technology manager (or a representative) in 7 prominent private and public Kuwaiti organizations. During the interviews we asked them to discuss the basic areas of knowledge needed by developers of e-Commerce systems and to highlight important skills within each area of knowledge. The interviews revealed several important high-level skills pertinent to the development of e-Commerce systems. Later, we organized these high-level skills in one list, deleted duplicate items from the list, and supplemented the list with certain of the high-level skills that we identified during our literature review. We pilot tested the instrument with two Information Technology managers and two Information Technology researchers. The managers and researchers provided minor albeit useful comments, which we incorporated in our final questionnaire. The final version of the questionnaire consists of two sections. The first section collects information on the respondents' background such as gender, age, education, etc. The second section requires the respondents to rate the usefulness of the 16 high-level skills, categorized into three knowledge areas. It also requires the respondents to indicate the extent to which newcomers who recently graduated from an academic institution are competent in these skills. All questions were anchored around a five-point scale, 1 = very low usefulness/competency, 2 = low usefulness/competency, 3 = medium usefulness/competency, 4 = high usefulness/competency, and 5 = very high usefulness/competency.

Rada (1999) maintains that the effectiveness of a worker can be characterized by how well he/she performs a list of individual tasks. Table 1 shows examples of high-level skills needed by developers of e-Commerce systems. The first set of skills relevant to technical knowledge and includes 6 high-level skills necessary for physical development of e-Commerce systems such as Web programming, Web internetworking, Web security, and the like. The second set of skills relevant to human knowledge and embodies 5 high-level skills such as interpersonal communication, problem solving, conflict resolution, and so on and so forth. The last set of skills relevant to organizational knowledge and covers 5 high-level skills such as the ability to facilitate the integration between the e-Commerce system with the organization and existing information technologies.

The questionnaire was sent to the Information Technology manager (or a representative) in 15 private and public organizations operating in Kuwait and to 15 Information Technology academicians/consultants. All questionnaires that were sent were completed and returned to the author. Table 2 summarizes usefulness rankings of high-level skills needed by developers of e-Commerce systems as seen by Information Technology managers and academicians. It is evident from the table that there are some agreements and disagreements among Information Technology managers and academicians with regard to usefulness of the different skills needed for developers of e-Commerce systems. For example, both groups of Information Technology managers and academicians agree that web security, networking and programming skills are important for e-Commerce professionals. However, the same two groups disagree with regard to the importance of organizational goals and procedures. While Information Technology managers perceive organizational goals as less useful a skill to the work of e-Commerce developers, Information Technology academicians see the opposite. Information Technology academicians rank understanding the goals of the organization as the third most useful/important skill for work in an e-Commerce context. In the same vein, while Information Technology managers rank organizational procedures high in the usefulness scale, Information Technology academicians put the same skill last in the usefulness list. An interesting finding that comes out of our study is that Information Technology managers believe that skills relevant to the technical knowledge area (web security, web networking, web programming, web databases, web management, and web site design) are

TABLE 1
HIGH-LEVEL SKILLS NEEDED BY DEVELOPERS OF E-COMMERCE SYSTEMS

Knowledge Area	High-level Skill
Technical	Web programming
	Web networking
	Web databases
	Web security
	Web management
	Web site design
Human	Interpersonal communication
	Problem solving
	Conflict resolution
	Collaboration
	Dealing with change
Organizational	Organizational goals and objectives
	Organizational policies and procedures
	Organizational functions and processes
	Organizational culture
	Organizational constraints

the most useful skills needed by developers of e-Commerce systems. In addition, Information Technology academicians to some extent share this view except the fact that they believe problem solving and understanding organizational goals and objectives are more useful than some technical skills such as web management.

Table 3 shows Information Technology managers and academicians' ratings of the extent to which recently graduated Information Technology professionals are competent in e-Commerce skills. The table reveals that once again there are some similarities and differences among Information Technology managers and academicians perceptions with regard to perceived e-Commerce skills and knowledge of recently graduated Information Technology professionals. For instance, both groups of Information Technology managers and academicians agree that newly graduated Information Technology professionals are well trained in interpersonal communication, problem solving, collaboration, and dealing with change. Nonetheless, the perceptions of Information Technology managers and academicians differ with regard to the level of training that newly graduated Information Technology professionals receive on several skills, most notably the preparation they receive on web security, conflict resolution, web programming, web site design, understanding organizational goals, and following organizational procedures. Although Information Technology managers perceive newly graduated Information Technology professionals as inadequately trained on web security, web programming, web site design and understanding organizational goals, Information Technology academicians believe their students are getting adequate training on these subjects. Moreover, whereas Information Technology managers perceive newly graduated Information Technology professionals as adequately trained on conflict resolution and organizational policies and procedures, Information Technology academicians believe their students are getting inadequate training on the same two skills. Another interesting finding that comes out of this study is that Information Technology managers believe that students usually come to the market prepared to exploit web databases.

Table 4 summarizes the usefulness-competency gap as perceived by Information Technology managers. Overall, the results reported in Table 4 reveals that Information Technology managers believe that the competency level of new Information Technology graduates in all skills, but conflict resolution, is below what they believe could be useful for their current work. Web security, web programming, web management, web site design, and web networking come at the top of the discrepancy list as perceived by Information Technology managers. Besides that, these skills come at the top of the mismatch between the usefulness-competency gap as perceived by Information Technology managers and the same gap as perceived by Information Technology academicians.

TABLE 2
USEFULNESS RANKINGS OF E-COMMERCE SKILLS—IT MANGERS VS. IT ACADEMICIANS

High-level Skill	Usefulness Rank	
	IT Managers	IT Academicians
Web programming	3	4
Web networking	2	2
Web databases	4	7
Web security	1	1
Web management	6	9
Web site design	5	6
Interpersonal communication	9	8
Problem solving	7	5
Conflict resolution	16	15
Collaboration	13	13
Dealing with change	11	11
Organizational goals and objectives	12	3
Organizational policies and procedures	8	16
Organizational functions and processes	14	10
Organizational culture	15	12
Organizational constraints	10	14

TABLE 3
THE COMPETENCY OF NEW IT GRADUATES—IT MANGERS VS. IT ACADEMICIANS

High-level Skill	Competency Rank	
	IT Managers	IT Academicians
Web programming	14	6
Web networking	6	2
Web databases	1	7
Web security	16	4
Web management	15	11
Web site design	13	5
Interpersonal communication	8	9
Problem solving	3	3
Conflict resolution	4	14
Collaboration	11	10
Dealing with change	9	12
Organizational goals and objectives	12	1
Organizational policies and procedures	2	15
Organizational functions and processes	5	8
Organizational culture	10	16
Organizational constraints	7	13

TABLE 4
THE E-COMMERCE USEFULNESS-COMPETENCY GAP—IT MANGERS VS. IT ACADEMICIANS

High-level Skill	Usefulness-Competency Gap	
	IT Managers	IT Academicians
Web programming	1.93	0.20
Web networking	1.53	0.20
Web databases	0.67	0.13
Web security	2.67	0.33
Web management	1.60	0.00
Web site design	1.53	0.00
Interpersonal communication	0.60	0.00
Problem solving	0.60	0.00
Conflict resolution	-0.07	-0.40
Collaboration	0.40	-0.53
Dealing with change	0.47	-0.20
Organizational goals and objectives	0.60	0.00
Organizational policies and procedures	0.33	-0.40
Organizational functions and processes	0.07	-0.40
Organizational culture	0.20	0.00
Organizational constraints	0.47	-0.33

Additionally, the table reveals an interesting finding. In spite of the fact that Information Technology academicians believe that newly graduated Information Technology students possess higher competency than required in skills such as collaboration and understanding organizational constraints, Information Technology managers believe that the students should get more training on the same skills. Tables 3 and 4 together reveal another quite an interesting finding. Although they concur that newly graduated Information Technology students have reasonable training on web databases, Information Technology managers believe that the students should get more training on the same to be more useful for the work of the organization.

CONCLUSIONS

According to Rada (1999), many Information Technology jobs go unfilled due to a lack of adequately skilled people to fill them. The goal of this paper was to address this concern by exploring the skills needed by developers of e-Commerce systems. The study proposed a framework pertaining to three categories of e-Commerce development knowledge—technical, human, and organizational—and found some 16 possible high-level e-Commerce skills tapping the three knowledge areas. The preliminary results reveal that there are some agreements and disagreements among Information Technology managers and academicians with regard to usefulness/importance of the different skills needed for developers of e-Commerce systems. The results also reveal that there are some similarities and differences among Information Technology managers and academicians perceptions with regard to perceived e-Commerce skills and knowledge of recently graduated Information Technology professionals. Furthermore, most technical e-Commerce skills come at the top of the mismatch between the usefulness-competency gap as perceived by Information Technology managers and the same gap as perceived by Information Technology academicians.

Given the rapid change in nature of e-Commerce development and consequently the skills needed by developers of e-Commerce systems, managers and academicians worldwide will value the implications of the present empirical investigation. This change is projected to have significant impacts on various elements of the e-Commerce training/preparation system (Heckman 1998). One of the critical challenges facing managers and academicians in this regard, hence warrant further research, is to understand low-level (as opposed to high-level) skills needed by developers of e-Commerce systems.

The practical implications of the present study could be many. However, we limit ourselves to two suggestions that we offer to academic institutions offering programs in Information Technology at this point. The first recommendation is that the Information Technology curriculum should give more emphasis on technical web courses to ensure that graduates have a strong web security, web programming, web networking, web management, and web site design foundation in order to meet the current and future demands of the e-Commerce environment. The greatest transition in job requirements in the Information Technology market has usually occurred for technical knowledge and skills (Todd et al. 1995). The second suggestion is that Information Technology graduates should be equipped with the ability to collaborate with work partners and to cope with the changing e-Commerce environment and demands. Students must be made to realize that the academic education is only to prepare them with a foundation in Information Technology and that the best training it can provide for them is the ability to cooperate with others and to learn in whatever area necessary.

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DO ACCOUNTING STUDENTS HAVE REALISTIC EXPECTATIONS OF INFORMATION TECHNOLOGY USAGE IN NONPROFIT ORGANIZATIONS?

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ABSTRACT

Not-for-profit organizations employ 11% of all U.S. workers; these organizations are often the recipients of hand-me-down hardware and software. This study investigates accounting students' expectations of the information technology available to and used by not-for-profit organizations. In this descriptive study, based on two different surveys, students had much higher expectations of number of paid staff and amount of hardware than the reality of Louisiana nonprofit organizations. Clear discrepancies existed between student expectations of number of software applications in use and actual use reported by nonprofits. Accounting students ranked accounting software as the most important software for nonprofits, yet only 44% of nonprofits reported the use of this type of package. Students clearly think that not-for-profits in Louisiana are more technology-rich and technology-savvy than the not-for-profits report about themselves.

INTRODUCTION

This project investigates the expectations of upper-level accounting students regarding the availability of information technology (IT) in private nonprofit organizations in Louisiana.

Researchers, practitioners, and academicians have been calling for changes in the accounting curriculum for the past 15 years (American Accounting Association, 1986; Accounting Education Change Commission, 1996; Russell, et al, 2000). Comments from one university that formed a Curriculum Review Team (CRT) and surveyed all stakeholders of the accounting department included "concern among faculty about the (in)ability of the department's curriculum to prepare students adequately for the rapidly changing and complex accounting environment they would enter upon graduation." The CRT's research indicated that "both the stakeholders and commentators in the literature expressed the view that accountancy teaching is too divorced from 'real-world' situations . . ." (Porter, 1999).

Yet in the process of upgrading the curriculum to include more technology, to require accounting information system courses as well as a varying number of computer information systems or computer science courses, have we led the students to expect more technology than is actually available in the "real world"?

According to John Palmer Smith (2000), "there are now more than 1.5 million nonprofit organizations in the United States." Approximately seven percent of all paid employees in the United States work for nonprofit organizations. If the full-time equivalent of volunteer workers for nonprofits is included, the total accounts for about eleven percent of United States workers. Why should the researchers study a segment that's a relatively small part of the economy? Today's accountants, indeed all workers, are less likely to hold one job over their careers than in past decades. Job and career changes increase the likelihood of working in a not-for-profit organization over a worker's career. Also, accountants are often in contact with not-for-profit organizations away from their jobs—they are volunteers for churches or community organizations, for example.

Kleen and Foust (2001) found that Louisiana nonprofit organizations often had no organization-owned computers. Those nonprofits having computer hardware frequently used only a very few application software packages. Only 44 percent reported using any type of accounting software package such as Peachtree, Quick Books, etc.

Companies and organizations in the "for-profit" world regularly upgrade their computer hardware and software, resulting in personal computers having a useful business life of three or four years. Many firms give their outdated computers to nonprofits, schools, or employees ("New Uses for Old Computers," 2000). Microsoft has instituted a nationwide program to grant software to higher education, environmental, human service, and civic-related organizations that have nonprofit, tax-exempt status, and adequate hardware to operate the software (Briggs-Harty, 2000; Lundine, 2000). However, if hardware is older "hand-me-downs," many nonprofits may not be able to accept these software grants.

To provide software to nonprofit organizations, service companies have been developed recently. Software companies have been formed that provide online fundraising technology, as well as relationship (members, donors) management technology ("Program helps nonprofits," 2000). Nonprofits are using the Internet for fund raising—not just accepting on-line donations and gifts, but also conducting online auctions. More and more nonprofits are using application service providers (ASPs) to save them money and remove the need for software maintenance. The ASPs provide the software available online and are responsible for keeping it updated. The nonprofit's rental is based on number of users or some other use measure ("Nonprofits Discover," 2001).

An investigation of the literature found no studies directly focused on student expectations of information technology use in nonprofit organizations.

PURPOSE

Not all accounting graduates work for traditional corporations; some will have working relationships with not-for-profit organizations. Whether the IT used within not for profits is state of the art, backward, or in between is a relevant subject of study. More modern not-for-profit organizations may be better able to compete than less modern organizations. Student perception of that IT level in not-for-profits is also relevant. If student perceptions are inaccurate, their training time and job adjustments are often longer.

What are accounting students' expectations of information technology (IT) available to and used by nonprofit organizations for which they may volunteer, be paid staff, audit accounting records, or have some other type of working relationship? The focus of this research is to determine what expectations accounting students in Louisiana public universities have regarding the information technology available to and used by Louisiana nonprofit organizations. How well do these expectations match the reality of IT usage in Louisiana nonprofit organizations? The findings of a survey of accounting students, conducted by the researchers, were compared to results of a recent study of actual Louisiana nonprofit organizations."

METHODOLOGY

The researchers constructed a survey instrument to determine accounting students' expectations of information technology availability and use by nonprofit organizations. The instrument paralleled an instrument used in an earlier study that focused on determining how nonprofits in Louisiana reported using information technology to support their activities and mission. The current instrument was designed for accounting students as the responding group. Students in selected junior and senior-level accounting classes at two Louisiana public universities participated. Classification variables for the student respondents were gender and age group. The researchers obtained approval for the current study through their university's Human Subjects Institutional

Review Board procedures. This data collection does not represent a random sample, but is rather a pilot study. Only limited attempts will be made to conduct hypothesis tests within student respondents, and none between student expectations and actual not-for-profit responses. Where hypothesis test results do appear in the analysis below, it is for two purposes: guiding survey redesign and validating researchers' *a priori* expectations.

Survey questions focused on the following expectations of information technology usage among nonprofit organizations:

- Hardware and software availability
- Productivity software packages in use
- Monitoring of finances/program results (accounting systems)

Analysis of the data was completed using SPSS software. In addition to descriptive statistics that illustrate which areas of IT support are most commonly expected, cross tabulation and correlation tools were used to show how (or whether) the extent of IT expectations varies with the organizations' classification data. Linear regression relates organization paid staff size to number of software applications used. The students' expectations were compared against the actual findings from the previous study of nonprofit organizations in Louisiana.

Investigative questions to be dealt with in the statistical analysis include:

- Student expectations for size of not-for-profit organizations' paid staff and volunteers
- Student expectations of computer availability and operating system currency
- Student expectations of number of software applications used by not-for-profits
- Student expectations regarding use of accounting software
- Student expectations of importance of software applications used
- Student expectations about other information technologies used by not-for-profits

FINDINGS

Fifty-seven accounting students in three accounting classes responded to the survey. Of these students, 77.2% were female. Four-fifths (80.7%) were under the age of 25.

Student Expectations of Not-for-Profit Organizational Staff

As shown in Table 1, although over 90% of students expected a minimum of three or more paid staff in a nonprofit organization, 58.3% of the nonprofit organizations surveyed reported no paid staff. Students also had higher expectations of number of volunteers active in the organization than reported in the survey of actual nonprofit organizations. As shown in Table 2, contrary to student expectations, more than 50% of nonprofits reported 10 or fewer active volunteers.

Student Expectations of Computer Availability and Operating System Currency

Although 98% of students expected the nonprofit organization to own at least one computer, over 50% of nonprofits surveyed reported no organization-owned computers. Over 70% of students expected at least three organization-owned computers; only 24.6% of organizations reported a minimum of three computers. (See Table 3.)

Over one-third (35.1%) of students surveyed expected the computers to be exclusively PCs. Another 61.4% expected mostly PCs. Only 1.8% expected mostly Macs. No students expected exclusive use of Macs by

TABLE 1
NUMBER OF PAID STAFF

Paid Staff	Student Expectations Percentage (n = 57)	Actual Nonprofit Findings Percentage (n = 163)
0	7.0	58.3
1-2	1.8	12.3
3-5	45.6	11.7
6 or more	45.6	17.2
No response	0.0	.6
Totals	100.0	100.0

TABLE 2
NUMBER OF ACTIVE VOLUNTEERS

Number of Volunteers	Student Expectations Percentage (n = 57)	Actual Nonprofit Findings Percentage (n = 163)
10 or fewer	21.1	50.9
11-20	29.8	11.7
21-30	29.8	9.2
Over 30	19.3	27.0
No response	0.0	1.2
Totals	100.0	100.0

TABLE 3
COMPUTERS OWNED BY NONPROFIT ORGANIZATIONS

Number of Computers	Student Expectations Percentage (n = 57)	Actual Nonprofit Findings Percentage (n = 163)
0	1.8	52.1
1-2	26.3	23.3
3-5	42.1	12.9
6 or more	29.8	11.7
No response	0.0	0.0
Totals	100.0	100.0

nonprofits. What operating system do students expect the nonprofits to be using on their computers? The results shown in Table 4 illustrate that students predominantly expected the more recent versions of Microsoft Windows to be in use. For the smaller number of students expecting Macintosh operating systems (not illustrated in Table 4), the respondents once again indicated they expected the more recent versions of the operating systems to be in use. (There were no comparable questions in the earlier survey of not-for-profits.)

Do students expect laptop computers to be in use in nonprofit organizations? As shown in Table 5, almost two-thirds of respondents expected mostly desktop systems to be owned by the organizations; only 3.5% expected mostly laptop systems. Over two-thirds (71.9%) of students expected the computers to be in use in the organization's office. No students expected the organization's computers to be in use in organization workers' homes.

TABLE 4
STUDENT EXPECTATIONS OF OPERATING SYSTEMS IN USE ON PCS (MACS EXCLUDED)
(n = 55)

Operating System	Percentage*
Windows NT, XP, ME, or 2000	57.9
Windows 98	61.4
Windows 95	24.6
MS-DOS	12.3
Other	7.0

*Totals are more than 100% because of multiple answers selected.

TABLE 5
STUDENT EXPECTATIONS OF USE OF LAPTOP AND DESKTOP COMPUTERS
(N = 57)

Type of System	Percentage
Exclusively desktops	29.8
Mostly desktops	64.9
Mostly laptops	3.5
Exclusively laptops	0.0
No response	1.8
Totals	100.0

Students do expect nonprofit organization members/ volunteers to use their home computers for organization work, as shown in Table 6. Only one of the 54 respondents answering this question expected mostly Macs. All others expected either exclusively PCs or mostly PCs. Almost two thirds of respondents (64.9%) expected mostly desktop systems in use by volunteers.

TABLE 6
STUDENT EXPECTATIONS OF INDIVIDUALLY OWNED COMPUTERS USED IN THE ORGANIZATION
(N = 57)

Number of Computers	Percentage
0	8.8
1-2	26.3
3-5	29.8
6-8	14.0
More than 8	21.1
Totals	100.0

Student Expectations of Software Usage

What software applications do students expect the nonprofit organizations to be using? As illustrated in Table 7, student expectations of software used in nonprofit organizations was much higher than what is happening in reality. Only word processing, e-mail, and spreadsheet software were reported in use in more than 50% of nonprofits, although students expected those percentages to be in the 80 to 90 percent or more range. Figures 1a and 1b further illustrate the discrepancy between student expectations of number of software packages in use and the reality of nonprofit organization software usage. The mean number of applications expected by students was 5.11; the mean reported by actual not-for-profits was only 3.33.

What components of accounting packages do students expect nonprofit organizations to use? As illustrated in Table 8, 53 of 57 respondents (93%) expected the nonprofit organizations to use an accounting package and 91% the use of more than one component of the package. This again reflects much higher expectations of accounting package usage than reported in actual nonprofit organizations. The reality is that less than half use an accounting software package, and only 35% use more than one element of it. Figures 2a and 2b clearly illustrate this discrepancy between expectations and reality. The distribution of number of accounting package elements used are dramatically different.

Based on a cross-tabulation of "Number of individually owned computers used" versus "Use of an accounting package," students expected a positive relationship. The percentage of not-for-profits using accounting packages rises with the number of computers, exceeding 90% for the most number of computers category. The data revealed no relation between type of computer (PC versus Mac) or type of computer system (desktop versus laptop) and the likelihood of using an accounting package.

How do students rank the importance of the software applications used within nonprofit organizations? Table 9 below illustrates that while accounting students ranked accounting software first in importance, nonprofit organization respondents ranked it fourth in importance. While nonprofits ranked e-mail third in importance, higher than spreadsheet and accounting packages, students ranked it sixth in importance.

TABLE 7
SOFTWARE APPLICATIONS USED WITHIN NONPROFIT ORGANIZATIONS

Software Package	Student Expectations Percentage (n = 57)	Actual Nonprofit Findings Percentage (n = 163)
Database management	53.0	45.0
Spreadsheet	82.0	51.0
Word processing	88.0	74.0
Contact management	35.0	Not asked
Newsletter/desktop publishing	68.0	42.0
Accounting package	82.0	44.0
E-mail	93.0	56.0
Web-site building package	44.0	17.0
Tax preparation	40.0	Not asked

FIGURE 1A
STUDENT EXPECTATIONS OF SOFTWARE APPLICATIONS IN USE IN NONPROFIT ORGANIZATIONS

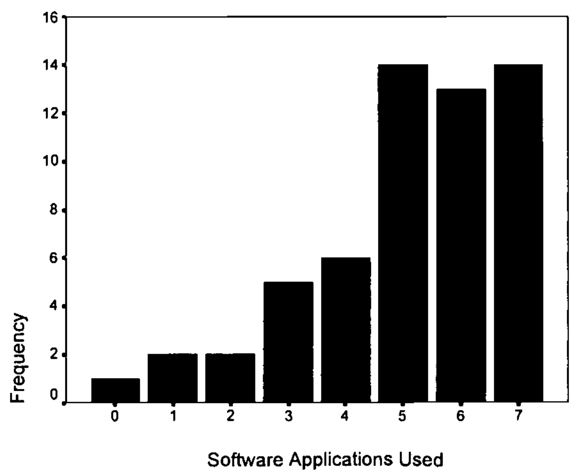

FIGURE 1B
ACTUAL SOFTWARE APPLICATIONS IN USE AS REPORTED BY NONPROFIT ORGANIZATIONS

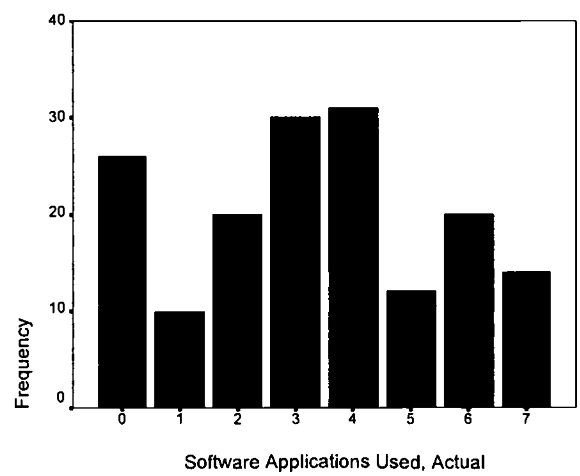

TABLE 8
USE OF ACCOUNTING SOFTWARE

Package	Student Expectations Percentage (n = 57)	Actual Nonprofit Findings Percentage (n = 163)
General ledger	86.0	40.5
Accounts payable	77.0	33.7
Check writing	84.0	Not asked
Payroll	81.0	22.1
Pledges/Membership receivable	75.0	22.1
More than 1 component	91.0	35.0
No accounting package	5.0	36.2
No response	2.0	17.8

FIGURE 2A
STUDENT EXPECTATIONS OF ACCOUNTING SOFTWARE APPLICATIONS IN USE IN NONPROFIT ORGANIZATIONS

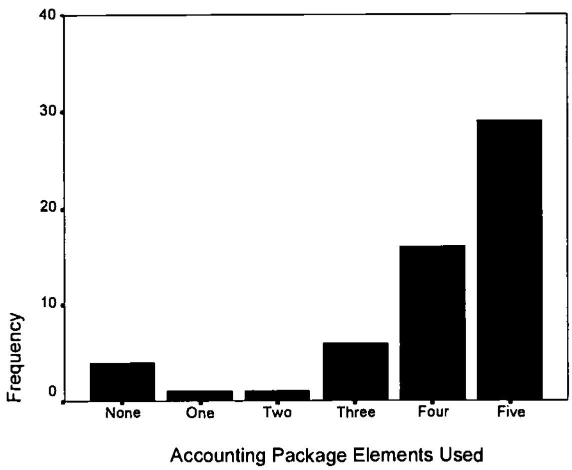

FIGURE 2B
ACTUAL ACCOUNTING SOFTWARE APPLICATIONS IN USE AS REPORTED BY NONPROFIT ORGANIZATIONS

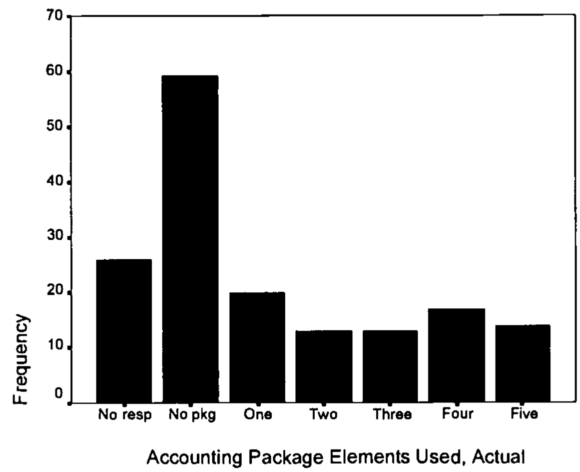

TABLE 9
RANKING OF IMPORTANCE OF SOFTWARE

Software Package	Student Expectations Ranking	Actual Nonprofit Findings Ranking
Database management	3	2
Spreadsheet	4	5
Word processing	2	1
Contact management	8	Not asked
Newsletter/desktop publishing	5	6
Accounting package	1	4
E-mail	6	3
Web-site building package	7	7
Tax preparation	9	Not asked

Student Expectations of Other Technology Usage

Students were also asked about their expectations concerning the use of such items as pagers, cell phones, fax machines, and personal digital assistants (PDAs) in nonprofit organizations. As illustrated in Table 10 below, almost 90% of students expected the use of fax machines, but a minimal 3.5% expected use of PDAs. (There were no comparable questions in the survey of not-for-profits.)

TABLE 10
STUDENT EXPECTATIONS OF USE OF PAGERS, CELL PHONES, FAX MACHINES, AND PDAS
(n = 57)

Device	Percentage
Pagers	40.4
Cell Phones	61.4
Fax Machines	89.5
Personal Digital Assistants	3.5

Correlations

When the student expectations survey results alone were analyzed, there were no significant correlations between expected size of organization and the rank of the software in use. As expected, the correlation between one application's rank and another application's rank were universally negative. Number of volunteers was positively correlated ($r = .282$) with use of pagers. Use of cell phones was positively correlated ($r = .285$) with use of pagers.

Number of paid staff was positively correlated with use of database management ($r = .304$), spreadsheet software ($r = .282$), and accounting software ($r = .282$). Not surprisingly, the use of one part of an accounting package is correlated with use of the other parts.

Regressions

The researchers conducted a linear regression with paid staff size category as the independent variable and number of software applications used as the dependent variable (even though both variables are ordinal and the sample is not random). Student data revealed an apparent relationship between the number of applications used by a nonprofit organization and its number of paid staff. Findings revealed students expected organizations with more paid staff to use more applications. With each change in staff size, applications rise by almost one. This positive relationship matches researcher expectations.

CONCLUSIONS AND RECOMMENDATIONS

Study findings revealed that accounting students' expectations of the information technology available to and used by not-for-profit organizations do not match reality. Students clearly expected more hardware available than what was reported by Louisiana nonprofit organizations. Clear discrepancies existed between student expectations of number of software applications in use and actual use reported by nonprofit organizations. Likewise, students had much higher expectations of accounting package usage than reported in actual nonprofit organizations. While accounting students ranked an accounting package as the most important software application for nonprofit organizations, only 44 percent of nonprofits reported using any type of accounting software; the nonprofit organizations ranked accounting software fourth in importance, behind word processing, database management, and e-mail. The student data revealed an apparent relationship between the number of applications used by a nonprofit organization and its number of paid staff; students expected organizations with more paid staff to use more applications.

The researchers plan further research related to not-for-profit organizations and student expectations The not-for-profit survey instrument needs revision to add hardware questions as were used in the student survey. Future research should include random samples of accounting students in parallel with surveys of not-for-profit organizations. Perhaps a separate survey for CPAs could be conducted as the reality check.

IMPLICATIONS FOR EDUCATORS

Louisiana accounting students clearly think that not-for-profits in Louisiana are more technology-rich and technology-savvy than the not-for-profits report about themselves. The immediate lesson from this is to prepare students for this low-tech reality. This may take only a segment of a lecture, or a short exercise. Students in accounting systems classes can have an opportunity to experience the low-tech reality through real-world not-for-profit organization projects. Internship opportunities in not-for-profit organizations may also provide this reality check the classroom alone does not provide. Service learning may provide students with a much more realistic view of what technology is available to and utilized by nonprofit organizations. The findings of this study also have implications for various other disciplines.

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E-BUSINESS EDUCATION: A QUANTITATIVE REVIEW OF PROGRAM ATTRIBUTES AND OFFERINGS

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ABSTRACT

This paper reviews several previous studies of course offerings in a large number of Electronic Business/Commerce concentrations in both MBA and MS programs. Results from these earlier studies indicate that there is no apparent consensus in what knowledge is core to the Electronic Business/Commerce concentration. This study takes data from these previous studies and looks at the number and types of courses offered in Electronic Business/Commerce concentrations and compares and contrasts what is offered in MS and MBA programs. This analysis reveals that there are some trends that can be identified in Electronic Business/Commerce concentration offerings. Certain core knowledge is offered in many of the programs reviewed, but the level presented varies greatly. The analysis also reveals that there is some correlation among the most common course offerings. A key discriminant is the presence of an E-business marketing course. When this course is present, it often signals the co-occurrence of other specific additional courses, forming a package of core course content. When the course is not part of the program, there is significant variation among the remaining course offerings of the program.

INTRODUCTION

This paper discusses some of the issues and concerns voiced by those tasked with planning and developing Electronic Business or Electronic Commerce programs at schools, and practitioners or students trying to find a "good" E-business program. The main issue seems to revolve around the question of what should an Electronic Commerce/Business program present as key elements. This is not a new discussion, but it is one that has still not been satisfactorily resolved. This paper builds on material developed in three prior studies and applies several statistical tools in an attempt to answer this question. The task is complicated by the fact that Electronic Business/Commerce programs, although most often found in MBA or MS in Information Systems business programs, can also be found in Marketing, Arts and Science, Computer Science, and Engineering programs as well.

BACKGROUND

For the purposes of this paper, academic programs with the names Electronic Business, Electronic Commerce, E-Business, E-Commerce, Internet Commerce, et cetera will be referred to generically as E-business. Organizations continue to be focused on the potential of E-business to increase their competitiveness and improve profitability (Payne, 2001). Four recent studies Novitzki (2002), Whitten and Stephens (2001), Siau and Davis, (2000), and Sendell (1999), presented results of surveys or analysis of E-Business programs. They identified a large and diverse number of course offerings across the schools and programs studied. They presented either lists of courses or summary tables that describe the varied curricular offerings found and discuss their impact. There are many points made, but a consistent theme is the wide variety and number of courses offered in the various programs makes it difficult to determine what is key E-Business knowledge.

A study done by Mitchell and Strauss (2001) identified several skill and cognitive based clusters that they felt were common to many programs. King et al (2001) and Etheridge et al (2001) presented findings which indicated that while there may be some broad clusters of knowledge, there is still considerable variety in course offerings between schools and considerable change in offerings from year to year in this rapidly evolving field. King (2001) also reported that programs are often driven more by faculty skill and stakeholder wants rather than academic focus or need.

There have been several articles (Herrmann and Pernul (1999), Teo and Too (2000), and Williams et al (2000)) which indicate that while there is significant difficulty in identifying the key issues in dealing with E-business, there is an even greater problem developing the programs that can best communicate this information to students and practitioners in the field.

CURRENT STUDY

There is, as was described above, a wide and varied perspective in E-business program offerings. Two characteristics that have not been studied quantifiably is, are there real clusters of knowledge as Mitchell and Struss (2001) contend, and is there a consistency in what is offered across programs? This study looks at the results of three previously mentioned studies (Novitzki (2002), Whitten and Stephens (2001), and Sendell (1999)). It combines the schools and programs used into a large sample of programs to determine such critical points as what does an average E-business program look like? What is the probability that a program will have one of the most common courses? What is the probability of a program having all of the most common courses? Is there any correlation between course offerings in programs that indicate a consistency of offerings or theory? With the wide variation in both school focus and degree offered, a key question that must also be considered is, how much do these factors impact the curriculum that is presented to students?

Sendell (1999) and Whitten and Stephens (2001) reported on E-business programs in Association to Advance Collegiate Schools of Business (AACSB) International accredited schools which are a subset of all schools offering these programs, and provided no comparison to other schools. Novitzki (2002) looked at a wider range of schools including AACSB schools and degree programs certified by Certified E-Commerce Consultants, many of which were not AACSB accredited.

METHODOLOGY

This study combines the schools and programs reviewed in the previous studies to develop a statistically significant sample of E-business programs. The data was reviewed for all the studies and duplicate programs were eliminated from the study. This reduced the number of schools being reviewed to 163. Offerings at these schools were broken down into MBA or MS program as appropriate due to the differences inherent in the focus, course offerings, and course requirements in these two programs.

FINDINGS

The most widely used courses for MBA and MS programs were tabulated and the results placed in Table 1. The table contains the top ten courses offered in the two degrees from a list of over 100 unique courses. The table also shows the difference in E-business concentrations between MBA and MS programs. Only three of the four top MBA courses are in the top four for MS programs, and the differences in offerings between other courses listed shows how degree focus affects course offerings. The table also clearly shows the wide variation in program offerings within each degree program. In the MBA programs only one course, E-business Marketing, is being offered in more than 50% of the programs. The MS situation is similar showing only two courses, E-business Marketing and E-business Technology being offered in more than 50% of the programs studied.

No course was offered in 100% of the schools reviewed. If we look at the top four courses in the MBA programs (the most common number in an MBA concentration), the highest presence in programs for a course was 78% and the lowest was 34%. Given the breadth and number of offerings available noted above, there is a significant variation in what is being offered in programs and some schools could have an entirely different set of courses than the ones shown here. The fact that no specific course was required in all MBA programs also means that the focus of the concentration can change significantly depending on the individual school and program.

TABLE 1
MOST COMMONLY OFFERED COURSES

Most Common Courses	MBA	MS
E-Business Marketing	78%	76%
E-Business Strategy	49%	12%
E-Business Technology	34%	73%
Legal Issues and Ethics	31%	46%
Introduction to E-Business	38%	29%
Supply Chain Management	23%	4%
E-Business Programming	4%	13%
E-Business Security	12%	13%
E-Business System Analysis and Design	6%	9%
Datamining/DBMS	9%	8%

The MS groupings also show wide variation in offerings, and Table 1 summarizes those as well. If we look at the top six courses in these programs (the most common number in an MS concentration), the top two are found in over 70% of the programs, but the lowest was found in only 13% of the programs. This wide range was due to several reasons. The schools offering an MS in E-business were varied with many not being in business schools. Due to differences in the programs' focus, there were more unique courses offered. Thus an E-business concentration in a Computer Science program had proportionally more technical and less business courses than a program offered in a business school. Similarly, a Masters in E-commerce Management in a School of arts and Science had a more balanced list of course offerings. An MS in E-business Marketing would have another mix of classes, while an E-business concentration in an MS in Information Technology from a school of Applied Science had yet another mix of course offerings.

DISCUSSION

One of the most serious problems identified is the complete lack of consistency in what is offered between programs whether they are an MBA or MS. If you take the numbers presented in Table 1 for the various programs, then the statistical likelihood of two programs offering the four most common courses to their students is barely 5% for MBA programs and less than 1% for the six courses in the MS programs. For MS programs, however, the situation is much better when you consider a subset of the courses. If only the top three courses are considered, more than 25% of the programs offer the same courses. This comparison does not help the MBA programs as much with only 12% of the MBA programs containing the top three courses.

Table 2 shows that E-business MBA concentrations, as currently offered by schools, have little consistency, and as a result it is extremely difficult to identify what the core knowledge of the E-business concentration is. Employers can have little hope expecting consistent knowledge when hiring from graduates of more than one E-business program. Students wanting an E-business concentration besides deciding whether they want an MBA or MS, must clearly research each program to see if it provides the skill set that they are looking for.

This study also reveals several points about E-business programs that have both good and bad indications. There is a set of courses which are offered at some programs, but the number offering them is currently very small. In the MS programs the presence of the same three courses in more than 25% of the programs indicates the development of a core. Overall, however, the number of offered courses is large and there is little consistency. With more than 100 unique courses being

TABLE 2
CUMULATIVE PROBABILITIES OF PROGRAM COURSE OFFERINGS

Condition	MBA Programs	MS Programs
Probability of a school offering the most commonly offered course	0.78	0.76
Probability of a school offer the two most commonly offered courses	0.38	0.55
Probability of a school offering the three most commonly offered courses	0.14	0.25
Probability of a school offering the four most commonly offered courses	0.05	0.07
Probability of a school offering the five most commonly offered courses (MS only)		0.01
Probability of a school offering the six most commonly offered courses (MS only)		<0.01

offered in these programs, it is unlikely that a standard core can develop unless this number is significantly reduced. Even though the schools sampled differed in accreditation and base degree, many of the same courses appear in both degrees. Almost 70% of the course offerings are common to both the MBA and MS degrees. There are also indications that the grouping of courses is becoming more consistent. If subsets of schools are considered, then the probability of receiving a standard set of four courses increases considerably. For example, if large AACSB schools and small AACSB schools are considered separately, then the probability of receiving the same four courses in their MBA programs increases to 16% and 12% respectively. For the MS programs there is improvement as well, but it is not nearly as much. When the large AACSB programs are separated from the small AACSB programs, the probability of receiving the same six courses increases to 3% and 1% respectively.

There are some differences in offerings between AACSB and non-AACSB schools. The top four courses in non-AACSB program differ from the small AACSB programs, but tend to match those of the large AACSB schools. One reason postulated for this is, that at schools with small MBA programs, E-business is often taught by faculty from other base disciplines. As a result offerings often tend to build on the base discipline rather than having a strategic E-business focus.

The most interesting issue, that requires more study, is why the E-commerce Marketing course and not the Introduction to E-business course seems to be a major disciminant, as well as the most common course offered in both degrees. Nothing in the literature postulates why that should be true. Yet when the E-commerce marketing course is present, MBA programs are more likely to have one or more the remaining three courses than if the course is not present. Similarly the presence of the E-commerce marketing course in an MS program increases the likelihood of other courses, but not to the extent seen in the MBA programs.

CONCLUSION

E-business programs have been developed in several disciplines. Material presented in E-business concentrations often seems more linked to the base discipline than to the issues and concerns of E-business. There is wide variation in what different schools present as E-business programs, but initial statistical analysis indicates that there is in fact a grouping of knowledge and courses appearing in programs that indicates an internal consistency that is not apparent when looking at the raw data.

The field is still developing and the changes in technical capabilities impact E-business programs as well as organizations. There is obviously still no general consensus on what should be the core knowledge in the concentration. Will these programs eventually develop a standard core? They probably will in the future, but faculty are the ones who will have to make it happen. We must design programs that are truly responsive to the needs of student, but which are also academically sound and which provide the knowledge that our graduates will need in the future as well as now. Many current programs seem to have been created more in response to specific employer needs or faculty skills rather than as a result of a detailed analysis of critical elements and knowledge in the field. If we fail to move beyond the present confused state of programs, it is unlikely that the field will develop as a major independent field of study.

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RESEARCH AND CURRICULAR ISSUES FOR THE NEW MILLENNIUM: OPPORTUNITIES AND CHALLENGES FOR MIS FACULTY

Panel

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ABSTRACT

This panel will explore challenges and opportunities which MIS faculty encounter in the production of scholarly research and the development and dissemination of curricula. Discussion will address two issues including: (1) the trade-off between research and teaching in the promotion and tenure review process; and, (2) the effects of resource constraints on research activity and teaching endeavors.

Institutional demands exist which compel educators to focus their energies toward teaching or research. Universities are typically classified as research or teaching institutions. Research universities place greater emphasis on research than on teaching during promotion and tenure reviews. Teaching is considered important at research universities. Faculty must achieve above satisfactory teaching reviews in order to be considered for upward mobility. Faculty at research universities are often given reduced teaching loads to compensate for the added research demands.

At research institutions, scholarly research is typically assessed using ranking systems where journals and academic conferences are evaluated based on prestige and acceptance rates. The ranking of journals is accomplished on a four-point scale—A, B, C, and D. This classification schema forms the basis for assessment in the research-based institution. Academics are evaluated based on the quality and quantity of research activity. Institutions often maintain specified requirements such as 4 As or 6 Bs necessary for advancement to the subsequent academic rank.

Teaching universities emphasize curricular issues, teaching evaluations, and innovation in the classroom during the promotion and tenure process. Teaching is of greater consequence than research. Maintaining an active research agenda is important but the degree of activity varies across institutions. In addition, even if continuous involvement in research that translates into a consistent stream of peer reviewed journal articles is also a requirement for promotion at these universities, publication in "A" journals is less important. The faculty members at teaching universities typically have a higher teaching load than faculty at research institutions. Teaching load reductions for significant research activity are awarded less frequently at teaching institutions than at research institutions and when awarded, rarely match those typically observed at research institutions. Teaching innovation and novelty in the classroom is rewarded. The use of technology to facilitate learning is often deemed significant.

Academic institutions, both public and private, are impacted by various resource constraints including financial, staffing, technological, and time. Budget cutbacks exist at state institutions. Private institutions are holding spending flat. Many institutions are looking toward its faculty to generate revenue through grant writing. Administrations seek to generate revenue through increased class size. Technological constraints also exist. In a field of study, where change is constant and technologies frequently modify, both internal and external pressures may challenge MIS educators to offer instruction on the utilization and manipulation of the latest technologies. The use of new technologies requires financial resources to purchase the latest hardware and software. In addition, faculty time and intellectual resources are required to "ramp up" on these new technologies. Faculty must not only learn the technology but also transfer this knowledge to undergraduate and graduate students.

Maintaining exemplar educational information systems programs necessitates highly educated faculty, challenging curricula, new technology, and state-of-the-art facilities. Each component requires resources to remain competitive. Trade-offs exist between: (1) increasing faculty salaries, (2) compressing faculty salaries, (3) employing new faculty, (4) paying for faculty conference participation, (5) establishing new academic programs, (6) hiring additional graduate teaching assistants, (7) introducing new technology, and (8) building new facilities. These factors impact faculty at both research and teaching institutions, often making it more difficult to perform satisfactorily in the areas that carry the most weight in promotion and tenure processes: research and teaching.

A discussion pertaining to these issues will be undertaken. Intellectual exchange stimulated through an environment of open discussion is proposed for this panel presentation.

A STANDARDS-BASED APPROACH TO TEAM-BASED STUDENT PROJECTS IN AN INFORMATION TECHNOLOGY CURRICULUM

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ABSTRACT

Team-based student projects have become an intrinsic part of coursework in information technology courses. The rationale is that once students enter the work environment they will be required to work in teams. Challenges of teamwork are reviewed and factors influencing student team performance are identified. An approach is described which deals with four categories of concern when incorporating a team-based project in information technology courses, namely planning, execution, evaluation and team process improvement. The approach stresses the importance of utilizing best practices, as available in international standards, for team projects of a full term duration that is based on a case study. It is argued that such an approach contributes to bridging the gap between student project teamwork based on limited case studies and real-world projects conducted in the competitive business environment of today. The best practices and standards used in 34 classes for eight courses of a master's program in computer and information systems are summarized in the paper. A total of 150 teams participated in these courses.

INTRODUCTION

Team-based student projects have become an intrinsic part of coursework in information technology (IT) courses (Meyer, 2001; Stephens, 2001). The rationale is that once students enter the work environment they will be required to work in teams. Working in a team context challenges team members in a number of ways, such as:

- Teams are composed of individuals with different technical skills, cultural backgrounds, behavioral characteristics, cognitive styles and learning abilities.
- Performance of team members is influenced by the level of teamwork and in-field experience, knowledge of the application domain, pressures of schedule, geographical dispersion, full-time or part-time study.

Various authors have reported on project teamwork in the academic environment (Mennecke et al,1998; Jovanovic et al, 1998; McKendall, M., 2000; Stephens, C. and O'Hara, M., 1999). However, Stephens (2001) has analyzed the literature on student teams finding that a limited number addressed the issue of effective teamwork in the academic context. The fact is that most research equates the experience of student teams with that of professional workgroups despite the fact that the characteristics of the two types of teams are very different. For instance, the control structure, mechanisms for monitoring and managing, and the composition of the two types of teams are significantly different.

A team approach to student projects over a full term has formed part of most of the courses in the master's program in computer and information system at the University of Detroit Mercy. Our experience in 34 IT courses, where teamwork formed part of the pedagogy, has confirmed experiences reported by others (Jones, 1996; Stephens, 2001) regarding the importance of factors such as:

- Thorough planning of the team project
- Appropriate interventions to improve effectiveness of student teams

- Efficient and effective project team leadership
- Active team member commitment and participation
- Appropriate groupware technologies.

In addition it is our experience that using best practices as available in international standards enhances the quality of the project, the deliverables, and provides a mechanism to enhance the value of the student team experience once a student enters the market place. We argue that the approach presented here contributes to bridging the gap between student project teamwork based on limited case studies and real-world projects conducted in the business environment. By adopting a team approach in projects we intend to support and enhance a student's ability to learn by absorbing the subject matter individually and then applying the knowledge gained in a project as part of a team.

Team process categories structure the aspects relevant to planning and implementing a team-based, project-oriented process, referred to in this paper as the team approach, as part of the course pedagogy. Four team process categories are described that concern faculty when incorporating a team-based project in information technology courses, namely planning (in Section 2), execution (in Section 3), evaluation (in Section 4), and team process improvement (in Section 5). The processes described in the Project Management Body of Knowledge (PMBOK) (PMI,2000) have proved very useful for detailing the activities of planning and executing team-based projects. Team process improvement has been done in accordance to practices of the Team Software Process (TSP) (McAndrews, 2000) and processes recommended in the ISO15504 (1998). Section 6 summarizes the relevant industry standards and best practices used in a range of courses with 150 participating teams, and draws some conclusions.

PLANNING CATEGORY

Activities in this category deal with aspects that should be considered when preparing to incorporate the team approach in a course. A number of questions must be resolved, such as:

- What do you include under planning?
- Factors influencing choice of case study
- Do you have industry involvement?
- What Standards and best practices are used?
- Project materials used
- How do you measure outcomes?
- What software is used?
- Do you support classroom teaching with virtual teaching and learning aids?
- Do you maintain a team process database?
- What are your project deliverables?

Planning a team-based project within the context of the course syllabus requires answers to these questions and attention to aspects such as the ones discussed next.

Faculty should determine the standards and best practices applicable for a course with a team project. These standards are relevant for both the course specific teamwork and the project management tasks to bring the teamwork to successful conclusion. Supporting materials must be prepared for the team project, including tutorial material describing the team project, prerequisite knowledge for each team assignment, the case study to be used, the team assignments, the formats of project deliverables (e.g., a requirements specification document, or a design document), and related information.

Where appropriate an industry specialist could be identified and invited to participate in the course and team project. In some projects industry involvement is substantial in that the case study used for the team project is provided and a measure of support is provided for the teamwork. An example is a case study on the E-Business System of a division of an automotive company which was used in two courses (Steenkamp et al, 2002). In other cases the involvement is in the form of presentations on the application domain of the project.

Teamwork related forms, such as a student background evaluation (SBE) form, a team composition form, peer evaluation form, and related forms must be designed. Some generic formats have been developed and are available for use in project-based courses.

The planning and development of the course website needs to be done once some key materials are ready. At first support in establishing such a course website was provided by the Instructional Design Center at the university. More recently the university subscribed to the Blackboard e-learning software platform and faculty members are now able to develop their own course sites, with the necessary training provided by the Instructional Design Studio. Other e-learning software platforms are available, such as the Learning Space environment used at the ITESM in Monterrey, Mexico which is based on IBM's Lotus Notes (Murillo, 1998).

An important aspect in the planning category concerns the logistics arrangements for teamwork (rooms, projection equipment and internet-ready computer facilities, site visits where appropriate, and the like).

Table 1 summarizes typical activities in the planning category.

THE PROJECT EXECUTION CATEGORY

Once a course starts and a team project is due to commence activities in this category need consideration. Aspects include initiating the team project in class, coordinating teamwork, consulting with teams during the project life cycle, and mechanisms for monitoring teamwork. For teams to be successful in performing the technical tasks of a project it is imperative that they adopt a sound development methodology, with rigorous coverage of development process, representation schemes, notations and format of deliverables relevant to the particular course.

Each of the aspects in the project execution category is reviewed next. Table 2 provides a summary of project execution activities from the perspective of the faculty member.

Project Initiation

This aspect includes activities such as establishing the teams, and orienting them regarding the case study and teamwork. Some questions regarding initiating a team project include:

- How is the project initiated?
- How are teams compiled? Team size?
- How are team leaders identified?
- How are standards and best practices introduced to the teams?
- Do you conduct team tutorials?
- How do you monitor progress?

In some cases a prerequisite course may have provided adequate coverage of team collaboration and virtual

TABLE 1
ACTIVITIES IN THE PLANNING CATEGORY

	Planning Category
1.	Select a appropriate case study for the project that integrates the team assignment.
2.	Obtain industry involvement (case study) and arrange for presentation in course session.
3.	Identify appropriate references on teamwork and the virtual team.
4.	Identify appropriate references that orient, guide and support culturally diverse teams.
5.	Identify and obtain appropriate groupware tools to support teamwork.
6.	Identify and obtain appropriate software tools to support project work.
7.	Prepare tutorial materials regarding the team project, the case study, team members' responsibilities, team assignments and schedule. Include details of assignments, formats of project deliverables and final project report.
8.	Develop course website. Prepare teamwork related forms.
9.	Plan Project Review Exercise and reporting format.
10.	Plan team tutorial sessions.
11.	Make logistics arrangements for resources needed for team meetings.

TABLE 2
ACTIVITIES IN THE PROJECT EXECUTION CATEGORY

Project initiation
Introduce the team concept and provide orientation regarding teamwork. 1. Provide orientation regarding team functions in course website, project tools and project techniques. 2. Review standards to be used in the project. 3. Perform Student Background Evaluation Survey using SBE form. 4. Organize students into teams (team size depends on the number of students in the class but should not exceed 5 persons). 5. Identify team leaders based on student background survey; provide orientation to team leaders; make Team Composition Form available on course site. 6. Identify the role players; provide orientation to role players. 7. Take digital photograph of each team; post on course website. 8. Introduce case study. Where appropriate include presentation by industry consultant. 9. Give orientation on team assignments to full class. 10. Make example team project deliverables available to teams (reference only).
Teamwork coordination
1. Organize schedule of consultations with team leaders; with full team. 2. Implement mechanisms for teamwork participation of all team members. 3. Arrange availability of all project resources (computing, software tools, standards). 4. Arrange project presentation schedule.
Project consultation
1. Hold weekly technical consultations with team leaders. 2. Attend at least one team meeting per week with each team to consult on team-specific, technical issues. 3. Provide role-specific orientation for role players of all teams, and follow-up during project.
Project monitoring
1. Monitor team leadership; take corrective action when necessary. 2. Monitor team dynamics and progress; take corrective action when necessary. 3. Monitor all role players' responsibilities and involvement in project. 4. Monitor team collaboration on course site.

team requirements. At a minimum faculty should review the principles of successful teamwork and teamwork methodology. A schedule should be arranged once the teams have been established for future meetings with team leaders and their teams. The initiating aspect also includes orientation regarding the case study, the context and the scope of the team assignments, and other relevant topics. It has proved useful to make project folders from the archive available to teams for reference purposes, ensuring that such folders are not copied when referenced. These project folders have been stored in an archive as a record of past teamwork.

The first team assignment focuses on teamwork planning following an project planning standard. For most of our team projects standard IEEE1058 (1998) was prescribed (refer also to Table 6). The importance of planning for quality as part of any project was also stressed by prescribing the standard for software quality assurance plans (IEEE730, 1998 in Table 6).

Teamwork Coordination

Coordination of teamwork involves the coordination of teamwork within teams, as well as coordinating work with a number of teams in the class. Coordination centers on logistics involving time, resources and location. Answers should be provided to the questions:

- How is teamwork coordinated?
- Do you appoint team leaders, or does the class choose them?
- Do you assign roles for team members?

- Are teaching assistants involved?
- How do you deal with culturally diverse teams?
- How do you handle inadequate understanding within teams?
- How do you handle dysfunctional teams?

Faculty must work with team leaders to ensure that the necessary computing resources, relevant standards and software tools accessible to all members of the team. An equitable team consultation schedule should be followed (weekly meetings are appropriate), and opportunities should be provided for collaboration among teams. It has become evident that a fair amount of cross-training takes place within teams and also among different teams, all beneficial to the overall learning experience.

Project Consultation

Supporting the technical development work of a team project has proven to be most challenging. Some teams with skills and experience in the technical tasks of the project may need limited support. Such teams conduct productive team meetings and produce quality deliverables on time. They are usually keen to receive detailed feedback on deliverables and have a good teamwork dynamic and consequently high morale. The conditions for learning are clearly high in such team. Other teams struggle to come to terms with the context of team assignments for a case study, and to apply theoretical concepts and knowledge. For example, students may have studied a software design methodology, design processes and notations but still have significant problems to model a design for a given subsystem. If and when problems of this kind emerge faculty must increase the level of consultation and support for a team to ensure a successful team experience.

Questions for this aspect include:

- What issues are team-specific and what are of general concern?
- How do you address such issues? (in class/on the website/ during consultation with teams)
- How do you address responsibilities of role players in teams?
- How do you coach team leaders?
- How do you handle inadequate understanding within a team?

Project Monitoring

It is important to implement mechanisms for monitoring team performance. Although specific roles and responsibilities may have been assigned, the team assignments and the schedule reviewed, occasions invariably arise where team members fail to participate effectively. In some cases participation is irregular; deliverables are late, not according to specification or not submitted by the responsible team member at all. Since all teams have a quality assurance role late deliverables causes immediate frustration since the quality assuror does not have the opportunity to review the work before turning it in for grading. An issues like this one must be addressed as soon as it arises to avoid further conflict.

In planning this aspect questions to be answered include:

- How is team progress monitored?
- How do you deal with team discipline?
- How do you deal with dysfunctional teams?
- How do you deal with a discontented team member?
- Do you use groupware/Internet/course website for virtual team monitoring?

TEAM PROJECT EVALUATION

One hopes to determine the outcomes of a team project in terms of the objectives for the course as a whole.

Questions in this category ask:

- How do you evaluate teamwork?
- What percentage of the grade is based on teamwork?
- What measures do you use?
- How do you distinguish team member contributions?

Evaluation of teamwork usually focuses on the deliverables, but may also include evaluation of the team process (Stephens and Myers, 2000) and team collaboration (McKeage et al, 1999). These authors have proposed intervention mechanisms such as evaluating the team process to improve the effectiveness of student teams. We have used project review exercises also, where a team reviews deliverables of another team in the class, or where all teams review a specific deliverable from the project archive. Other mechanisms to determine individual accountability include team presentations, peer evaluations and participation during team tutorials. Table 3 summarizes typical activities in this category.

TABLE 3
ACTIVITIES IN THE TEAM PROJECT EVALUATION CATEGORY

1. Evaluate team deliverables.
2. Evaluate revised team deliverables.
3. Evaluate final project report.
4. Evaluate project review exercise report.
5. Evaluate team progress meeting minutes (submitted by team leaders).
6. Evaluate team member peer evaluations (submitted by each team member individually).
7. Evaluate team member presentations.
8. Evaluate overall team presentation.
9. Assess each team's experience (based on assessment by each team at the end of term).
10. Assess project outcomes.

TEAM PROCESS IMPROVEMENT

Where teamwork forms part of a course it is desirable to establish a defined team process that represents a baseline according to which teamwork may be planned and performed. Defining the team process and documenting each team experience in a team process database make it possible to benefit from good ideas and techniques while avoiding past mistakes or negative outcomes. We need answers to the questions:

- How do you document project outcomes?
- How do you update your team process database?
- What measure and metrics do you use?

The ISO 15504 standard for software process improvement and capability determination (formerly known as SPICE) and CMMI framework which is an integration framework for mature IT (but mainly) software processes have proved useful as references to establish processes and activities for this category. Table 4 lists some typical activities in this category.

TABLE 4
TEAM PROCESS IMPROVEMENT CATEGORY

1. Adopt an industry standard for team process improvement.
2. Archive all A project reports.
3. Archive all A project prototypes.
4. Review teamwork approach (all phases) and analyze students' responses to teamwork experience.
5. Update team process database with project data.

Guidelines regarding how to deal with differences in competence and skills among team members, how to deal with ethnically and culturally diverse team members, resolution of conflicts within teams, alternatives to teamwork in a project-oriented class are valuable for planning team-based, project-oriented courses.

DISCUSSION

The team-based, project-oriented approach described in this paper has matured over a number of years in project-based courses in software engineering, requirements engineering, software design, database design, software process management, software quality assurance, system and information technology architectures, and software system metrics. Data on 34 project-based classes has been accumulated representing teamwork by 150 teams. A comparative evaluation of the team project outcomes of the courses in general, and of the deliverables of specific courses over a number of semesters has revealed a substantial improvement in quality. This quality improvement is partially attributed to the structured project-oriented approach and the use of standardized notations, as well as to the software development methodologies that were adopted in the respective courses.

Table 5 summarizes the standards and best practices used to guide teamwork in the listed courses. Projects were conducted by teams following a three stage process: project planning, project execution, and project review. Industry standards relevant to the tasks and activities of the three stages are provided in Table 5. Using the best practices embodied in these standards has provided faculty with a mechanism to introduce some measure of real-world exposure in the class room. Feedback from graduates who are employed in the IT industry, though very positive, needs to be surveyed to quantify the outcomes of this team approach.

As may be seen in Table 5 planning was a key category for all projects, requiring all teams to use IEEE Std 1058 for planning the teamwork, supported also by the IEEE Std 730 for planning software quality assurance. For the Software Quality Management course the ISO9001 standard was also used for planning the project work. For the course in Software Process Management the organizational life cycle processes of the ISO 12207 Standard and the processes in the process improvement category of the IEEE Std 1074 were used for planning software process improvement projects. Project execution was supported by a range of standards dependent on the course subject. Project evaluation was guided by two standards among a number of other competing ones, namely ISO 15504 and IEEE Std 1028. The project management body of knowledge is documented in detail by PMI (2000) and in IEEE Std 1490 (1998). Although this is a general project management reference the processes described there apply to IT projects also and are valuable for student projects. The Software Engineering Institute, Carnegie-Mellon University has published a number of capability maturity models with key process areas in each of the team process categories discussed in this paper. Exposure to these models provides an additional advantage when conducting team projects for courses other than software process management.

Further analyses of the team project data are planned to determine, for example), team performance versus individual performance of team members in a team, performance of teams in different sections of a particular course, individual performance of team leaders versus performance as team leaders of a team, and similar analyses.

TABLE 5
STANDARDS AND BEST PRACTICES ADOPTED FOR TEAM PROJECTS

Courses	Project Planning	Project Execution	Project Review
Requirements Engineering	IEEE730 IEEE1058	PMBOK IEEE830	ISO15504 IEEE1028
Software Design	IEEE730 IEEE1058	PMBOK IEEE1016	ISO15504 IEEE1028
Database Design	IEEE730 IEEE1058	PMBOK IEEE1016	ISO15504 IEEE1028
Software Process Management	IEEE1074 ISO12207	IEEE1074 ISO12207	ISO15504 IEEE1028
Software Quality Management	IEEE730 ISO9001	ISO9000 ISO12207	ISO15504 IEEE1028
Software/IT Architectures	IEEE730 IEEE1058	IEEE1471 IEEE1220	ISO15504 IEEE1028
Software Metrics	IEEE730 IEEE1058	IEEE1045 IEEE1061	ISO15504 IEEE1028

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IEEE Std 1016-1998, IEEE Recommended practice for Software Design Descriptions.

IEEE Std 1028-1997, IEEE Standard for Software Reviews.

IEEE Std 1074-1997, IEEE Standard for Developing Software Life Cycle Processes.

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TEACHING THE PROCESS OF REQUIREMENTS ANALYSIS: USING COMPARATIVE EXPERIMENTS TO INFORM TEACHING PRACTICE

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ABSTRACT

Requirements analysis has long been considered one of the most critical phases of the systems development life cycle. It follows that requirements analysis should be an essential part of the training and education of future systems analysts. This paper identifies important skills associated with requirements analysis and then reviews the experimental literature to find out what can be used to inform our educational practice. The paper finishes with a set of recommendations for educators and suggestions for future research.

INTRODUCTION

Requirements analysis is one of the most important activities in the systems development process because it shapes everything that comes afterwards. Unfortunately, identifying complete and accurate requirements for an application is very difficult (Davis, 1982). Given this importance and difficulty, it is obvious that teaching future systems analysts the knowledge and skills necessary to do requirements analysis properly is crucial for teachers and trainers in information technology.

The purpose of this paper is to review the experimental literature concerning requirements analysis and to make recommendations on how the empirical findings can be used to improve the education of future systems analysts. The approach taken is to first associate categories of knowledge/skills with the activities that make up requirements analysis. Then experimental studies are reviewed in light of these categories in an attempt to distill out results that can be applied in an educational setting. Finally, a set of recommendations are made based on these findings for educators and for researchers.

REQUIREMENTS ANALYSIS KNOWLEDGE AND SKILLS

Requirements analysis consists of the following activities (based on Nuseibeh & Easterbrook, 2000): (1) elicitation of requirements, (2) modeling and analysis based on elicited information, (3) communication of requirements and models to others, (4) validation of the accuracy of the requirements and models, (5) gaining agreement on the requirements by the affected parties, and (6) evolution of the requirements over the life of the application. To perform these activities systems analysts use a combination of knowledge and skills. Table 1 shows how these activities map to categories of knowledge/skills.

For the purposes of this paper, knowledge and skills are combined into a single category. Knowledge is the set of facts, rules, procedures, heuristics, and strategies that are learned and then applied to complete a particular requirements analysis activity. Skills are highly learned physical and cognitive behaviors. Knowledge of how to do something becomes a skill when it is practiced so much its execution becomes automatic, i.e., does not involve significant cognitive attention. The goal of

TABLE 1
REQUIREMENTS ACTIVITIES

Requirements Activity	Description	Activity Outcome	Knowledge/Skills Required
Elicitation	obtaining requirements from users	Analyst requirements understanding	interpersonal; interviewing
Analysis	creating a conceptual model of current and desired systems	Models	modeling; problem solving
Communication	documenting requirements and communicating to others	User/Manager requirements understanding	documenting; comprehension; interpersonal
Validation	reviewing requirements for accuracy and completeness	Assurance of requirements quality	error finding
Agreement	gaining acceptance of requirements among stakeholders	Agreement about requirements	group processes; interpersonal
Evolution	updating requirements based on changing needs	Up to date requirements documentation	(all of the above)

education is to transfer knowledge and develop skills that students need to be successful. For this paper we will use the term skills to refer to this combination of learning that produces effective performance.

While there are many possible categories of skills, the ones used in this paper are described below.

- Interpersonal: verbal and non-verbal behaviors involved in communicating with another individual. Listening is a key skill in this category. Knowledge of what behaviors should be exhibited is important but effectiveness usually requires that this knowledge be converted into skill.

- Interviewing: high-level, goal driven cognitive behaviors designed to obtain specific information from another person. These skills focus on the structuring and high level processes of the interview. Lower level interpersonal skills are used to implement the structure and strategy.

- Modeling: cognitive and physical behaviors required to create specific models. Higher level strategic skills that are applicable across different kinds of models are included in the problem solving category.

- Problem solving: includes the cognitive behaviors associated with defining the problem the system is to solve, generating potential solutions, evaluating the solutions, and selecting one to recommend. Information to support problem solving is obtained by using interpersonal, interviewing, and modeling skills.

- Documenting: verbal, physical, and cognitive behaviors involved with creating written, graphical, audio, video and/or computer materials that describe the requirements so that users, managers, or other analysts can understand them. Documentation often includes the products of modeling skills.

- Comprehension: behaviors involved in reading and understanding models and requirements documentation.

- Error-finding: cognitive behaviors associated with finding inaccuracies, inconsistencies, and incompleteness in documentation.

- Group processes: verbal, non-verbal, and cognitive behaviors used to manage group processes. Group processes include group idea generation and evaluation, consensus building, negotiation, leadership, etc. Interpersonal skills may be important in group processes but are not included in this category.

Two additional categories are mentioned here because, while not normally thought of as requirements analysis skills, they become important when the prototyping approach is used.

- Designing: cognitive behaviors used to create a technical design for an application that will meet the stated requirements of the user(s).

- Constructing and testing: cognitive and physical behaviors used to create a working application based on the given design.

The purpose of this paper is to review experiments that have compared techniques, methods, approaches, or levels of experience to find out what we have learned about th requirements analysis process that can inform our teaching. The comparative experiments that are reviewed for this paper are listed in Appendices A-F and described below.

REVIEW OF EXPERIMENTS

Twenty-seven experiments conducted over the last 25 years are reviewed in this section. None of the reviewed experiments was designed as a learning study. Most were meant to prove that one technique, method, or approach was better than another. In spite of this, there are aspects of the research that can inform our teaching. Studies that compare high rated analysts to novice analysts can suggest skills that should be developed in our students. Studies that teach subjects the techniques, methods, or approaches that are compared can tell us which approaches are easier to teach and which are more effective when taught. Since the focus here is on developing necessary skills for successful requirements analysis, we will review the research in terms of the key skills listed in Table 1.

Interpersonal Skills

Interpersonal skills have long been regarded as essential for successful systems analysts (Leitheiser, 1992). Skills include the ability to question, listen, empathize, reflect, paraphrase, clarify, challenge and summarize. These skills represent the micro skills of effective communication. Higher level skills involving the planning and overall structuring of interviews will be dealt with in the interviewing skills category. Micro skills make up part of the "effective communication patterns" called for by some researchers (Bostrom & Thomas, 1983; Bostrom, 1984; Guinan & Bostrom, 1986). Unfortunately, no experiments comparing training or techniques in this area were found. One study (Tan, 1992) examined how three pre-existing interpersonal skills; i.e., orientation toward users, management of the interview, and building of rapport, impacted the mutual understanding of systems requirements (see Appendix A). Both verbal and nonverbal behaviors were examined. The results were mixed with one measure of client orientation, two measures of interview management, and one measure of rapport found to be related to at least one measure of mutual understanding. Given the paucity of research in this area, it is clear that there is much more to be learned about how interpersonal skills are related to requirements analysis success. Tan's results suggest that educators should at least be aware of the possible impact of these often neglected skills.

Interviewing Skills

Interviewing skills are those planning and structuring skills that are used by the analyst to organize and manage requirements analysis interviews. The structure of the interview is usually based on some goals and a plan for how to achieve the goals. For example, decision analysis has the goal of identifying the information needs for a user's decisions. A plan is created to define decisions and then for each decision, identify required information. This plan establishes the interview structure and the content of the question prompts. At the prompt level, the micro interpersonal skills mentioned above take over.

A number of studies (Appendix B) compare different approaches to structuring the interview process. Structuring approaches that have been studied focus on:

- decisions (Munro & Davis, 1977; Teng & Sethi, 1990; Agarwal & Tanniru, 1990),

- existing data (Munro & Davis, 1977; Teng & Sethi, 1990),

- prototypes (Alavi, 1984; Boehm, et al., 1984; Teng & Sethi, 1990),

- goals (Zmud, et al., 1993; Browne & Rogich, 2001),

- Critical Success Factors (Zmud, et al., 1993),

- imagery (Zmud, et al., 1993),

- episodic knowledge (Moody, et al., 1998),

- process inquiry (Marakas & Elam, 1998),

- checklists (Moore, Shipman, 2000),

- computer support (Moore, Shipman, 2000),
- task characteristics and requirements obstacles (Browne & Rogich, 2001), and
- interrogatories (Browne & Rogich, 2001).

Sometimes the alternative to the experimental treatment was an untrained control (e.g., Agarwal & Tanniru, 1990; Marakas & Elam, 1998; Moody, et al., 1998).

What can academics learn from these studies? First, structure seems to matter. In those studies that compared a structured interviewing approach to an unstructured one, the structured approach produced more/better requirements or knowledge (Agarwal & Tanniru, 1990; Moody, et al., 1998; Marakas & Elam, 1998). Second, there are mixed results about which structured approach to take. Based on direct comparisons the following conclusions can be made.

- Decision analysis may be better than data analysis for programmed decisions (Munro & Davis, 1977),
- Prototyping may produce better requirements and more satisfied users than other approaches (Alavi, 1984; Teng & Sethi, 1990),
- Using positive imagery may result in more information requirements than using a goal focused approach (Zmud, et al., 1993),
- A questionnaire based approach can produce more functional requirements and may lead to more creative solutions than a computer tool approach (Moore & Shipman, 2000),
- A computer tool approach may lead to more procedural requirements and more documentation than a questionnaire approach (Moore & Shipman, 2000), and
- A task characteristics approach derived from a cognitively based model may produce more requirements than other structured alternatives (Browne & Rogich, 2001).

Hopefully in the future more head to head comparisons will be done to help sort out which structure is the most effective one to teach to our students.

A special note should be made about prototyping. Prototyping is listed under interviewing skills when user interaction is part of the process. The reason for this is that the prototype defines the structure of the initial and follow-up interviews. In our review it also shows up under problem solving skills because analysts must create a prototype to solve their users' problems. Other skills are also involved, many of which are not usually associated with information requirements analysis. Analysts must be able to design, construct and test prototypes. If they have poor skills in these areas the requirements analysis process may be hindered. On the other hand, good design and construction skills may help them overcome deficiencies in interpersonal and interviewing skills. Future research will hopefully help us tease apart the effects of different skills on the success of prototyping.

One interesting, and troubling, observation from the studies is the finding that prior experience did not produce higher performance. Agarwal and Tanniru (1990) and Marakas and Elam (1998) both found that systems analysts did no better than students in their experiments. Is this an artifact of the experimental design or is it a generalizable result?

Modeling

The studies comparing different modeling approaches (Appendix C) were designed to show which approaches are better than the others. They also suggest which can be more effectively taught. The modeling approaches differ primarily in their emphasis; i.e., (1) on processes, (2) on functions, (3) on data, or (4) on objects and classes. All but one of the studies in involve process modeling so we will use it as the basis for summarizing results. The major conclusions that can be drawn are:

- process modeling is easier to learn and use than functional modeling (Yadav, et al., 1988),
- process modeling produces better results on process-oriented tasks and elements than object-oriented (Agarwal, et al., 1996),
- process modeling may result in less complete models and may be viewed as harder to use than object-oriented modeling (Wang, 1996a),

- process modeling may result in better model semantics than object-oriented modeling (Wang, 1996b),
- structured interviewing results in better process models than unstructured interviewing (Marakas & Elam, 1998),
- process modeling may result in lower cognitive workload than object-oriented modeling (Morris, et al., 1999), and
- object-oriented modeling is preferred over process modeling by inexperienced subjects who feel it is easier to use (Morris, et al., 1999)—although using it produced no improvement in performance.

In the one study that did not involve process modeling, Kim and March (1995) found that analysts captured semantics better with an entity-relationship model than with a binary object model. They also felt that ER was easier to use and more valuable.

One obvious conclusion is that process modeling should not be abandoned for strictly static object-oriented approaches. In fact, popular object-oriented development processes include an array of process focused models that extend the standard class and object representations that are the basis of object-oriented approaches. For example, the Unified Software Development Process (Jacobson, Booch, and Rumbaugh, 1999) includes use-case modeling, activity diagrams, collaboration diagrams, statechart diagrams and sequence diagrams to capture various parts of the processes being modeled. It seems clear that process is important but given the popularity of object-oriented methods we should move on to experiments that examine these alternative approaches to capturing process information.

Problem Solving

The studies of problem solving were of two types (Appendix D). The first examined the abstract cognitive problem solving process while the second was concerned with the concrete process of creating a system solution. Included in the first category are two similar studies on specific problem solving behaviors. A comparison of their results can be summarized as:

- Hypotheses: high rated analysts discard more hypotheses (Vitalari & Dickson, 1983) vs. no differences in the total number of hypotheses stated, but experts tested and discarded more of them (Schenk, et al., 1998),
- Strategies: high rated analysts modified and verbalized more strategies (Vitalari & Dickson, 1983) vs. novices verbalized more strategies than experts but they tended to be more "text book" (Schenk, et al., 1998),
- Triggers: high rated analysts search for more triggers (Schenk, et al., 1998) vs. no differences in verbalization and searching for triggers except that novices tended to be less specific than experts (Schenk, et al., 1998),
- Goals: high rated analysts tended to set more goals (Vitalari & Dickson, 1983) vs. experts verbalized more goals than novices (Schenk, et al., 1998),
- Heuristics: high rated analysts apply more heuristics (Vitalari & Dickson, 1983) vs. neither experts nor novices verbalized many heuristics (Schenk, et al., 1998).

The latter study also found that: (1) experts took longer on the task; (2) experts referenced more "domain specific" issues and covered more kinds of domain issues; (3) novices referenced user involvement more but experts mentioned it more consistently throughout the task; (4) experts focused on functional requirements, types of reports, and procedures while novices focused on development issues, design of system, and purpose of system; and (5) experts' approach was bottom-up while novices was top-down (Schenk, et al., 1998).

It is clear that there are differences between analysts in the way they solve problems. The results suggest skills that novices should do to be more like expert analysts, but they do not tell us how to achieve them with education and training. An experiment comparing how different training treatments impact the development of these skills would help us take advantage of these interesting findings.

Another study of cognitive problem solving did examine the impact of treatment conditions on problem solving. Vessey and Conger (1993 & 1994) found that an object-oriented approach resulted in more problem solving breakdowns than process oriented or data oriented approaches. They also found that problem solving in an unfamiliar domain resulted in both longer modeling time and more unresolved problem solving breakdowns. In addition to contributing to the argument mentioned above about process modeling, the findings also suggest that there may be a reason for students to specialize in a functional area, industry or type of application.

Two prototyping studies are included in problem solving because subjects went beyond identifying requirements to building solutions to users' problems. This process includes problem solving as well as design, construction, and testing. One of the studies involved interviewing (Alavi, 1984) while the other did not (Boehm, et al., 1984). If the outcomes of the prototyping studies can be viewed as the ability to solve users' problems then the results suggest that:

- prototyping leads to higher user satisfaction than traditional approaches (Alavi, 1984),
- prototyping takes less time and results in a smaller system (Boehm, et al., 1984),
- prototyping results in a system with less functionality and less robustness (Boehm, et al., 1984), and
- prototyping results in a system that is easier to use and maintain (Boehm, et al., 1984).

As mentioned above, prototyping involves a range of skills beyond problem solving.

Documentation and Comprehension

Documentation and Comprehension are opposing sets of skills. Documentation is the ability to create understandable representations of requirements while comprehension is the ability to understand them. Only one of the reviewed studies (Appendix E) focused on comprehension. Agarwal, et al. (1999) found that students who used process-oriented representations better understood aspects of the model that involved combinations of process and structure than did students using an object-oriented representation. There were no differences on pure structure or pure process questions. Kim and March (1995) did have a comprehension component in their experiment but did not find any significant differences between their modeling groups on this measure.

Error Finding

Error finding is the ability to find problems in the comprehended documentation and is essential to validation. Results from the three reviewed studies that examined error finding (Appendix F) can be summed up as:

- different teams find different errors, so having multiple teams looking at the same documentation can be beneficial (Schneider, et al., 1992),
- students who reviewed entity relationship models felt that they were more valuable than students reviewing binary object models, even though no significant performance differences were observed (Kim & March, 1995),
- a structured error finding approach that divides and focuses efforts among team members results in more identified problems than approaches that are less structured and focused (Porter, et al., 1995), and
- using a group session to identify errors after individual reviews may not result in a net increase in the number of errors identified (Porter, et al., 1995).

As was observed in the Interviewing section, more structure seems to improve the performance in this requirements analysis activity. It may not be clear yet, what structures are best, but we can conclude that we should give students a detailed approach for error finding.

Group Processes

Group processes are in effect for any study that involves teams. For example, the Schneider, et al. (1992) error finding study reviewed above used teams to find faults in documentation. These studies are not reviewed here because the authors did not focus on the group processes used so we cannot make any conclusions about associated skills. In fact, group processes involved in requirements analysis have been little studied. The experiments discussed here (Appendix G) were mostly concerned with the impact of group technology on these processes. Two related experiments (Ocker, et al., 1996 and Ocker, et al., 1998) and one other experiment

(Damian, et al., 2000) compared various group settings, some supported by group support technology and some not. The authors used the face to face setting as a control and tried to find GSS technologies that provide improvement in requirements analysis processes. Summarizing the findings produces the following.

- asynchronous group support technology resulted in more creative and better requirements than face to face settings (Ocker, et al., 1996),
- a combined approach using asynchronous group support and face to face meetings produced more creative and better requirements than either approach by itself (Ocker, et al., 1998),
- a configuration with the analyst and one user in one location, video conferencing with a facilitator and second user in another location, resulted in better negotiated requirements (Damian, et al., 2000), and
- local participants were regarded as more emotional, more argumentative, and more competitive than remote participants (Damian, et al., 2000).

The results say more about the possible use of technology than about what group process skills should be taught. The finding that location and technology may affect how team members are perceived (Damian, et al., 2000) deserves further exploration and may effect the training of analysts. Clearly, more research needs to be done on group processes in requirements analysis, both computer supported and unsupported.

CONCLUSIONS

This paper reviewed comparative experiments that investigate requirements analysis activities. The goal of the paper is to derive suggestions for how to improve the teaching of requirements analysis skills for future systems analysts. One major conclusion is that there is a lot yet to be learned if we are to base our education on experimental results. Hopefully, this review has helped to identify opportunities for researchers so that this need can be met. The following recommendations are based on the review of experiments and organized by requirements analysis activities.

Elicitation

The research shows that elicitation success can be enhanced by teaching a specific process for structuring requirements interviews. There are many options for this structuring but the task characteristics approach created by Browne and Rogich (2001) is particularly interesting and deserves more exploration. There is also evidence that improving the interpersonal skills of analysts will benefit elicitation. Teaching students how to build rapport with users, develop a client orientation, and manage the interview process should improve their results.

A consistent finding is that prototyping may provide benefits for requirements analysis in some settings. This suggests that prototyping should be included in our education process. A challenge for prototyping, however, is that it involves a large array of knowledge and skills that go beyond what is traditionally considered as necessary for requirements analysis. Questions about the importance of design, construction, and testing skills in determining requirements through prototyping have yet to be answered.

Analysis

Analysis results are improved by effective models and good modeling techniques. The research suggests that standard class and object models do not do a good job of capturing required system behaviors. Since object-oriented methods are becoming the standard way to teach systems analysis, instructors should be aware of this deficiency. OO-based methods for effectively capturing behavior (e.g., use cases, sequence diagrams, activity diagrams, statechart diagrams, and collaboration diagrams) exist but have yet to be tested experimentally.

Future analysts can be helped if they can be taught more effective problem solving techniques including (1) setting goals, (2) developing solution strategies, (3) recognizing triggers in problem, (4) generating, testing and discarding of hypotheses, and (5) using heuristics. Unfortunately, specific methods for training students in these techniques are not widely available.

Communication

Communication to users and manages is helped by documentation and models that are easily comprehended. The research in this area tells us that class and object models by themselves do not do a good job of communicating behavior. This activity would also benefit from additional research into the effectiveness of OO-based behavioral representations.

Validation

The validation activity benefits from a structured approach to error finding. The structured approach described by Porter, et al. (1995) seems to have promise and should be compared to other, equally structured methods. Students should also be taught to bring additional perspectives to the error finding process. Research tells us that more participants mean more errors are found.

Agreement

Gaining agreement on system requirements is a group process. No research was found comparing different face to face situations but there is research comparing various computer mediated processes with face to face settings. Some use of group support systems in the process seems to increase the creativity and quality of the requirements produced. The specific combination is not clear but educators may want to explore using GSS as part of their requirements training.

Evolution

No new skills were designated for the evolution activity. No experimental studies were directed specifically at it. The ongoing evolution of requirements is an area that has not received much attention from researchers or educators.

In conclusion, a significant number of experiments have been done that investigate the requirements analysis process but more are needed. This paper has summarized many of these studies and has tried to glean from them lessons that can be applied to educating future systems analysts. It also points out areas where more work needs to be done and invites researchers to fill in the knowledge gaps.

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APPENDIX A
INTERPERSONAL KNOWLEDGE/SKILLS

Study	Learning Treatment	Subjects	Results
Tan, 92	none	28 systems analyst/user pairs	comprehension is related to client orientation, interview management and rapport on some measures

APPENDIX B
INTERVIEWING KNOWLEDGE/SKILLS

Study	Learning Treatment	Subjects	Results
Munro, Davis, 77	none (experimenter applied data or decision analysis)	experimenter as analyst; 16 college administrators	for programmed decisions, decision analysis produced better requirements
Alavi, 84	traditional life cycle vs. prototyping	29 MBA's in 9 analyst groups; 34 MBA's in 9 user groups	prototyping lead to higher user satisfaction with system and process
Agarwal, Tanniru, 90	structured vs. unstructured interviews; novice vs. experienced	MBA's and systems analysts	structured > unstructured on acquiring knowledge; experienced vs. novice – no difference
Teng, Sethi, 90	decision analysis vs. data analysis vs. prototyping	12 MBA users (4/case), 12 IT PhD analysts (4/method)	prototypers produced higher quality requirements; users & analysts preferred prototyping
Zmud, et al., 93	goals oriented vs. CSF method vs. positive imagery vs. negative imagery	4 PhD students (1/method) and 100 business senior students (25/method)	positive imagery produced more information items than goal oriented
Moody, et al., 98	standard vs. cognitive interviewing	10 senior students, 42 librarian users	cognitive interviews produced more events
Marakas, Elam, 98	semantic structured vs unstructured interviewing; novice vs. experienced	20 IT students and 20 systems analysts	semantic subjects had better DFD models; experience – no difference
Moore, Shipman, 00	GUI design tool vs. questionnaire	4 students with questionnaire; 6 with tool	questionnaire produced more functional requirements and more creative requirements; tool produced more procedural requirements and more text
Browne, Rogich, 01	task characteristics prompting vs. interrogatory prompting vs. semantic prompting	15 employee subjects each treatment	task char. prompting produced more requirements, more process requirements, more information requirements.

APPENDIX C
MODELING SKILLS

Study	Learning Treatment	Subjects	Results
Yadav, et al., 88	process vs. functional modeling	20 grad students in 10 teams (5 per treatment)	process modelers felt method was easier to learn syntax and to draw.
Kim, March 95	entity relationship vs. binary object modeling	Exp. 2: 26 analysts	Exp. 2: analysts did better on semantics with ER and felt ER was easier and more valuable;
Agarwal, et al., 96	process vs. object-oriented modeling; process-oriented vs. structure-oriented tasks	24 business students OO method; 19 business students process method	process modeling produced better results on process-oriented task and on all process elements
Wang, 96	process vs. object-oriented modeling	32 undergrads do both methods	OO method resulted in more complete models, and was rated easier to use and better overall
Wang, 96b	process-oriented vs. object-oriented modeling	44 IT undergrads (24 process and 20 OO)	process subjects scored higher on semantics
Marakas, Elam, 98	semantic structured vs unstructured interviewing; novice vs. experienced	20 IT students and 20 systems analysts	semantic subjects had better DFD models; experience – no difference
Morris, et al., 99	process-oriented vs. object-oriented; prior experience with process-oriented modeling	34 IT majors (experienced) and 37 pre-business students	all subjects reported lower cognitive workload with process-oriented method; experienced subjects had better solutions; inexperienced subjects preferred OO and felt it was easier

APPENDIX D
PROBLEM SOLVING KNOWLEDGE/SKILLS

Study	Learning Treatment	Subjects	Results
Vitalari, Dickson, 83	high rated vs. low rated analyst	systems analysts	problem solving differences exist
Alavi, 84	traditional life cycle vs. prototyping	29 MBA's in 9 analyst groups; 34 MBA's in 9 user groups	prototyping lead to higher user satisfaction with system and process
Boehm, et al., 84	specifying approach vs. prototyping	11 grad students in 4 specifying teams; 7 grad students in 3 prototyping teams	prototyping took less time and produced a smaller system; prototype had less functionality and robustness but was easier to learn and maintain.
Vessey, Conger, 93 & 94	process-oriented vs. data-oriented vs. object-oriented modeling; familiar vs. unfamiliar domain	6 IT students (2/method)	object-oriented subjects had more problem solving breakdowns; unfamiliar domain required more time and resulted in more unresolved breakdowns
Schenk, et al., 98	novices vs. low rated analysts vs. high rated analysts	7 novices (< 6 mos. experience), 9 low rated experienced, 9 high rated experienced	differences in problem solving behaviors

APPENDIX E
DOCUMENTATION & COMPREHENSION KNOWLEDGE/SKILLS

Study	Learning Treatment	Subjects	Results
Kim, March 95	entity relationship vs. binary object modeling	Exp. 1: 28 grad students;	Exp. 1: no differences in comprehension;
Agarwal, et al., 99	process-oriented vs. object-oriented; different case for each experiment	Exp. 1: undergrads (18 OO and 18 PO); Exp. 2: undergrads (18 OO and 17 PO)	process-oriented subjects did better on combined process/structure questions

APPENDIX F
ERROR FINDING KNOWLEDGE/SKILLS

Study	Learning Treatment	Subjects	Results
Schneider, et al., 92	none	computer science students in teams	different teams found different errors
Kim, March 95	entity relationship vs. binary object modeling	Exp. 1: 28 grad students;	Exp. 1: students felt ER more valuable;
Porter, et al., 95	ad hoc vs. checklist vs. scenario fault detection methods	48 CS grad students in 3 person teams	scenario method > ad hoc, checklist; groups did not produce more faults than individuals

APPENDIX G
GROUP PROCESS KNOWLEDGE/SKILLS

Study	Learning Treatment	Subjects	Results
Ocker, et al., 96	GSS support vs. face-to-face; structured vs. unstructured process	214 IT and MBA grad students in 40 teams	GSS more creative and better requirements; structure - no difference
Ocker, et al., 98	GSS synchronous vs. GSS asynchronous vs. face-to-face vs. combined f-to-f & asynchronous	teams from Ocker, et al., 96 and 22 teams of IT students	combined was more creative and produced better requirements
Damian, et al., 00	face-to-face and video conferencing combinations	15 student teams with 1 analyst and 2 users	analyst & user conferencing to facilitator and user worked best

STRATEGIC PHILANTHROPY ON UNIVERSITY CAMPUSES: HOW DOES IT AFFECT CURRICULUM?

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INTRODUCTION

Economic need has placed many colleges and universities at the mercy of businesses that have enormous pocketbooks and overpriced products. Software vendors (and some hardware vendors) are now playing a role in the IS/IT curricula at numerous universities via product donations and partnership programs. Microsoft, SAP, and other major vendors have forged education partnerships with a large number of universities and have enabled students to gain hands-on experience with tools and applications that have the potential to strengthen and differentiate the skill sets they possess upon completing their degrees. There is, however, a darker side to these partnerships that many IS/IT professors and the administrators to whom they report often choose to overlook and downplay. Such partnerships, for example, include not so subtle marketing of vendor products to students as well as exploiting economic realities faced by colleges and universities by exchanging product donations for the ability to advertise to a captive audience.

Today, access to current technology is important at all levels of education. Hardware, software, and training of instructors are typically critical determinants of success in today's classrooms. IS/IT technology currency is an ongoing challenge for educational institutions. This is often very expensive to maintain and the amounts included in administrative budgets to do so often falls woefully short of the mark. In some instances, computers are obsolete by the time they are installed and maintaining hardware currency requires their replacement within two or three years. In addition, because the technology (both hardware and software) is so dynamic, it is difficult for educators to abreast of the changes. Funding and other necessary support for ongoing faculty development is typically under-funded, if it is funded at all.

Any serious commitment to maintaining currency in technology infrastructure requires a steady stream of cash. Given the economic realities facing higher education funding (both public and private) in many states, many universities have turned to technology vendors for assistance in the form of donations, sponsorships, and full-blown education partnership programs. In general, vendors have been responsive. They have provided needed software (and/or hardware) and have provided instructors with the training they need to leverage upgrades and other new developments for the benefit of their students. In a previous study a list of partnership opportunities between industry and academia were developed and summarized as shown in Table 1 (Duncan, 2000, 98).

In some instances, major employers of a university's IS/IT graduates have helped the university secure vendor donations. This assistance is often inspired by their desire for new hires to have specific skill sets. Despite the recent economic downturn, the Information Technology Association of America (ITAA) reports that 1.1 million new IS/IT jobs will be created in 2002 and that more than half of these (600,000) will go unfilled

TABLE 1

- Advisory Committees
- Student Internships
- Industry Projects for College Seniors
- Faculty Internships/Consulting
- Faculty/Industry Exchange Programs
- Faculty Training and Updating
- Hardware/Software Resource Sharing
- Mentoring
- Research Grants and Contracts

because of a lack of qualified workers (ITAA Press Release, 2002). While a number of IS/IT workers displaced as a result of the economic downturn may argue otherwise, the ITAA study suggests that businesses across the nation continue to face a shortage of appropriately skilled technology workers. And, the outlook for the future does not look any less bleak.

The state of Georgia's attempt to position itself for the new economy faces similar challenges. According to a report released by the U.S. Department of Commerce there will be an average shortage of 5,560 technology workers every year until 2006 in the state of Georgia (1999). Collectively, however, the state's public universities and technical schools graduate less than 2500 IS/IT students each year. In order to respond to this gap, the University System of Georgia is taking steps to increase the number of graduates in technology fields such as computer programming, computer engineering, systems analysis, and Web development. A high-visibility aspect of the University System's attempt to close the gap is the creation of a new School/College of Information Technology at Georgia Southern University (GSU). This project, backed by Governor Roy Barnes, includes a $33 million building. According to one group of researchers this "will make the coastal region of Georgia and the state as a whole, an attractive site for high-tech relocation and expansion" (Burns et. al, 2000, pg. 287). The school/college is being tasked by the state to more than triple the number of IS, IT, computer science, and computer engineering students graduating annually (to approximately 500). While this, by no means, will close the gap between the number of IS/IT graduates needed by businesses in the state and the number produced by the state's publicly funded schools, it does represent a step in the right direction.

There are many issues that universities should consider before accepting vendor donations, entering vendor-sponsored partnership programs, or allowing advisory boards to have a direct say in curriculum decisions. These issues have been previously outlined by other researchers and we don't pretend to be saying anything that is new or earth-shattering in the pages that follow. However, we do feel that these are issues that we need to remind ourselves about and not dismiss out of expediency. These issues will be surfaced as we look at how a series of donations and partnerships has shaped the IS curriculum at Georgia Southern University. Key issues in our discussion include who is providing the resources, what strings are attached to donations and partnership programs, and what is the long-term impact of donations/partnerships on IS/IT curricula. Perhaps the most important issue is whether donations/ partnerships result in a mutually beneficial collaboration or if there is a decided imbalance that favors the providers (vendors). We have included a series of photos to assist in illustrating the impact that donations/ partnerships have had on the College of Business Administration at Georgia Southern University.

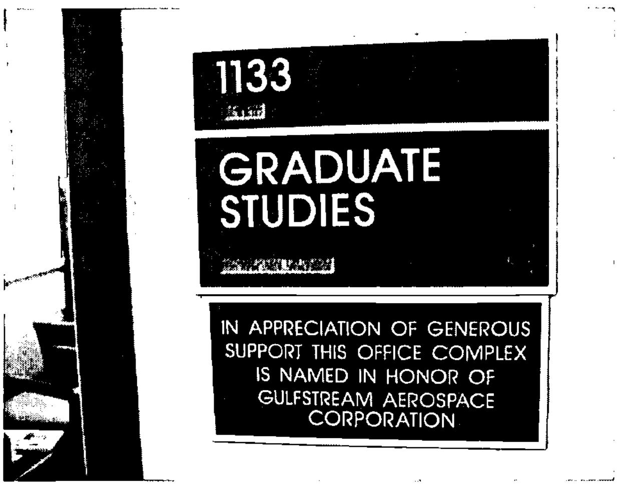
WHO IS PROVIDING RESOURCES?

The bulk of the additional funding (beyond state appropriations and the university's student technology fee) for technology at Georgia Southern comes from three primary sources, all of whom have an interest in having access to highly skilled college graduates. The philanthropists can be categorized as technology-producing companies (such as SAP America), non-technology corporations who have technology needs (such as United Parcel Service), and various government sources. For example, technology funding at the university is also being provided by the Georgia Lottery program implemented in 1993 through distributions made to the Board of Regents (Dolan et. al, 1997). Other potential sources for government funding for IS/IT programs include the national Tech Corps program. Both legislators and the governor have helped ensure funding for the new school/college of Information Technology at Georgia Southern through budget appropriation processes.

As noted previously, COBA' s School of Information Technology (IT) is being positioned to eventually blossom into a College of IT. Being initially housed in COBA has meant that many of the mechanisms established to provide external support and involvement in COBA have been carried over to the School of IT, including having corporate executives serve on an advisory board.

The advisory board for COBA includes executives from Georgia Pacific, BellSouth, Georgia Power, and Gulfstream Aerospace Corporation (see photo), just to name a few. When the current business building opened its doors in 1995, the Dean of COBA wanted to express appreciation for the many corporations who provided funding. As a result for a certain level of donation they could have a faculty office, classroom, computer lab, or common area named in their honor as seen in some of the photos throughout this text.

FIGURE 1
GULFSTREAM AEROSPACE CORPORATION



A high-powered Board of Advisors has also been assembled to help ensure the success of the new School/College of Information Technology. It consists of executives from a wide-range of technology producers and heavy technology user organizations including BravePoint, BellSouth, Clarkston Potomac, Coca-Cola, CommerceQuest, Georgia-Pacific, SAP America, Southern Company, TSYS, United Parcel Service, and Verisign,. Several of the companies that represented on COBA's advisory Board are also represented on that for the School of IT. The school's advisory board also includes the Commissioner of the Georgia Department of Industry, Trade, and Tourism as well as the state's CIO and executive director of the Georgia Technology Authority. The schools board of advisors includes representatives from all three of the major interest groups mentioned earlier: technology-producers, heavy technology-users, and state government. Some of the technology-producers on the board include BravePoint, SAP, Verisign, Commerce-Quest, and Safe Systems, Inc. Heavy technology users include BellSouth, Coca-Cola, Georgia Power, Gulfstream Aerospace, the Southern Company, and United Parcel Service.

RESOURCES PROVIDED

In addition to financial donations, corporations are providing many resources to help support technology programs at universities. These include scholarships, internships, assistance in securing hardware and software donations, and much more. Representatives from businesses also give of their time and serve on advisory council committees. Some even provide faculty development training in current technology.

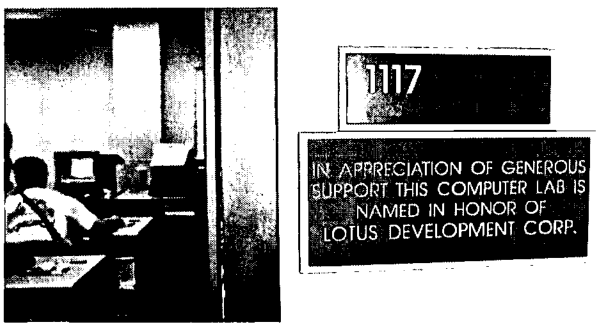
GSU's Lotus Donation

As an example of technology donations, Lotus Development Corporation provided a $1 million software site license in 1994 to the university that allowed any computer on campus to have the Lotus SmartSuite software program installed on it. In addition, the university also received a site license for the Lotus Notes which could be leveraged to facilitate communication among administrators and to create an intranet. The $1 million software donation from the Lotus Development Corporation to the College of Business Administration (COBA) also qualified the college for matching lottery money. Needless to say, this was a powerful incentive to accept this vendor's donation, even if though there were strings attached.

The Lotus donation is a good example of *strategic philanthropy.* It gave the company visibility at the university that we would not have gotten otherwise. For example, for their generosity, they got a sponsorship plaque on a computer lab, which serves as constant reminder of their donation for students, faculty and staff. In addition, the Lotus SmartSuite software program was integrated into multiple courses across the business curriculum including, but not limited to, Introduction to Computers, Business Statistics, Accounting, and Finance courses. Such integration was one of the major strings attached to the donation. It spawned a great deal of debate, largely because of competing (Microsoft) products with larger market shares. The lack of Smart-Suite lab manuals for the Introduction to Computers course was also a bone of contention until several faculty members (including one of the authors of this paper) published a series of books to address this need.

Lotus Development Corporation, now part of IBM, got a great deal of mileage out of its donation. It succeeded in having the SmartSuite installed in more than 1000 computers across campus and in having thousands of students exposed to this product via the Introduction to Computers and the other courses in which it was used. By doing so, the company also succeeded in demonstrating that its products could be integrated into the business curriculum. And, the plaque recognizing the company's generosity still hangs outside COBA's computer lab.

FIGURE 2
LOTUS DEVELOPMENT CORPORATION



The Lotus donation, however, was not without its detractors. There were a number of faculty members who resented having not having a choice about the applications to be used in particular courses. Others questioned whether any company or donation should be allowed to dictate course/curriculum content. Most detractors, however, were grateful for the COBA resources purchased by the $1million in matching lottery money that flowed into the college as a result of the donation.

The IBM AS/400 Education Partnership Program

Another program that has had an impact on the IS program at Georgia Southern is the IBM AS/400 Education Partnership Program. This program was available to technical schools during the early 1990s, but in 1996, it was expanded to include four-year colleges and universities in order to increase the number of entry-level system/business analysts with AS/400 experience for IBM Business Partners. The program included the donation of an AS/400 from IBM. The hardware donation was worth $100,000 and qualified for matching lottery funds. The machine was installed and maintained by an IBM Business Partner agreeing to serve as the university sponsor. Faculty training (a mandatory part of the program) was provided by IBM. In return for the donation, the university agreed to integrate the machine into its curriculum. In our case, this meant creating and implementing an AS/400 Applications course. Student benefits from the program include the opportunity to acquire some niche skills that differentiate them in the entry-level job market.

MK Logistics

In another example of collaboration, the MK Group of computer associates in Atlanta (now part of InterBiz) provided its logistics software to the COBA in order to enhance the opportunities for logistics majors to gain hands on experience with logistics, warehouse management, and supply chain management software. InterBiz provides training for faculty on how to incorporate the software into their courses. In return, InterBiz requires documented evidence of its use in business courses.

SAP Education Partnership Program

The donation that has had the farthest-reaching impact on COBA's curriculum is the SAP partnership. This was initiated soon after the MK Group's logistics software donation, but is yet to be fully implemented. More than a half-dozen faculty members have had SAP training. Most business disciplines within COBA have been represented in the training including Accounting, Finance, Operations, Logistics, and Information Systems. While there is no cost for the training itself, COBA has had to bear considerable travel and accommodation expenses associated with the training. And, although the software is donated, an appropriate hardware platform had to be purchases. Other associated costs have included the salary and benefits of an SAP administrator. As a result of the startup and ongoing costs, several administrators have come to call the SAP initiative "the gift which keeps on taking."

The SAP partnership agreement calls for the software to be used in multiple courses by students in several majors. Thus far, business students are working on SAP tutorials in Introduction to Business course, in some accounting courses, and in an advanced operations management course. Thanks to COBA's ability to hire a faculty member with extensive SAP training and experience, beginning next fall, students will also be able to take an Introduction to SAP course and over the next academic year, an ERP course will also feature hands on experience with SAP as its centerpiece. An

SAP Programming course is a planned addition to the IS curriculum and SAP's HR module will be featured in new Human Resource Information Systems course.

Students in a variety of majors are excited about the opportunity to gain hands on experience with SAP. They tend to see SAP experience as something that will differentiate them from other undergraduate business students competing for entry-level jobs. They are putting pressure on COBA administrators to roll out the SAP courses as quickly as possible. The creation of such grassroots demand among students is probably exactly what SAP hoped would happen. Such ongoing demand translates into continued marketing for their products.

NCR POS Outsourcing Agreement

The most recent donation that is having an impact on Georgia Southern's IS program is the result of an outsourcing agreement between the university and NCR. NCR has outsourced the ongoing development of one of its major POS products to Georgia Southern. This startup has resulted in a faculty member being relieved of all teaching duties until a full-time project manger is hired to oversee the project and the students that will be working on it. The agreement between NCR and the university specifies the creation of several new courses, both graduate and undergraduate in addition to graduate and undergraduate internships to ensure ongoing work on the upgrade. Thus far, one new course has been created as part of this new (Fall 2001) agreement. More are planned.

This agreement has the potential to result in $50,000 to $150,000 in revenue from NCR for COBA and the Department of Information Systems and Logistics. It also provides students with the opportunity to be directly involved in the ongoing development of a widely used product—an experience that students at most other universities never get. The potential to gain a differentiating skill set in the market has inspired many of our best students to apply for the internships.

Other New Initiative?

COBA's Department of Information Systems and Logistics is currently considering other potential donations that are likely to have curriculum-altering strings attached. COBA's Acting Director for the Center for Logistics and Intermodal Transportation is confident that he can secure the donation of Manuguistics, arguably the leading logistics and supply chain management software in use today. The donation would be valued at approximately $1 million dollars and is likely to be followed by scholarship donations from major Manuguistics users. Providing logistics and IS students with hands-on experience with the software would instantly differentiate them in the marketplace and provide national visibility for GSU's logistics program. In exchange for the software, COBA would be required to integrate Manuguistics in multiple logistics courses and create a Manuguistics programming/ applications course for IS majors.

A final initiative under consideration is the potential donation of a customer relationship management (CRM) product and its integration in marketing and IS courses. Once again, students would be able to gain a skills set that would differentiate them in the job market.

MUTUALLY BENEFICIAL COLLABORATION?

The generosity of vendors and other corporations is not solely based on their desire to address the ongoing technology currency challenges faced by universities. Typically, they look at their donations as a form of strategic philanthropy that will result in a long-term return on investment, a gesture that is likely to increase their chances of hiring the best and brightest students graduating from the technology programs they have chosen to donate to, and an opportunity to create loyal consumers of their products.

The discussion of corporate partnership with secondary schools and universities must also include an analysis of the intangible benefits and consequences of such collaborations. Different views toward corporate involvement with secondary schools has been documented On one side, Dee McNosky, a special education teacher in Texas indicated her support of sponsorship by referring to corporations as another "stakeholder in the future of public education" (McNosky & Gump, 1998, p. 59). She believes that everyone both individually and collectively, should be involved in public education including corporations. On the opposing side, Judy Gump, a teacher in Wisconsin commented that

> Children have the right to a quality education, one that allows them to make choices about their futures. When corporations worm their way into the schools, they make the choices,

they set the agenda (McNosky & Gump, 1998, p. 59).

Both have very valid points. A major concern is how much influence corporations have over secondary schools and universities as the result of a donation or partnership agreement. Are colleges and universities allowing businesses to become owners of education and not just participants in the education process? Is this not what is happening when the curriculum is adapted to meet the conditions of a donation or the requirements partnership agreement with a vendor?

At the university level, students are not being trained for "low-skilled, low-pay jobs" as Henry Giroux (2000) would suggest. Data from the U.S. Department of Commerce suggests just the opposite, upon graduation, they will be entering some of the most highly skilled and highly paid occupations in the U.S. workforce. In many cases, students have a higher income than their professors within five years after graduation. This is especially true if they had the opportunity to develop a differentiating skill set prior to entering the job market. This suggests that adapting curricula to provide students with hands on experience with widely used vendor products may, in fact, benefit students.

FIGURE 3
CHICK-FIL-A CLASSROOM

Some individuals in higher education maintain that we must not never become complacent about corporate collaboration. As noted by one group, corporate dollars "come with too many strings attached" (Mangan, 1999, pg. A14) and are a threat to academic freedom. In addition, there is concern that corporate support for research can undermine objectivity. Some professors fear that they may be political consequences if you conduct research in an objective fashion and come up with results that are not favorable to the sponsoring industry. This could threaten the university's ability to attract corporate funding in the future and could cause be a loss of a tenured professor's job if he/she was discovered to be fudging results in order to make the sponsor look good. In order to help protect a researcher's academic freedom, the American Association of University Professors, AAUP, approved a statement that reads as fol lows

> The freedom to pursue research and the correlative right to transmit the fruits of inquiry to the wider community- without limitations from corporate or political interests and without prior restraint or fear of subsequent punishment-are essential to the advancement of knowledge (Mangan, 1999, pg. A14).

This is a bold statement, but it may not carry much weight in application. Researchers cannot control the purse strings of corporations and if they want to withdraw their money they can do so. In addition because most partnerships include formal and informal associations between corporate executives and academic administrators, the opportunity exists for executives to unduly persuade administrators to restructure the distribution of funding to professors.

SUMMARY

The foregoing discussion indicates that there are both advantages and disadvantages for universities involved with the strategic philanthropy of corporations. Funding and other economic realities facing universities increase the attractiveness of vendor donations and education programs, even when there are obvious strings attached. Both tangible and intangible benefits and costs should be weighed when considering whether to accept a donation or enter a partnership program.

Impacts on Curriculum

Corporate/vendor donations and education partnership programs confront educators with the perennial question of training vs. education. If we accept the donation and alter course content in order to integrate the software/hardware in the curriculum, are we moving away from education and toward training? Other important questions include

- Are donated software modules/applications the "best" ones for illustrating the enduring concepts needed for lifelong learning? Are the technologies truly best of breed?

- Where does the donated technology stand in terms of product obsolescence? Is this new or old technology?
- Will student exposure/use truly translate into better-prepared students?
- Is it possible to deliver an equivalent or superior curriculum and educational experience without this technology?
- Are we caving into vendor pressure and/or administrative pressure just to save money?
- Have we identified all potential costs and/or benefits? What hidden costs may jump up to bite us? What additional benefits might materialize down the road?
- Are we ready, willing, and able to live up to our contractual agreements? Are we willing to make adjustments to the curriculum called for by the donation or partnership agreements.
- Are we ready, willing, and able to take full advantage of the donation or partnership program?
- Is this really in the best interests of our students? Of the program? Of the university?
- Is the cost of doing nothing greater than that associated with saying no to this donation or partnership agreement?

Developing honest answers to these questions may be one of the best starting points for assessing the impacts of strategic philanthropy on your university's IS/IT program.

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INTEGRATION AND BOUNDARY FLUCTUATION: TEACHING BUSINESS POLICY/STRATEGY AND MIS STRATEGY

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ABSTRACT

Almost all undergraduate business programs offer a "capstone" course in business policy or strategy. In addition, may of these programs offer "capstone" courses in the various majors or disciplines, usually focusing on discipline-level strategy, such as an MIS strategy course. Typically, some of the content in the organizational-level strategy and discipline-level strategy courses is duplicated. Where exactly do we draw the boundaries? What are the implications for students? How can the duplication and boundary overflows between these different types of strategy be reduced or eliminated? We make three recommendations that we find helpful in our teaching of these two strategy courses.

For most undergraduate business programs, the Business Policy or Strategy (BPS) class is the capstone course, incorporating all of the foundation course knowledge developed during all business students' undergraduate program course work. The knowledge incorporated in the BPS course includes material from finance, marketing, accounting, management information systems, human resources, organizational theory, organizational behaviour, and operations management. The BPS course prepares the student for the real world and for making sense of the business world by forcing them to integrate knowledge gained in a variety of courses taken over two or more years. Most often, the business policy or strategy course is taken during the last or next to last semester the student is enrolled prior to graduation.

For many management information systems (MIS) undergraduate programs, the MIS Strategy course is the capstone course for the major and incorporates all of the knowledge learned earlier in the MIS major along with, typically, much of the knowledge listed above for the Business Policy or Strategy (BPS) course. The MIS capstone course has the same purpose as the BPS course, but with a narrower focus, highlighting the world of the IS professional. Many times, the MIS course may be taught during the same semester as the BPS course, but it is frequently taught prior to the BPS course.

Both the BPS and MIS capstone courses contain much of the same content and examples, use the same models, and occasionally, even the same cases. Regardless of which semester an MIS major takes the MIS capstone course, there will be a considerable amount of overlap between the two courses. This results in a variety of potential problems and duplicated efforts. The purpose of this paper is to delineate those problems and areas of duplication and to make recommendations on how to resolve the problems and decrease the duplicated efforts without losing any of the substance or rigor of either of these two critical-thinking courses. This is a delicate task undertaken by colleagues with the overall goal of enhancing the students' educational experience and knowledge. Indeed the boundaries between the two courses may be seen as fluctuating. Determining boundaries is a sensitive task, but a necessary one.

Our purpose in this paper is to uncover areas of potential overflow between class boundaries and to discuss ways in which these boundary overflows can be accommodated to best suit both students and faculty. We begin with an outline of some of the conceptual issues involved in strategy. We continue with an examination of the way in which these conceptual issues are applied in MIS and in BPS. We then offer an example of how the same model can be taught from each perspective. Finally, we offer some general recommendations on how to deal with duplication and boundary overflow in these two important subject areas.

POTENTIAL PROBLEMS AND DUPLICATION OF MATERIAL

The concepts "strategy" and "strategic" are common to both MIS and BPS capstone courses. Thus, one of the first tasks is to ensure that students understand these terms and their implications. One of the first difficulties students have is discriminating between strategies and tactics. Strategy is a plan designed to achieve a long-term aim, and strategic implies actions that are part of along-term plan or aim to achieve a specific purpose. Tactics, on the other hand, are actions that aim to achieve a specific end. While the definitions may seem ambiguous to some students, it is important to highlight the difference. *Strategies are planned in order to achieve an end beyond the immediate result.* Thus, in the MIS area, moving to client/server (tactic) may result in reduced profit over a particular period, but it should also result in much more flexibility and scalability as well as reduced costs in the long term (strategy).

Once the students have understood that "strategic" requires them to focus on the long-term, they can move on to an examination of what strategic means in the context of their course. In the BPS course, it is important to discuss business strategy and corporate strategy. Business strategy answers the question: How do we do business? Corporate strategy, on the other hand, answers the question: What business (or businesses) are we in? Each level of strategy requires analysis and visioning, followed by implementation plans. When we discuss implementation, the role of functional strategies will inevitably arise. Functional strategies are multi-purpose; they are crafted to meet area objectives, but also to support the organizational strategy. This is where the BPS instructor can make important links between MIS and BPS. Functional strategies are meant to be supportive of, rather than subordinate to, BPS strategies. Thus, it is important to frame discussion around the integration of business-level, corporate-level, and functional-level strategies, and to show how the successful integration of these strategies is essential for the organization to achieve sustainable competitive advantage.

In the BPS course at our school, we spend two classes examining ways in which functional strategies lead to distinctive competencies and competitive advantage. While some areas such as production and purchasing are easier to illustrate, MIS can sometimes be more difficult. Because it is often not directly a revenue-producing area, MIS can often be seen as simply supporting secondary activities, and not crucial to competitive advantage. It is important for both BPS and MIS instructors to demonstrate the fallacy of this argument through concrete examples showing how MIS strategy can be both supportive of primary activities and crucial to the firm's competitive position.

Similarly, in the MIS Strategy class at our school, we spend two classes at the beginning of the semester discussing the definitions of strategy, business strategy, MIS strategy (and other functional strategies), and the role of the functional strategies in supporting, enabling, and informing the organizational strategy. We frame the differences in the two types of strategy and discuss the need for alignment of MIS strategy with the organizational strategy as well as the need for deliberation and purpose in aligning the two. The next few classes are spent discussing how specifically does MIS enable business/corporate strategy, from various analytic techniques, such as Porter's Five Forces model, to implementation models. Many of the models and techniques we use are the same as those used in the Business Policy class, but the focus is much narrower, looking only at the MIS strategy and how it can align with and enable the organizational strategy.

Important models like Porter's Five Forces model can be powerful tools for understanding critical concepts in MIS and BPS. Students will therefore likely be exposed to a model like Porter's several times during their undergraduate career. There is the danger that, after the first exposure, they will pay less attention to the model and will thus lose sight of its applicability in a different context. BPS students will often state that they have already seen Porter in Marketing and MIS, at the very least, and will thus be tempted to gloss over the explanation of Porter's model in a BPS context. The solution is not to decide to cut out use of the model in another course, but rather to discuss the model from the perspective of the course in which it is taught.

Thus, for example, an examination of Porter's Five Forces model in the MIS capstone course typically will involve a detailed analysis of one of the forces and how information systems and technology (IST) can alter that competitive force and its impact on the organization. For example, American Airlines SABRE reservation system raised considerable barriers to entry for potential competitors. In this example, the SABRE system supported the organizational strategy of preventing new competitors from entering their market. Students are frequently then asked to look at the other forces in teams and report back at the end of the class on how MIS strategy can affect those four forces and the organizational strategy.

In the BPS course, on the other hand, it is important to develop the use of Porter's Five Forces as a tool for the evaluation of the *firm's* external environment. This discussion should keep in mind the opportunities that arise from the environment. During the internal analysis, the capabilities of functional areas such as MIS become critical in the development of the firm's strategy. A thorough environmental analysis using Porter's model, done from both a firm and MIS perspective, will make the development of a successful strategy that uses core competencies effectively that much more likely.

RECOMMENDATIONS

There are many different "types" of strategy, or disciplines in which strategy is a primary factor. Universities offer courses in financial strategy, marketing strategy, MIS strategy, HR strategy, and other types of strategy. Each of these courses is usually the capstone course for that discipline's major. Each of these types of strategy is a support tool or enabler of the overall organization's strategy. Yet the difference in the discipline-level strategy and organizational level strategy can become obscure when teaching the discipline-level strategy classes that are focused on the narrower, enabling strategies. Anecdotally, we have seen students in business policy classes say that MIS strategy *is* the organization's strategy, and students in MIS strategy classes have said that only the organizational strategy matters—neither of which represents the thinking or teaching of the authors. Given the discussion above, we offer the following recommendations to help integrate and differentiate these concepts.

Recommendation 1

Teachers in the discipline-level strategy courses should clearly and repeatedly emphasize the difference in organizational strategy, discipline-level strategies, and their own discipline's strategy. For example, in teaching MIS strategy, instructors should point out the differences in organizational strategy, the various discipline-level strategies and the ways they enable organizational strategy, and MIS strategy and its specific focus in enabling organizational strategy. By repeating these differences and by being clear and focused on these differences, students should better learn the differences and how these areas overlap. Students should better understand that the boundaries fluctuate between which discipline's strategies enable which organizational strategies and which discipline's strategies are more important to a particular organizational strategy than others.

Many times, in both discipline-level strategy classes and organizational strategy classes, students hear the same models being explained. Frequently, even the same cases are used. For example, Wal-Mart is a frequently used case in both MIS and organizational strategy classes. Yet the approaches of each case discussion should be different. Porter's competitive forces model is almost always used in both of these classes. Again, the approaches should be different, with MIS students focusing, for example, on how information technology can affect the five forces and the way the forces affect competition while organizational strategy students focus on how information technology can help the firm sustain competitive advantage in a given, sometimes changing, environment.

Recommendation 2

Teachers should clearly delineate the different emphases of each model and case to continue efforts to show the boundaries and differences between organizational strategy and discipline-level strategies. If the proper emphasis is placed on a particular view of a model or case, students will learn that there are many views possible for these models and cases, and that the distinctions and differences are significant.

The organizational strategy course should typically be taken in the last semester of the student's undergraduate career. Frequently, students have taken enough courses in their major to take their discipline-level strategy course during an earlier semester. For students who take the discipline-level strategy class earlier, the discipline-level strategy class must discuss organizational strategy, including explaining various models, such as Porter's competitive forces model, in order to proceed with discussions of discipline-level strategy.

Because most of the models and techniques that are used in both courses are frequently introduced in other courses, such as Introduction to MIS, Introduction to Marketing, or Organization Theory, it may be possible in the discipline-level strategy course to abbreviate the discussion of some of the models and techniques and focus only on their importance to the issues involved in the discipline-level strategy. The BPS class, on the other hand, would more likely discuss in greater detail these models and techniques and their importance to organizational strategy, taking into account their importance to the discipline-level strategies as well.

Recommendation 3

Instructors should, at the same time, discuss and evaluate areas of crossover or boundary overflow between strategies and strategic tools. It is crucial for students to understand that strategies must work in tandem in order for the firm to receive the most benefit. The first step in learning should be to clearly demonstrate how strategies are developed and applied in separate areas, as per recommendations one and two above. However, in order to move the students to a higher level of understanding, it is important to follow this with a discussion of how functional-level and business-level strategies work together.

Discussions focused on alignment and relationships between the functional and business strategies can help in this regard. In addition, discussion in the discipline-level strategy class of the importance of the other discipline-level strategies is also important. An example or two where the other discipline's strategy supersedes the strategy being taught in the class usually clarifies this for the students.

Recommendation 4

Finally, it is important for instructors to work together, across disciplinary boundaries, to ensure that there is less direct overlap, more integration, and more coherence in the way strategy is taught in their school. We have made a case for teaching strategy at both a discipline and a firm level. We have also made a case for emphasizing the importance of integrating these two levels of strategy in order to help the firm gain sustainable competitive advantage. Our colleagues in Organization Theory would urge the firm to develop boundary-spanning activities and create communication pathways in order to ensure this integration. We recommend that faculty members do the same. It is important to work with colleagues in other areas to discuss and revise how strategy is taught in different courses in order for students to derive the maximum benefit from their undergraduate business education.

For example, the sharing of syllabi and other course materials, such as a list of cases to be used in each class, can pave the way for a discussion of how the types of strategy are different and should be taught differently. Not everything that has strategy in the title is the deciding factor in how organizations operate and thrive. It is the integration of the strategies, working together, that accomplish this. In the same way, instructors working together can ensure that the concepts of what is strategic, what provides competitive advantage, and how these strategies can work together are understood by their students.

CONCLUSION

We have shown the similarities in discipline-level and organizational strategy classes and the duplication and conflicts that can arise when students take both courses. A cursory review of comparative syllabi at other universities shows that our findings of duplication are accurate. We recommend that instructors emphasize the differences in the two types of strategy and where the discipline-level strategy courses fit with the organizational level course. We recommend that instructors emphasize the enabling aspects of discipline-level strategies rather than making them appear to be the overriding organizational strategy. We recommend the inclusion of the concepts "strategy" and "strategic" from the start of the undergraduate business degree, so that students learn the different and nuanced ways they can be applied. Finally, we recommend that instructors of these two types of strategy classes work together to ensure that they emphasize different views of models and cases.

ELECTRONIC B2B COMMERCE: REASONS ADOPTION WAS SLOWER THAN FORECAST

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ABSTRACT

This paper addresses the current state of B2B electronic commerce and identifies the major reasons for slower adoption of B2B electronic commerce than was being forecast by the media, consulting firms and market research firms. Understanding the reasons for slower than expected adoption and growth rates provides business leaders with insights as they move forward in designing strategies for future business models and defining partnerships for electronic B2B commerce. This research represents a synthesis of current thought from the literature and the experiences of one major player in the B2B e-marketplace space.

INTRODUCTION

Much has been written about the many facets of B2B electronic commerce. More recently the focus has shifted to B2B exchanges and e-marketplaces that include consortia, independent marketplaces, and private marketplaces. As these models have evolved over time much has been published in the trade literature forecasting the success and rapid adoption by the various players in the business community. The most current trade literature has taken a turn toward addressing the issues of what went wrong and the reasons for slower than expected adoption rates and in some cases failure. The literature base for the research reported in this study comes primarily from the business community trade literature including white papers, industry reports, and company research. Very little has been reported in the academic literature with a focus on the issues of failure and the reasons for slow B2B e-commerce adoption rates. Although some related articles have been published (e.g., Kaplan and Sawhney, 2000; Han and Noh, 2000; Hope, Hermanek, Schlemmer and Huff, 2001; Essig and Arnold, 2001; Wise and Morrison, 2000) we did not find any academic work addressing the specific topic of this paper. This is likely due to the short time frame in which it has even been possible to study these issues. Given the time required to publish in most academic venues any comprehensive study of B2B e-commerce failure trends and growth rates would likely not yet be available to the public audience.

This work provides a foundation for more extensive examination of issues, trends, and management strategies for B2B e-commerce in the future.

OVERVIEW OF REASONS FOR SLOW ADOPTION

The Internet is redefining how businesses communicate and trade. Business processes and entire supply chains have been restructured and new business models have emerged. Although the Internet is dramatically affecting the way we do business, the rate of growth and adoption has been much slower than expected.

We have identified many reasons for this phenomena. Two primary reasons are 1) marketplaces and exchanges have not flourished and 2). the failure of companies to recognize the essential role of content. We will focus on these two major reasons for slow adoption in this study.

During the prosperous years represented by the e-commerce boom when the stock market soared and the hype was promoted by the press, many were persuaded that the pace of change reflected revolutionary transformation. In reality, however, it has taken much longer than anticipated for companies to transition to transacting B2B electronic commerce over the internet. B2B exchange transaction volumes, for example, are quite a bit lower than the original analysts forecasts.

It was a misconception to believe that B2B e-commerce and marketplaces were practically a guaranteed success. Although many companies will abandon traditional ways of doing business for the potential benefits of the new, the transitions will take place to varying degrees and within varying time frames depending on company characteristics and industry variables. It can be concluded that for most industries full scale B2B e-commerce has not yet materialized at the rate and degree predicted.

As an example, the rate of adoption has been measured with B2B media. At the beginning of the Internet boom, many assumed that the Internet would rapidly replace traditional media for the many "obvious" advantages. However, one recent study conducted by Yankelovich and Harris Interactive (2001) in the U.S. showed that professional trade magazines and journals still rank ahead of web sites as executives' most important source of information. A major conclusion from the study was that executives seek information from various sources and feel that a combination of information sources is the best strategy for staying on top of developments in their field.

In hindsight, the dangers of moving ahead based on the response of early adopters should have been evaluated more carefully and with greater scrutiny. Although there were a large number of good ideas, they were chasing a comparatively small potential market. As exemplified by the work of Geoffery Moore (1999), most companies are not early adopters of cutting edge technology. According to Moore, there is the danger of not being able to "cross the chasm" from early adopters to the point where there is a majority of adopters. Crossing this gap is the place where many companies fail because they miscalculate the time and effort required to move from the early adopter phase to that where a majority of adopters accept the technology. B2B e-marketplaces, for example, have not progressed as rapidly as predicted due to this slower pace of adoption from both the buyer and supplier side.

The process has been more difficult than most companies planned for. Business, however, has been forever changed by the digital transformation of processes and restructuring of supply chains. Progress will continue as companies extend advancements made within their boundaries to process improvements external to the organization. Hammer (2001) advocates that this will be the focus of company agendas during the next decade. The question at this point is not whether B2B e-commerce will flourish but how fast the rate of adoption will be.

E-MARKETPLACES HAVE NOT FLOURISHED

B2B marketplaces were prominent in the press and at industry conferences for most of 2000 and 2001. Countless articles, books, and papers have addressed the many facets of B2B e-commerce. Many start-ups entered the space seeking first mover advantage while others sought competitive advantage through consortia and exchanges. The hype created by the media and market forces overshadowed reality and practicality. (Laseter, Long, and Capers, 2001).

The number of marketplaces rose to approximately 2000 globally as companies rushed to take part in the B2B marketplace gold rush (Laseter, Long and Capers, 2001). These B2B marketplaces promised productivity gains, cost reductions, revenue generation, and increased efficiency in matching buyers and suppliers (AT Kearney, 2001).

Growth in marketplaces began to decline in 2001 and has continued on a downward spiral since then. Many of these e-marketplaces could not survive and were forced to close. B2B marketplaces and exchanges were among the very hardest hit when the dotcom stock market bubble burst. After running up to unbelievable levels, the typical marketplace stock is down by 90 to 99 percent.

Reasons for the Failures

In addition to cultural and technical obstacles, there are a multitude of economic, business and management issues which led to the downfall of B2B marketplaces.

- Greed led to the collapse of many e-marketplaces. There was an amazing gold rush mentality that went beyond reason. Business models that didn't make sense got funded to try to capitalize on the huge stock market valuations. Companies built something online, but most didn't meet the needs of an industry (Lay, 2000).

- Business models of most B2B exchanges were not well developed. They did not take the time to study customer expectations or develop a path to profitability. (Wise and Morrison, 2000).

- Procurement may not be the "killer app" for net markets that was assumed. To many, e-commerce is more about collaboration and streamlining supply chains. (Murphy and Baling, 2001).

- There was a lack of standards to promote integration across company sites, distributor sites, and industry sponsored exchanges with back end systems (IDC, 2001).

- Companies underestimated the value of catalog content in the success of e-procurement projects (Poet, 2001).

- Very few e-marketplaces have attained the critical mass of participants required to deliver the anticipated benefits. Too many buyers and suppliers are still waiting to see how this concept will develop. (BCG Research, 2000).

- Although marketplaces needed a content and catalog management strategy to be successful, few got it right. And still today, very few marketplaces possess the expertise or resources for acquiring, transforming categorizing, managing and distributing catalog content (Knickle, 2001).

- Excessive management hype created inflated expectations as to what marketplaces would do and how quickly they would be up and running. When reality didn't keep pace with the promises, many became disillusioned.

- Companies were surprised by the complexity of running an exchange. They struggled to develop the infrastructure, service offerings, and the business expertise required. Running a marketplace, selling it to buyers and suppliers, content mapping, and transaction enablement is not a core competency for many businesses other than those devoted to running marketplaces. (Cap Gemini and Earnst & Young, 2000).

- Companies decided to turn inward and focus on private exchanges that linked them with key partners and suppliers. The objectives were not to change processes, but make them more efficient (AMR Research, 2001).

- Suppliers were unwilling or unable to participate for various reasons. In particular, suppliers did not rush to join the many buyer-centric marketplaces where the primary application was reverse auctions aimed at squeezing supplier margins (IDC, 2001).

- A lot of e-marketplaces had an excessive focus on the technology in the mistaken belief that "if we build it they will come" (Fingar and Aronica, 2001).

- Consortium exchanges were stymied by huge integration barriers, runaway costs, technological complexity, administrative bickering, rivalry among competitors, and a souring market for B2B exchanges (IDC, 2001).

Survival of the Fittest

Despite the problems, optimism regarding the future of exchanges is strong. Nearly half of all companies polled in a Giga Group study (2001) expect exchanges to improve profitability and create standard business practices. Another study by Gartner (2001) states, "By 2005, public and private e-marketplaces will become the dominant B2B trade mechanisms for thousands of companies." The overall concept of marketplaces is sound. Marketplaces are the next wave of business transformation. The challenge is for e-markeplaces to create the critical mass and liquidity necessary for a viable business (Boston Consulting Group, 2001).

This will not be easy for most players in this space. Boston Consulting Group (2001) predicts that the US B2B marketplace will be reduced to a handful of e-marketplace giants serving a given industry. Many niche players will emerge to address specific needs of industry segments. It will be survival of the fittest with significant opportunities for those who survive.

A prerequisite of survival and success is to have a business model that is appropriate to the industry—and then to execute effectively. However, decisions as to what is the right business model vary tremendously by industry—and by where the marketplace fits in the value chain. Clearly there is no magic formula for selecting the right business model since most surviving marketplaces have evolved their models several times, often quite dramatically.

For consortium exchanges two factors will ultimately drive their success or failure. They will need to create services that become an industry standard. In addition, they need founders that remain committed to ensure the financing and usage fees necessary to keep the exchange afloat while it builds capabilities. For independent marketplaces it's essential to focus on the bottom line to conserve cash. Launching bleeding edge new services is no longer affordable. Independents that are clearly focused on a niche market and/or application will have the best chance of success—if they have built a sustainable customer base and deliver a clearly visible value proposition (Laseter, Long and Capers, 2001).

CONTENT WAS NEGLECTED AND UNDERVALUED

If one looks back at all the expert views on what it was going to take for B2B commerce and marketplaces to flourish, what stands out is that many grossly underestimated the value of content and the difficulty of creating and maintaining it.

The early focus on transactions from the sell-side, and the buy side was a primary reason for the lack of focus on content and catalog issues and thus jeopardized all e-commerce initiatives. Most procurement applications and marketplaces have failed to deliver the benefits expected primarily because of the difficulty of acquiring and managing content. In fact, the lack of suppliers with digital catalogs may be the biggest factor limiting the growth and widespread adoption of B2B e-commerce.

Why Content Was Neglected

How could so many smart people either not appreciate the importance of content, or not allocate the necessary resources to content? The reasons for this state of content, and particularly supplier catalogs, are many.

Assuming traditional hub and spoke behavior was a key reason. Just like years ago when buyers demanded that key suppliers move to EDI or lose the business, many expected that suppliers would be forced by buyers to get their catalogs digital. The lesson this time is that if you build an exchange or marketplace, suppliers will *not* come—without convincing and assistance.

Assuming that digitizing catalogs was a no-brainer today for suppliers was another key reason. However the software, tools, standards and services are still immature and evolving. Digitizing catalogs is a major change for suppliers that impacts many systems and business processes. While marketplace operators and e-procurement software vendors paid close attention to the giant distributors whose catalogs were the foundation for MRO procurement, no one was out getting face-to-face with the thousands of other suppliers. The reality is that most suppliers are not ready to develop and manage digital catalogs on their own—and that they require education, handholding, software, service and support.

Many who took content for granted were shocked to realize that content acquisition and maintenance is hard work and that there are no shortcuts. In addition, there was a shortage of firms who were even able to do it.

Lastly, there was a lack of clarity about who would pay for content acquisition and maintenance and even today, it's still unclear with an evolving combination of buyers, suppliers and marketplaces. E-procurement software vendors and marketplaces lacked business models that addressed the high cost of content. They seemed to hope that somehow, someone else would do it so that they could focus on large buying organizations and on the more glamorous and lucrative areas of transactions, collaboration and integration.

Content Reduces Interaction Costs and Creates Value

Today, success for many businesses depends on achieving advantages in the manufacturing process. This has driven firms to concentrate on core competencies and core products, which is behind the huge shift to outsourcing, and private label and offshore production. These trends have, in turn created high interaction costs (Essig and Arnold, 2001).

According to a McKinsey report (Bryan and Fraser, 2001), "interaction costs—expenses generated by the need to coordinate work among different parties—now represent as much as 51% of labor activity in the United States." The fundamental value of electronic and structured content is in it's ability, along with technology to reduce the huge interaction costs that businesses suffer from today. However, in addition to cost reduction digital content also expands the possibilities that purchasing and/or selling will create value for the firm. Better information and content can create significant competitive advantages for buyers and sellers.

Content Fuels Commerce and Exchanges

As emphasized in a recent report promoting the value of B2B content networks (Kinecta, 2001), content will drive every interaction, transaction and activity across the supply chain with customers, suppliers and partners. Product catalog information in particular, is the fuel for commerce. Without the electronic catalog there is no e-commerce. Content is also the fuel for exchanges. According to AMR Research (Knickle, 2001), "content is the heart of all marketplaces-private, consortium, and public." That's because incomplete or inaccurate content, or an ineffective search engine will dramatically reduce the value of a marketplace for all participants.

Since inefficiencies in purchasing are largely information driven, the availability of greatly enhanced information and content rich marketplaces gives buyers the ability to be much more efficient and effective (Essig and Arnold, 2001). According to a study by A.T. Kearney and CAPS (2001), sourcing represents 73% of the total procurement savings opportunity. Aberdeen Research (August 2000) had a similar finding, saying that "the initial sourcing process, from supplier search and identification through contract negotiation and final purchase, has the greatest impact on the cost, quality, and delivery of a product or service."

Since content fuels business activities, the value of a business network is highly correlated with the flow of content through the system to participants. The ability to get the right content to the right people in a defined format and time frame will be critical to the future success of companies in the B2B marketplace space (Kinecta, 2001).

Barriers to Content

High quality content is in much higher demand than the available supply. However the barriers are significant and there are no content management shortcuts—from standards, content suppliers or syndication. Companies have seriously underestimated the effort involved in managing content. The barriers are many including: incomplete and incorrect data, a lack of content syndication, incomplete vendor solutions, inadequate solutions and services from marketplaces, multiple sources of content within a company and a lack of standards (Mitchell, 2001). Each of these factors could be expanded on in more detail and represent key areas to be addressed as companies move forward with B2B electronic commerce initiatives.

CONCLUSION

In summary, B2B e-commerce has not grown or been adopted as quickly as was forecast. Two primary reasons as explained in this paper are that marketplaces and exchanges did not flourish as expected and the gross lack of attention to, and appreciation for, the importance of content, which is the foundation of all commerce initiatives.

More extensive research is needed to address company strategies and directions for successful implementation of B2B e-commerce and marketplace initiatives as we move forward in designing business models that address the needs of the industry and specific players in the e-marketplace space.

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BENEFITS AND DIFFICULTIES IN USE OF REAL PROJECTS FOR ADVANCED DATABASE APPLICATIONS

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ABSTRACT

Teaching advanced database applications presents opportunities and difficulties in providing students with a robust experience. The use of case studies, whether chosen by the instructor or by the student, is limited in scope and often has a finite and pre-determined termination; that is, the case studies are generally constructed to illustrate a point or set of points for a prescribed concept within database theory. Thus, the use of several case studies is often necessary. This precludes the use of larger, more difficult (and therefore more realistic) case studies due to the confines of semester timelines. The use of real problems, solicited from the community, can solve these challenges, but present others. These cases are solved in real time and imbue the student with a full and detailed grasp of the many factors that affect project success. This paper focuses on the experiences of students participating in an advanced database applications class solving challenging design problems using available technology and interacting with users of limited technological training.

INTRODUCTION

The database is the foundation of any information system. If the database is not robustly designed, free of anomalies and designed with a comprehensive knowledge of the organization and how the data will be used, any application built on top of it will contain problems. This leads to awkward and inefficient coding solutions and eventually a rebuild of the database. In addition, a properly designed database is a major factor in application speed, followed by index design and query design [1].

Database and application design does not occur within a vacuum. They are merely pieces of an overall and thorough systems analysis and design. Design specifications for the database are required along with input and output design, security and integrity. The stereotype of the isolated information technology professional is invalid. Database developers must be able to work in groups and communicate with non-technical, often untrained personnel in order to develop solutions that meet organizational goals. They must be able to translate sophisticated concepts into workable solutions. They must have depth in a broad range of skills, both technical and interpersonal.

Even the textbooks for courses in advanced database design tend to focus on one area: database theory, the underlying mathematical concepts, the physical implementation and tuning. While all these are important, students need an experience that will allow them to assimilate the entire range of a project from start to finish.

Students in this course have already completed a course in Systems Analysis and Design and an Introduction to Database Applications course, which requires completion of a small project. The use of case studies in such courses is valuable but limited. They tend to illustrate one trouble spot or one application of a theory. Even case studies that are followed throughout a text suffer from the lack of interaction between diverse members of a project team and cannot simulate the organizational climate.

Due to the confines of the standard sixteen-week semester, even a variety of more complex case studies cannot match the experience of students actually designing a fully functioning database application from start to finish. In addition, previous iterations of the advanced database course that is the topic of this paper found that students felt that completion of a "toy" project was unfulfilling. The amount of effort that was expended for a throwaway project left students dissatisfied.

PROJECT

A decision was made to obtain real projects for the next group of advanced students. Since Wentworth Institute of Technology is located within an economically disadvantaged section of Boston, a philosophical decision was made that only projects from local non-profit agencies would be solicited.

This requirement lead to the first set of difficulties. Non-profit agencies are always underfunded and may not have the necessary equipment. Social service agencies also tend to lack technically astute personnel due to their high cost. The time necessary to sit with a student design team would be time away from the agency's mission.

In addition, the projects chosen had to be completed within a sixteen-week semester. Information technology projects are organizationally famous for being over time and cost estimates. This meant that the projects had to be small enough to finish—in fairness to both the students and the chosen agency—but still complex enough to challenge the students.

A previous attempt at finding real projects for senior design students had been attempted at Wentworth. It was abandoned due to problems with the agencies chosen not wishing to expend the necessary time. However, the projects in question were not non-profit organizations, mostly small businesses. It was hoped that the incentive of decreased time spent on automated functions would be motivation for the non-profit agencies' staff.

There was then the difficulty of identifying appropriate agencies and calling them with this proposal. Since Wentworth is involved with a program entitled, "Technology Goes Home," where obsolete equipment is donated to local agencies, there were the names of local agencies that had requested equipment available. This significantly cut down on cold calling of agencies.

Several meetings were necessary with the course instructor and the acting department chair, along with representatives of two agencies that had agreed to be a part of the pilot program. The two agencies were the Parker Hill/Fenway branch of Action for Boston Community Development (ABCD), and the Nelson Mandela Training Center. During this time, ten projects were identified and carefully negotiated to be technically and operationally feasible.

The ABCD projects consisted of a database of daycare openings, searchable by location, languages spoken, ages accepted, and fee schedule; a database of employment opportunities searchable by job title, location, and requirements; a database of education training programs; a database of available low-income housing, searchable by location, cost, size and subsidies accepted; and a grant-tracking database to assist the agency in coordinating requests for external funding and meeting grant guidelines.

The Nelson Mandela Learning Center wound up with a centralized client database and five applications: a marketing application for students completing programs who may want to take an advanced course; an application that tracks student progress through class levels, one for computer students and one for accounting students; an online test bank that randomly serves questions to students taking exams (to discourage cheating) that automatically calculates their grades; and an online application that can be filled out over the Internet for new students.

The agencies had computers that were capable of running a database application, but only Access 2000 software was available. This precluded the students from gaining experience in SQL Server or ORACLE, two highly complex and popular database engines.

Students were surveyed during the first week of class. There was one questionnaire on student skills outside of prescribed coursework in the curriculum, specifically if they knew how to web-enable databases. The second questionnaire described each project, and asked students to rank them in the order of their interest. The instructor then spent several hours matching student skills to interests and assigning groups. All but one group received their first or second choice of project.

During the next sixteen weeks, the instructor acted as a project manager. It was felt that the agencies all deserved a completed project after the time invested, so it was imperative to monitor group progress more strenuously than when teaching the course with toy projects.

Students were often frustrated with the limited ability of agency staff to answer specific questions or grasp technical concepts. Then, as the projects came together and the agencies began to see the potential, feature creep became intense. In addition, some agency contacts were under the misconception that students would be doing data entry of existing paper records. The instructor had to intervene on more than one occasion.

During the final weeks, when the projects were actually being coded, students discovered a known bug in a service patch of Access 2000. There was no time to obtain and install the fix, so students were forced to write workarounds.

At the end of the semester, all ten projects were fully functional. Students reported an estimated 500 programming hours had been donated to the two agencies. Students gave professional presentations on their projects and demonstrated the software for their agencies to representatives of Wentworth and the participating agencies. Then, students met at each agency for the installation and staff training.

PREVIOUS RESEARCH

Service learning is not a new concept, and there are other ways to introduce it to students. Other organizations have various implementations of providing a real-world experience to students. Wisconsin University at Eau Claire requires all baccalaureate students to complete thirty or more clock-hours engaged in an approved service-learning project, to allow students to apply classroom knowledge and serve their community [2]. All twenty-three campuses of California State University have a designated service-learning center. Service learning has been integrated throughout their curriculum, and they have found their programs to be highly successful [3]. Carnegie Mellon offers credit to students through a course specifically for computer science majors, entitled "Service Learning in Technology." Students are required to work with a non-profit organization [4].

SOME OBSERVATIONS

Programs that offer students real projects are not to be undertaken lightly. Many months of preparation were required from the instructor, and many hours of extra work were added as negotiations between students and agencies, or disagreements between student groups arose.

One student group repeatedly insisted that they should be compensated financially. The instructor replied that a project was required anyway, and that the real project would be advantageous on their resumes and could realistically translate into a better post-graduation job offer.

The student frustration with the users was actually seen by the instructor as a benefit. Interacting with non-technical users is an unavoidable feature of information projects, and the more experience with it, the better. Communications skills are imperative to designing a system that does what the customer wants.

Overall, student enthusiasm was quite high. Students were very animated in laboratory sessions and were clearly pleased when the agency users expressed satisfaction with project progress. Since some projects for each agency required a common database, students got to see first hand the intricacies of designing large-scale databases and learned to work with other students not in their group.

The director of the Nelson Mandela Training Center gave students an eloquent and impromptu speech on the impact of their work on their agency. He stated that in a time when social service agencies are underfunded and understaffed and needs are exploding, the software would free the staff from repetitive tasks and speed the services to clients. The students were moved.

Other non-quantitative observations are that some students were not performing as team members. One student was reported for refusing to repair significant anomalies in his data design that were causing problems in another group's application. This also required instructor intervention. These problems occur in all jobs and students need to learn to address them.

Another added benefit is the guarantee that student work is original. These custom-designed projects preclude the use of solutions copied from other students, textbooks or web sites. This is especially true when using non-profit organizations where the usual business models of customers, orders, products, and inventory aren't applicable.

FEEDBACK BY AGENCIES

Both the Nelson Mandela Training Center and ABCD expressed satisfaction with the process and the result. They would recommend working with Wentworth students to other agencies, and expressed a desire to work with Wentworth again.

The director of the Nelson Mandela Center has already requested a web-enabled online survey to measure student satisfaction and tailor program features to client needs. This would work with the core demographics portions of the existing database. The director of Parker Hill/Fenway ABCD has expressed interest in replicating the software to other divisions.

FEEDBACK BY STUDENTS

The following are comments from student evaluations and instructor interviews:

1. We need to be challenged more; this is a good project.

2. We should have done a project in SQL Server or ORACLE; we don't use Access in my job and the DBA (database administrator) laughed at me when I told him we were learning Access.

3. Next time, don't have a real project.

4. This took WAY more time than I expected (the most common observation from students).

FUTURE PLANS

The instructor plans on continuing to use real projects in the classroom. The benefits seem to greatly outweigh the difficulties and further iterations will eliminate problems experienced in this pilot study. The non-profit agencies win; the students win; and Wentworth also wins as it proves its commitment to the community. The department head has offered continuing support.

It is hoped that as word of the program expands, that area agencies will contact Wentworth instead of the previous tedious process.

The department is currently exploring partnering with a local college in the Boston area that offers an education major. The other school would devise an educational assessment study to determine if students in the sections using real projects have a greater understanding and retention of the material.

This program could also be expanded to include other majors at Wentworth. It is currently being explored to have the Management of Technology majors formally act as project managers so that they can benefit from a live project. This would free the instructor from project management duties as well.

It is also hoped that projects can be completed using something other than Access. While Access is an affordable database, it lacks the sophistication of higher end databases and will not assist students in obtaining more lucrative positions such as database developers or database administrators.

CONCLUSIONS

Using real projects is preferable in advanced classes that require students to draw on a significant and broad pool of resources cultivated in prerequisites. This will prepare students to be more successful in their jobs after graduation and expand their resumes. It is also hoped that the experience of working with nonprofit agencies will instill in students a lasting commitment to community service.

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ONLINE LEARNING: EVALUATING ITS EFFECTIVENESS

Panel

Panel Members

Marianne J. D'Onofrio
Central Connecticut State University

Raymond Papp
University of Tampa

Lance Revenaugh
Cedarville University

TOPIC

Within the last five years the number of universities and colleges offering courses online has increased substantially; however, there is some skepticism about the actual value of online learning. The current state of online learning evaluation, its adequacy, and potential for additional evaluation methods will be discussed by the panel presenters.

This panel presentation is intended to foster dialogue on the importance and need for online learning evaluation and on the comparison of online learning environments with the influx of a variety of Virtual Learning Communities (VLCs) including Blackboard, WebCT, and eCollege. It is expected that the panel presentation and dialog will generate ideas for research exploring the effectiveness of online learning in these VLCs.

FORMAT

Each panelist will begin with a brief overview of his/her experiences with on-line learning using one or more of the Virtual Learning Communities (VLC's) described above. The audience will then be invited to ask questions from the panel members regarding their experiences and thoughts.

Audience members will take with them a better understanding of the most common VLC's in use today, their strengths and weaknesses, as well as general guidelines for how to use these tools pedagogically in the classroom.

INTERNET-ENABLED AUDIO COMMUNICATION: A RICHER MEDIUM FOR STUDENTS FEEDBACK?

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ABSTRACT

This study compared the effects of using voice mail (v-mail) to electronic mail (e-mail) over the Internet to provide student feedback using Media Richness Theory (MRT) and Social Presence Theory (SPT) as the theoretical framework. MRT and SPT would predict that v-mail would be perceived as higher than e-mail in media richness and social presence. Results indicate, however, that while v-mail was perceived to have significantly higher social presence, the two media were not significantly different in terms of perceived media richness. Both e-mail and v-mail were perceived as capable of providing a reasonably high quality of feedback. Implications of these findings are discussed.

INTRODUCTION

The rise of Internet computing and related technologies has created a technological platform that allows professors to rethink the way they deliver feedback to their students. Providing timely and appropriate feedback is a must for a student to have a successful learning experience (Nabors, 1999). It can promote student learning, increase student satisfaction with a course and an instructor, and improve course/program completion rates (Hackman & Walker, 1990; Inglis, 1998). Students receive intrinsic feedback while engaging in their learning activities and/or extrinsic feedback through some form of communication with the instructor (Inglis, 1998). Traditionally, the extrinsic feedback is provided either through face-to-face or via written comments on student assignments and exams during the following class meeting or much later. Computer-mediated-communication (CMC) technology has made it possible for students to receive their feedback electronically without having to wait for a meeting with the instructor at a specified time or location. This can reduce the time between submitting an assignment and receiving feedback on the assignment (Inglis, 1998; Xu, 1996).

Due to its ability to support asynchronous communication, text-based e-mail facilitates communication between individuals or groups of individuals (El-Shinnawy & Markus, 1997) and has become a popular communication medium (Inglis, 1998). In a recent study, Blake (2000) noted that most students preferred submitting an assignment as well as receiving feedback via the Internet. In comparing the Internet with face-to-face feedback from the instructors, more students rated receiving feedback through the Internet as extremely effective (64.6% vs. 54.2%) or very effective (27.1% vs. 16.7%). The increased use of e-mail among both students and faculty creates new avenues for delivering feedback to students. Many faculty members have used e-mail to communicate with their students, thus providing immediate feedback and a direct means for communication (Huang, 2000; Nabors, 1999; O'Neill, 1997).

Bates (1995, p. 202) noted that CMC is "one of the fastest growing technologies, in terms of the number of teachers and learners who are using it." E-mail is one type of CMC that allows for both one-to-one and one-to-many textual communications via a host computer. The recipient can save the e-mail messages indefinitely in computer memory, read or reread them at any time, copy them, change them, or forward them. E-mail provides faster communication with greater efficiency compared to face-to-face communication or postal services. E-mail allows individuals to exchange ideas spontaneously and casually, discuss problems and share skills, coordinate activities, and stay in touch with one another without regard to an individual's physical location (Grunwald, 1990; Huang, 2000; Sproull & Kiesler, 1991).

In spite of the benefits that e-mail can offer, it is a limited symbolic representation system devoid of oratory and graphic appeal. It requires keyboard skills and writing abilities in order to avoid misunderstandings (Bates, 1995; Sproull & Kiesler, 1991). Social and contextual cues that usually regulate and influence group communication dynamics are missing or attenuated. However, when there is a highly developed and shared interpretive context, e-mail is an appropriate communication mode (Huang, Watson, & Wei, 1998; Trevino, Lengel, & Daft, 1987; Zack, 1993). It can be used to complete numerous instructional activities such as course material presentation, collaborative and project work, help hotline, group discussion and group activities, and evaluation (Xu, 1996).

While many faculty members have embraced traditional e-mail as a means of communicating with students, few have ventured beyond text-based communication such as using v-mail systems to communicate with students via voice rather than the text form of e-mail (Huang, 2000). The purpose of this research was to explore the media richness and social presence of the two media, traditional text-based e-mail and internet enabled v-mail, in providing feedback to students, and to compare which of the media, traditional e-mail or internet enabled v-mail, would provide a higher quality of feedback to students. Media Richness Theory (MRT) and Social Presence Theory (SPT) provide the theoretical foundation for comparing the two media. These two theories suggest that one medium may be inherently richer or more socially present than another. While there has been considerable research on MRT and SPT, and measures have been developed to assess the media richness and social presence constructs, there has been little, if any, attempt to reconcile these two constructs, or to apply them within an education and learning context. Therefore, in conducting this study, the following research questions were addressed:

RQ#1) Would students perceive v-mail attachments sent over the Internet to have a higher media richness as compared with more traditional text-based e-mail?

RQ#2) Would students perceive v-mail sent over the Internet to have a higher social presence as compared with more traditional text-based e-mail?

RQ#3) Would students perceive v-mail sent over the Internet to provide a higher feedback quality as compared with more traditional text-based e-mail?

BACKGROUND AND LITERATURE REVIEW

Effective communication has long been recognized as a key element in problem solving and decision making within and among organizations. The emerging information technologies, such as e-mail and v-mail, have expanded communication choices. MRT and SPT have been used to examine the effectiveness and appropriateness of traditional media, such as face-to-face meetings and written documents, as well as new media, such as e-mail and v-mail, in organizational communication.

Media Richness Theory

According to MRT, different media vary in information richness based on their capability of providing immediate feedback, the number of cues involved (i.e., body language, facial expression, tone of voice, etc.), message personalization, and natural languages (Daft & Lengel 1984; 1986). The more attributes the medium possesses, the richer the medium. Based on this definition of media richness, face-to-face communication is considered to be the richest medium because it provides immediate feedback and multiple cues, as well as utilizes natural languages. This is followed in media richness by the telephone which has fast feedback capability but lacks visual cues; "individuals have to rely on language content and audio cues to reach understanding" (Daft & Lengel, 1984, p.

198). Formal written communication is considered even less rich because of slow feedback, limited visual cues, and lack of audio cues.

Based on MRT one would predict that e-mail (which is an asynchronous text-based medium with near instantaneous delivery speed) would fall somewhere between synchronous voice communication and formal written communication (e.g., a letter sent in the mail) in terms of media richness. A study by Zmud, Lind, and Young (1990) provides some empirical support for this. Several studies have shown empirical support for the notion that voice communication (telephone) is perceived as having higher media richness than e-mail (Schmitz & Fulk, 1991; Fulk & Ryu, 1990; and Trevino et al., 1990). While e-mail is text-based (low language variety and cues) and asynchronous, it offers faster communication than paper-based documents, which allows for immediate feedback. Therefore, e-mail has been ranked between face-to-face meetings and letters in terms of its perceived media richness (Trevino, et al., 1990; Trevino, Webster, & Stein, 2000).

MRT would predict that v-mail (which allows for asynchronous voice communication) would fall somewhere between the telephone (which allows synchronous voice communication) and e-mail. Again, the study by Zmud, Lind, and Young (1990) provides some empirical support for this, as does a study by Rice (1992).

Other studies (Dennis & Kinney, 1998; Trevino, Webster, & Stein, 2000; Westmyer, DiCioccio, & Rubin, 1998) have confirmed that for *traditional* media (i.e., face-to-face, telephone, letters, memos), perceived media richness was significantly higher with increased multiplicity of cues and increased immediacy of feedback. However, with respect to *new media* such as e-mail, there has been some debate as to whether or not the medium itself is inherently lean. Studies by Zack (1993) and Lee (1994), for example, suggest that e-mail can be regarded as a rich medium, particularly when those who are communicating have a shared context or understanding. These authors and others would argue that media richness is not an inherent property of the medium, but rather an "emergent property of the interaction of the electronic-mail medium with its organizational context" (Lee, 1994, p. 143). Even proponents of media richness theory have acknowledge that e-mail, because of its rapid delivery, may be quite appropriate for exchanging time-sensitive information, and in this respect it is similar to the traditional medium of the telephone (Rice, 1993; Rice & Case, 1983; Trevino, Lengel, & Daft, 1987).

Social Presence Theory

According to Short, Williams, and Christie (1976), social presence is a subjective quality of the communication medium and relates to the social psychology concepts of intimacy (determined by physical distance, eye contact, smiling, and personal topics of conversation) and immediacy (determined by the media capacity of transmitting information). Therefore, social presence depends on the amount of information transmitted as well as the words conveyed during communication, verbal cues (e.g., tone of voice), nonverbal cues (e.g. facial expression, direction of gaze, posture, dress), and the communication context. Based on this theory, communication media such as face-to-face meetings, which are capable of conveying nonverbal cues and social context cues, are considered to have higher social presence than computer-mediated communication media and written documents because they lack nonverbal feedback cues (King & Xia, 1999). Presumably, the higher intimacy and immediacy the medium has, the richer the medium and the higher the social presence (Daft & Lengel, 1984; 1986; Dennis & Kinney, 1998; Short, Williams, & Christie, 1976; Trevino, Webster, & Stein, 2000).

Rice (1993) used social presence theory to compare traditional and new media by analyzing data from six studies designed to examine the use and effects of new media. He found that due to the lack of social presence, both v-mail and e-mail were ranked lower in their overall task appropriateness than traditional face-to-face meetings and e-mail was ranked even lower than v-mail in both overall appropriateness and for exchanging timely or confidential information.

Based on MRT and SPT, one would expect text-based e-mail to be a richer and more socially present communication medium for providing feedback to students than the written feedback students normally receive on their returned assignments and exams (because e-mail has the ability to provide immediate feedback). However, e-mail would be predicted to be a much leaner and less socially present medium than traditional face-to-face or telephone communication due to its inability to provide the same level of social presence and nonverbal cues. In the same vein, MRT and SPT would predict that v-mail via the Internet should be perceived as a richer and more socially present medium than text-based e-mail in providing feedback because v-mail has a personal focus and is easier to express in dynamic natural language, whereas e-mail can only convey static visual cues in text.

While social presence and media richness are treated as separate and distinct constructs in the literature, they would appear to be quite closely related constructs. There have been no studies of which the authors are aware that measure both constructs and seek to compare the results. Thus, although one might predict that a medium which is perceived to have higher media richness would also be perceived as having a higher social presence (and vice versa), this has not been demonstrated empirically.

Moreover, no single study has been conducted to compare the effects of using Internet based v-mail to e-mail to provide feedback to students. Recently, internet-based communication technologies have made it possible for individuals to send and receive asynchronous voice communication over the Internet in the form of e-mail attachments more easily. This study was designed to compare students' perceived media richness, social presence, and the quality of feedback associated with v-mail sent over the Internet versus e-mail.

RESEARCH METHOD

To address the research questions of this study, traditional text-based e-mail and Internet-based v-mail were utilized to provide feedback to students. In this study, the traditional text-based e-mail feedback was composed, delivered, and received using standard e-mail software whereas the v-mail feedback was recorded and played back using PureVoice™. PureVoice™ software allows the user to share his or her voice file with anyone in the world who has an e-mail account, access to the Internet, and a computer running on either the Windows or the Macintosh operating system. PureVoice™ is compatible with most e-mail systems, including Qualcomm's Eudora Pro and Eudora Light. The PureVoice™ Player-Recorder lets the user record and send voice messages as e-mail attachments and allows the recipient play back the sender's voice-mail messages on his or her Windows or Macintosh computer with the click of a mouse. Voice messages composed with PureVoice™ have extremely high sound quality—(nearly as high as one would experience in a local phone call made over a high-quality connection). Yet, because PureVoice™ uses compression technology, the messages take up relatively little disk space and can be sent very quickly over the Internet (Qualcomm Incorporated, 1998).

Design

An experimental design was employed in this study. Students enrolled in two graduate courses at a large southeastern university during the 1999-2000 academic year were randomly assigned to one of the two experimental conditions, Internet-based v-mail (v-mail group) and traditional text-based e-mail (e-mail group). Students in the v-mail group received their feedback via an attached voice file sent over the Internet as an e-mail message. Students in the e-mail group received their feedback over the Internet using a traditional text-based e-mail message without a voice attachment. Such an experimental design ensured that students not assigned to the treatment group would not pay a penalty in terms of how quickly they received feedback on their exams from the instructor. A total of 46 students participated in the study with 23 students being assigned to the v-mail group and 23 students being assigned to the e-mail group.

Students in both groups received either voice-based or text-based feedback on their exams in the course. A copy of the exam questions was attached to each e-mail message, regardless of the group to which a student was assigned. When preparing an e-mail feedback message, the instructor composed and edited using a word processor whereas a voice feedback message could only be edited by erasing the message and starting over again (El-Shinnawy & Markus, 1997). In order to provide consistent and high quality feedback to both groups, all feedback for each student was first composed and edited in a word processor, then e-mailed to students in the e-mail group or read to those in the v-mail group. This extra step of composing and editing ensured that students received the same level of feedback and comments regardless of the group to which they were assigned.

Data Collection and Analyses

Students in both groups completed an anonymous questionnaire with each of the two versions tailored to the particular group in which the students were assigned (v-mail or e-mail group). Some students offered additional comments in response to open-ended questions that were included in the questionnaire. Apart from minor modification of wording to reflect the treatment group to which a student was assigned, the two versions of the survey were designed to be as identical as possible and to allow for comparing responses across the two treatment groups.

The questionnaire included established measures (4-item scales) for media richness (Schmitz & Fulk, 1991) and social presence (Short, Williams, & Christie, 1976), as well as specifically designed items measuring perceived quality of the feedback (see Appendix). The media richness measure was adapted from Schmitz and Fulk (1991) and was based on the criteria specified by Daft and Lengel (1984). This measure has been widely used by others (Carlson & Zmud, 1999; El-Shinnawy & Markus, 1997; Fulk & Schmitz, 1995). The social presence measure was based on an instrument developed by Short, Williams, and Christie (1976). In addition, the questionnaire included 4-item measures for perceived feedback quality, single-item measures for perceived usefulness and perceived ease-of-use of the software, as well as several open-ended questions designed to gather qualitative data from the students regarding their reactions to the feedback mechanism used in the group to which they were assigned. The Appendix holds the measurement items that were used to assess media richness, social presence, feedback quality, usefulness, and ease-of-use.

Both descriptive and inferential statistical analyses were conducted to describe and compare the perceptions of media richness, social presence, quality of feedback, and the usefulness and ease-of-use of the software. Qualitative responses were discussed and related to the quantitative data.

RESULTS

Though the items used to assess media richness and social presence represent established measures, their reliability was assessed using Cronbach's alpha. The four-item measure for media richness had a reliability of 0.61. Statistical analysis revealed that the reliability of this scale could be increased to 0.72 by dropping the first item while retaining the other three items. A decision was made, however, to retain all four items, since they represent an established measure that has been used elsewhere (Carlson & Zmud, 1999; El-Shinnawy & Markus, 1997; Fulk & Schmitz, 1995; Schmitz & Fulk, 1991) and since their reliability was judged to be adequate for exploratory purposes. The four-item measure for social presence had a reliability of 0.83. The four items designed to measure perceived feedback quality were factor analyzed and revealed a single-factor structure. These four items, which measured helpfulness, usefulness, quantity and detail of the feedback received, exhibited high reliability (Cronbach's alpha = 0.86).

A one-way analysis of variance (ANOVA) indicated that there was a significant difference between treatment groups on perceived social presence of the media (F = 28.65, Sig. = 0.000). Specifically, attached v-mail files sent over the Internet (using PureVoice™) were perceived as having significantly higher social presence as compared with text-based e-mail. A similar one-way ANOVA was conducted to investigate whether the same pattern of results would hold true for perceived media richness. This ANOVA, however, revealed no significant difference between treatment groups in terms of perceived overall media richness (F = 0.428, Sig. = 0.517).

Both media (e-mail and v-mail) were perceived as being reasonably rich and relatively high in social presence (mean score 3.74 vs. 3.86 and 3.25 vs. 4.08, respectively, on a 5-point scale with 1 being the lowest richness/social presence and 5 being the highest). As expected, both e-mail and v-mail were perceived to have provided relatively high quality feedback (mean score 3.70 vs. 3.76 on a 5-point scale with 1 being the lowest quality and 5 being the highest). The difference between the two groups was not found to be statistically significant in the one-way ANOVA (F = 0.097, Sig. = 0.756).

The e-mail group perceived that the software they used was both more useful (4.1 mean) and easier to use (4.74 mean), as compared with the v-mail group on these same measures (3.95 mean for usefulness and ease-of-use). The difference in perceived usefulness of the software was not found to be significant (F = 0.421, Sig. = 0.502), but the difference in perceived ease-of-use *was* found to be statistically significant (F = 8.90, Sig. = 0.005).

Tables 1 and 2 provide a representative sampling of the qualitative data students furnished on the survey in response to the open-ended question, "What was the thing that you liked the most about receiving feedback via e-mail/attached voice-mail files?" and "What was the thing that you liked the least about receiving feedback via e-mail/ attached voice-mail files?"

TABLE 1
REPRESENTATIVE RESPONSES TO THE QUESTION, "WHAT WAS THE THING THAT YOU LIKED THE MOST ABOUT RECEIVING FEEDBACK VIA E-MAIL/ATTACHED VOICE-MAIL FILES?"

E-mail Group	V-mail Group
Could be printed and filed/shared. Could easily refer to earlier/later sentences within the e-mail.	It was good to hear comments and be able to form an impression of the instructor's view/expectation of work.
It gave me sometime to reflect on the answer. Also, it was useful in providing feedback and questions to the instructor.	I like the real voice from instructor. From that, I know that instructor really read/graded my paper. Otherwise, I really wonder/doubt that the instructor read it or not.
Timely: can get the feedback before the next class. Personal: feedback is based on my own performance and more focus, more specific. Easy to reference: since it is a written message, it's very easy to use as a reference.	It attached a human to the exchange. Also I believe, it gave a more honest evaluation in the sense that I did not interpret correctly or incorrectly what the words mean (i.e., inflection, posture, regulative). It was right there.
The rapidity and completeness. I liked knowing what I got on the exam and why before I got the exam back.	It is really to identify the points that you wanted to stress. The inflection of your voice.
Easier to read than on a copy, usually more detailed— having it in another place than on a copy force you to think and retrace what you wrote.	I think it allowed for more timely response. Forming an answer and recording is faster than writing it out and seems to allow the responses to be returned to us faster.
The timeliness of the feedback—getting results in private. More personal than class review.	I felt like you are probably more familiar with us, the students, and that you spoke to each of us "on our level."
E-mail feedback is descriptive and tailored to individuals	Tailored, customized and more personal.
Getting feedback before class.... More one-on-one feedback than class time.	Psychological. Make me feel differentiated from the class. Easy to understand than to read someones handwriting.
I liked the timely nature and availability. It is nice to be able to reference the comments.	The potential timeliness of feedback. Ability to say what you mean may be quicker and easier than writing.

TABLE 2
REPRESENTATIVE RESPONSES TO THE QUESTION, "WHAT WAS THE THING THAT YOU LIKED THE LEAST ABOUT RECEIVING FEEDBACK VIA E-MAIL/VIA ATTACHED VOICE-MAIL FILES?"

E-mail Group	V-mail Group
No info written on test. If I look a test in the future I will have to find the e-mail message.	Not readily referable. Have to play back several times if you don't understand part of points.
I think of the two forms of written communication e-mail & handwritten on exam, the latter is richer. Professors tend to write little notes next to item, from which I infer more than summaries of grading of my answers.	With the voice responses it is not as easy to move backwards and forwards in the response to pinpoint and coordinate with each section of the test. I had to listen to the response all the way through. It was not always easy to get to the right place.
Not having my answers to compare to comments/grading. Scanned test with answers would be ideal attachment, but not practical for large class.	Making myself take the time to do it. Using the normal method was more convenient since I am in class and everyone else is reading over their test at the same time.
The comments could not be specifically related to answers on the exam. You are not able to see a comment next to a specific area.	The initial setup of the plug-in. A URL for the plug-in with the e-mail, or, a pilot e-mail with plug-in URL to test sample would have been good.
The e-mail comments were too general.	In transmitting the message or information, it isn't much different from e-mail in usefulness and effectiveness
I didn't have my exam back yet, so couldn't remember exactly what I wrote to compare it to the feedback.	If you did not do well, it feels like the professor is in front of you telling you the bad news.

As the comments in the two tables reveal, students in both treatment groups appreciated the timely and personalized feedback. Although students in both groups had copies of the exam questions, both groups found it frustrating to relate the feedback to their own exam answers. This frustration was caused by two factors: (1) students received feedback before they received the hardcopy of their exam answers, and (2) the feedback was not on the exam itself. Students in the v-mail group experienced additional frustrations in that they had to install the PureVoice™ software and had to replay the entire message multiple times in order to access specific portions of the feedback. It is clear, however, that students in the v-mail group appreciated the higher social presence of the medium, whereas students in the e-mail group appreciated receiving the text-based feedback because it could be printed, filed, shared, used as a reference and accessed in a non-sequential (direct or random) manner.

DISCUSSION AND IMPLICATIONS

Perceptions of social presence observed from this study were consistent with SPT. As SPT would predict, attached v-mail files sent over the Internet were perceived as having a higher social presence than e-mail. In accordance with MRT, v-mail was perceived to be slightly higher than e-mail in terms of media richness. However, this difference was not found to be statistically significant, and in fact e-mail (which is often regarded as a lean medium) was perceived as being a reasonably rich communication medium. This suggests that the two constructs—media richness and social presence—are somewhat separate and distinct.

Although the difference in overall media richness perceptions was small and statistically insignificant, it was noted that e-mail was perceived to be significantly richer in "giving and receiving timely feedback" than v-mail (mean score 4.57 vs. 3.96 on a 5-point scale with 1 being the lowest richness and 5 being the highest, $F = 10.08$, $p = .003$). This might have affected the magnitude of the overall media richness perception because such a significantly different richness perception occurred in the opposite direction to the other three items measuring the overall media richness perception.

Perceived media richness may have also been affected by the perceived ease-of-use and previous knowledge of and experience with the software. Based on the experimental design, both groups physically received their feedback via e-mail or v-mail at the same time, but they perceived the timeliness of the media differently. This could be explained by the fact that individual perceptions of media richness are influenced not only by objective media characteristics (Rice, 1993; Trevino, Webster, & Stein, 2000), but by individual's experience with the medium (Carlson & Zmud, 1999; Fulk & Schmitz, 1995; King & Xia, 1999; Schmitz & Fulk, 1991), interaction between the individual and technology (media experience, preference, and skill) (Rice, 1992; Trevino, Webster, & Stein, 2000), perceived usefulness (Fulk & Schmitz, 1995), and perceived ease of use (the extent to which an individual believes that using a particular technology system would be free of effort (Davis, 1989; Davis, Bagozzi, & Warshaw, 1989; Trevino, Webster, & Stein, 2000).

In this study, all of the subjects were graduate students who had extensive experience with e-mail and Internet usage, but no one had prior experience of using v-mail software. Although PureVoice™ was easy to use, it was new software and had to be installed for the first time for the students in the v-mail group. This not only affected an individual's media experiences and expertise, but may have also influenced the perceived ease-of-use (e-mail software was perceived to be significantly easer to use than v-mail software, $F = 8.90$, Sig. = 0.005). This might have influenced students' perception that e-mail was a significantly richer medium in "giving and receiving timely feedback" than v-mail. The qualitative data collected provides an indication that at least some students found the initial setup of the PureVoice™ software (downloading/installing the plug-in) to be somewhat inconvenient. In contrast, students in the e-mail group (who presumably already had access to e-mail software) would not have had to deal with downloading and installing any special software.

Putting the issue of timeliness aside, it is still possible that v-mail simply may not be perceived as a richer medium than e-mail in providing feedback to students via the Internet. For the other three items measuring the overall media richness ("transmitting a variety of different cues beyond the spoken message," "tailoring messages to your own or other personal characteristics," and "using rich and varied language"), v-mail was perceived as a somewhat richer medium than e-mail. Such differences, however, did not reach statistical significance ($p > .05$).

The fact that v-mail was not perceived to be significantly higher than e-mail in terms of media richness appears to run counter to MRT. However, it is consistent with some research studies that have suggested that e-mail can, in fact, be a rich medium (Lee, 1994; Zack, 1993).

Both the e-mail group and the v-mail group perceived feedback quality to be reasonably high and there was no significant difference between the two groups. This indicates that the step of composing and editing feedback for each student beforehand did control for the quality of feedback. In addition, this result suggests that perceived feedback quality may be influenced less by the type of *medium* that is used, and more by the actual *content* of the feedback. This study did not compare the quality of feedback provided by these two new media with that provided by more traditional media such as paper-based or face-to-face. Therefore, it is impossible to say that either e-mail or v-mail produces higher quality feedback than the traditional media do. One advantage of providing text-based or voice-based feedback to each student individually via the Internet was that it avoided student complaints of embarrassment or invasions of privacy noted by Blake (2000). In this study, no students expressed their dissatisfaction in this regard and at least one student mentioned "getting results in private" as one of the things that s/he liked the most.

Students in the v-mail group experienced frustration because they could only access portions of the feedback in a sequential fashion (by playing back the entire message) as compared with a text-based message that can be more easily scanned in a direct access (non-sequential) fashion. This finding is consistent with the literature (El-Shinnawy & Markus, 1997; Valachich, Paranka, George, & Nunamaker, 1993). E-mail's text quality helps people interpret the message accurately, and it is easier to process, filter and transfer than v-mail. A recipient of e-mail messages has random access to any of the messages in his/her inbox and the recipient can scan through a message in order to get to the important points, whereas a v-mail recipient has to go through all the v-mail messages sequentially and if there is a long sequence of messages, the cognitive overload tends to be higher.

Both e-mail and v-mail appear to be useful media for receiving feedback from the instructor and both are easy to use. In this study, both e-mail and v-mail received a high mean score (4.13 and 3.95 respectively on a 5-point scale with 1 being the lowest usefulness and 5 being the highest). This perceived high level of usefulness might relate to the relatively high quality of feedback students perceived because students in both groups ranked quality of feedback above 3.70 on a 5-point scale with 1 being the lowest quality and 5 being the highest. With regard to the ease-of-use perception, e-mail was perceived to be significantly easier to use than voicemail (presumably because v-mail was new to the students and required them to download software for the initial installation).

LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

As with all studies, this one is subject to certain limitations. First, while useful data were gathered to assess media richness, social presence, feedback quality, usefulness, and ease of use, there was no attempt to measure the possible impacts of different feedback channels (e.g., e-mail and v-mail) on learning outcomes.

Second, this study only compared the quality of feedback provided by two Internet-based media (text-based e-mail and v-mail attachments sent via e-mail). It is impossible, based on the results from this study, to tell whether these Internet-based media provide a higher quality of feedback as compared to paper-based or face-to-face feedback. Future studies should be conducted to include both traditional and Internet-based media that can be used to provide feedback to students.

Third, since all of the study subjects were graduate students majoring in computer information systems, generalizations to other populations should be made with caution. Similar studies should be conducted in other student populations as well as among employees who receive feedback from coworkers or supervisors.

Fourth, in order to reduce the overall length of the questionnaire, perceived usefulness and perceived ease-of-use were both assessed by single item scales, which cannot be evaluated for reliability. Ideally, a multi-item scale should be used to assess each of those two measures.

Finally, the finding that v-mail is perceived as having higher social presence than e-mail, but that the two media are not perceived as being significantly different in terms of media richness and media richness, suggests the need for further research into the subtle distinctions that may exist between these two constructs and the way in which they have been operationalized.

CONCLUSIONS

This study has shown that both e-mail and v-mail can be used to provide timely, high quality feedback to students. Perceptions of social presence observed in this study were consistent with the predictions of SPT; v-mail was perceived to have higher social presence than e-mail. However, the two media were not perceived to be significantly different in terms of media richness, casting some doubt on the applicability of MRT in this context. These results suggest that while the two constructs are related, there may be important nuances of difference in their conceptualization and operationalization that merit further study. The findings also lend some support to the notion that perceived media richness may not result from an inherent property of the medium, per se, but may result from some combination of the medium, its properties, and the social context in which the medium is used.

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APPENDIX
CONSTRUCTS AND MEASURES

Media Richness

We are interested in **your** perceptions of the **richness of this medium** along the following dimensions. Information richness is defined as the potential information-carrying capacity of data. If the communication of an item of data, such as a wink, provides substantial new understanding, it would be considered rich. If the datum provides little understanding, it would be low in richness. This concept of richness is also believed to apply to the richness of information that can be carried on different communications media. This is known as **media richness**. For each dimension of **media richness** below, **circle the number that best expresses your perception of [e-mail/attached v-mail file] as a communication medium.**

MR1. Giving and receiving timely feedback.

Not at all Rich — Extremely Rich

1 2 3 4 5

MR2. Transmitting a variety of different cues beyond the spoken message (non verbal cues).

Not at all Rich — Extremely Rich

1 2 3 4 5

MR3. Tailoring messages to your own or other personal characteristics.

Not at all Rich — Extremely Rich

1 2 3 4 5

MR4. Using rich and varied language.

Not at all Rich — Extremely Rich

1 2 3 4 5

Social Presence

Different media are believed to have varying levels of social presence. The capacity to transmit information about facial expression, direction of looking, posture, dress, and non-verbal cues all contribute to social presence of a communications medium. For each dimension below, **circle the number that best expresses your perception of the social presence of [e-mail/attached v-mail file] as a communication medium.**

SP1. Impersonal — Personal

1 2 3 4 5

SP2. Cold — Hot

1 2 3 4 5

SP3. Dehumanizing Humanizing

1 2 3 4 5

SP4. Insensitive Sensitive

1 2 3 4 5

Feedback Quality

Please evaluate the **quality of the feedback** that you received on your exams along each of the following dimensions.

The feedback I received on my exams was:

FBQ1 Not Very Helpful Very Helpful

1 2 3 4 5

FBQ2 Not Very Useful Very Useful

1 2 3 4 5

FBQ3 A Little A Lot

1 2 3 4 5

FBQ4 Not Very Detailed Very Detailed

1 2 3 4 5

Usefulness

Rate the **usefulness of [e-mail/v-mail]** as a medium for receiving feedback.

Not at all Useful Extremely Useful

1 2 3 4 5

Ease of Use

Rate the **ease-of-use of [e-mail/v-mail] software** as a medium for receiving feedback.

Not at all Easy Extremely Easy

1 2 3 4 5

IS ON-LINE DISTANCE EDUCATION A VIABLE ALTERNATIVE FOR UNDERGRADUATES? AN EXPERIMENT WITH THE STUDENTS IN GEORGIA, THE PROFESSOR IN AUSTRALIA

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ABSTRACT

This paper uses under-graduate students undertaking an on-line distance education class as the source for the evaluation of such classes. Although the sample size is small and there is some self-selection, it provides some preliminary answers to what such students see as the advantages and disadvantages of on-line education, whether these perceptions change with experience and to what extent such classes are effective. The results of the study reported in this paper suggest that some student students see on-line distance education in a very positive light, that these perceptions don't change with experience and that the learning outcomes can be positive.

INTRODUCTION

Higher education, particularly in the business schools in the US, is facing some interesting demographics—the University of Phoenix (an on-line for-profit university) has become one of the largest markets for business text-book publishers, demonstrating its rapid growth in this field; the US professorate is aging and there will soon be many retirements—at a time when college enrollments will have to grow to deal with the "baby boomlet" (children of baby boomers currently approaching college age); and supply shortages in the information intensive fields are likely to be chronic in the professorate because of the pace of change and the financial rewards available in industry for qualified individuals. Not surprisingly, there is growing and potentially intense interest in alternative course staffing and delivery models among American academic administrators.

The concept of enhancing education by the use of technology, and in particular the opportunity to move to different modes of delivery, continues to attract the attention of both practitioners and researchers. Importantly, the research is moving into the mainstream professional literature, particularly the IS literature (Alavi. and Leidner, 2001, Picolli, Ahmad, and Ives, 2001). The acceptance of such articles by these leading journals is indicative of the serious view of the research within the IS discipline. It is possible that the IS interest and focus results from the acceptance of research into the use of the technology, or from the expectation that the computer communications technology involved presents less of a barrier to IS students and therefore is closer to the everyday activities of IS academics, or both.

This paper reports the results of a study, conducted using as its base an on-line class of final year non-IS students (with an apparent propensity for on-line distance education) almost completely on-line. It attempts to deal with three main issues.

1. The potential attractiveness (or unattractiveness) of on-line distance education to such students

2. The role of student experience in on-line distance education

3. Satisfaction with, and effectiveness of, such courses

The paper sets out the literature leading to the above issues and poses research questions along the lines of these issues, explains the methodology employed, outlines the data involved (and its limitations), presents a discussion of the results and concludes with general comments on this type of class and the limitations of the study.

BACKGROUND

There have been many calls in the literature for more research into particular areas of distance education. Alavi (1994) sought future studies, which would reduce the potential impact of student interactions by administering the study during different semesters or at different geographic locations (e.g., different campuses). Alavi, Wheeler and Bradley (1995) concluded that it was important to continue the inquiry into the effectiveness of collaborative telelearning environments. They stated that with the declining cost and continued convergence of computing and communication technologies and the subsequent increase in prevalence of networked, multimedia computers, collaborative tele-learning would be an increasingly viable educational alternative. They posed several specific questions for future research including:

1. How do the learners respond to these new experiences?

2. How effective are the new experiences?

The call for further research was recently repeated (Alavi and Leidner, 2001).

A model for the assessment of the possible take-up of online distance education has been proposed (Dick, Case, and Burns, 2001)—the model dealt with both the academic institution and student perspectives. In that paper, which reported the results of a preliminary study primarily aimed at assessing the validity of the model, it was suggested that on-line distance education would only suit some of the students, and only for some of the time. By and large the students (particularly the under-graduate students) in that study did not want on-line distance education due to a perception that there was more help available on campus, there were distractions at home, concentration periods would not be enhanced, there would be a diminished classroom experience and it would be costly to set up the home to facilitate on-line distance education. However the paper suggested that it might suit a small percentage of mainstream students who have the skills, resources and perhaps the need to not attend campus classes.

While the model put forward by Dick et al. was heavily drawn from the telecommuting literature, (see particularly Belanger, 1999, Gray, Hodson and Gordon, 1993, Mokhtarian and Salomon, 1996, and Tung and Turban 1996), it was noted in the paper that there is considerable support for the issues from the distance education literature—accessibility, convenience, international (or recognised) instructors and a "consumer orientation" (Alavi, Yoo and Vogel, 1997; Emmons, 1999), and the ability to continue education or keep up to date while having only limited time available due to heavy work commitments (Jana, 1999; Boisvert, 2000). Likewise, many of the potential disadvantages—there is broad support for the notion that an educational programme is far more than a curriculum and that there are benefits from a "surround interaction" between the students, the instructor and the lectures. This rich variety of interaction is likely to be lost (Bertagnoli, 2001). Others include not learning the skills to think on one's feet, the absence of support and help, longer to develop a rapport between student and professor and cost issues related to tuition and technology (Emmons, 1999). Attempts to measure satisfaction with distance education have been sporadic, other than the measure of enrolments and the growth in the number of institutions offering some form of distance education. One recent approach using the service industry as a base (Long, Tricker, Rangecroft and Gilroy, 2000) based the assessment largely on immediate application in the work place—not in an invalid measure, but perhaps only one of many.

Recent papers have reported on success—Volery (2001) attempted to relate success with technology, the academic, and the students' previous use of the technology and Stallings (2002), has put forward the need for the institution to be well placed to measure the success of the on-line experiences. Piccoli et al. reported increased self-efficacy by students involved in a virtual learning environment, but dissatisfaction with the learning process. The academic institutions appear ready to adopt a model where the computer is used as a conduit for teaching and learning (Marold, 2002) and the author points to several "successful" classes measured by student grade and compared to more traditional classes (student satisfaction with the courses is not reported).

One area commented on in much of the literature, but rarely studied, is that of experience with on-line distance education and whether such experience has an influence on perceptions of it (Alavi, 1994). While there is some work (for example Althaus, 1997) on the effects of computer literacy and familiarity with on-line distance education, it seems that many researchers feel that experience with on-line education affects perceptions and may affect the ability of students to undertake education using this form of delivery.

The above literature gives rise to the following research questions:

1. What will a group of students who seem to have the propensity for on-line distance education see as the advantages and disadvantages and will they view these in a similar light to the large majority of students?

2. Will a respondent's perception of distance education change due to experience in this mode of delivery?

3. Will under-graduate students be satisfied with such courses?

METHODOLOGY

A previously developed and validated questionnaire was used as the primary basis for the study. This questionnaire was administered twice to all students in a class, once at he beginning and once at the end of the course. The returned questionnaires were not anonymous, enabling paired sample testing to be performed (a statistically stronger test than independent sample testing, which is normally performed when the individual's responses at different points in time cannot be compared). A copy of the questionnaire maybe found as Appendix A.

As stated above the survey had been validated previously (Dick, 2001)—initial reliability of the instrument in terms of stability was measured for that study by test-retest surveys and in terms of construct validity by Cronbach alpha scores to determine intemal-consistency reliability.

Validity of the measurement instrument was assessed in terms of content validity, (specifically including face validity and sampling validity), empirical validity and construct validity. This methodology is in accordance with generally accepted procedure (Frankfort-Nachmias and Nachmias, 1996). Specific procedures conducted to assess each of these for the current study were:

- Face validity (a necessarily subjective assessment of the instruments' appropriateness) was assessed and achieved by the researcher by using the previously validated study.

- Sampling validity (whether a given population is adequately sampled by the measuring instrument) was provided by the distribution of the survey to all members of a class and by the researcher not following any particular bias in selection of the students to whom to distribute the survey.

- Empirical validity was evaluated both by using measures contained within the survey to check the consistency of results and by comparing some parts of the survey document with another survey run independently (and anonymously) by the School management.

- Construct validity was assessed by means of Cronbach alpha scores.

External validity issues deserve special mention. It will be noted in the next section of this paper (dealing with the data), that there are limitations to the generalisability of the conclusions that can be drawn from the results of the analysis of this data. In particular these relate to the particular characteristics surrounding the students in the class used for the study. Nevertheless it is believed that the study does provide a reliable basis for commenting on the on-line distance education issues as they relate to similar students and courses.

In order to assess the effect of each of the independent variables on the preference for distance education, linear regression was performed on the data. Also a series of non-parametric paired t-tests (Wilcoxan) and was conducted to identify variations in the perceptions and preferences between the different groups of students in the data.

DATA

The data for this study comprised respondents to a survey of on-line distance students undertaking a senior level Information Technology Management course for non-IS majors in the Business School at Georgia Southern University in the United States. The course is compulsory for Business School non-IS majors and some 200 take the course each semester. The on-line class had 38 participants. All of these students were given the opportunity to complete the survey at the beginning and end of the course; an incentive was provided in the form of points for extra credit. In the event, 25 students completed the survey once and 15, twice. The response rates were therefore 56% and 40% respectively. Also, enhanced departmental anonymous course evaluations were used, partly to validate the survey findings and partly to address learning and management issues. 28 students completed these—a 74% response rate.

In the sample of 25, there were 12 males and 13 females, only one student had any prior experience with any form of distance education, 23 were in the 21-25 age group with one in the 26-30 group and one in the 31-40 group. 12 of the respondents indicated they were currently working, either full-time or part-time.

The approach to the selection of the class and to the acceptance in that class deserves some explanation and consideration. It was decided to run the class in an on-line distance delivery mode after some students had already enrolled in what they assumed would be a traditional class. All of these students were contacted and were advised how it was proposed to run the course and offered the opportunity to join another class if they felt uncomfortable with the method being proposed. The students were also encouraged to discuss any concerns they might have with the instructor. At this stage there were 25 students enrolled. Few discussed the class with the instructor and none withdrew from the class. Other students were then offered the opportunity to enroll in the class, up to maximum of 40 (2 of whom though in the class lists, did not attend any classes and subsequently withdrew).

A further relevant factor was that the class selected for on-line distance delivery was a class scheduled to meet at 5pm on Mondays and Wednesdays. This particular class was chosen for two reasons—it was intended to run "chat" sessions which would take place at the scheduled class times—5pm in the relevant US time zone is early-mid morning the next day in Australia, where the instructor resided. The time was seen as convenient to both students and instructor. The second factor was that it was believed that a group of undergraduate students who enrolled in a 5pm class would be likely to be attracted to this mode of delivery due to the likelihood of work, family or other commitments.

Finally a word about the class, as the conduct of the class may also be relevant to the perceptions of on-line distance education. The instructor visited Georgia and conducted one face-to-face class in week one of the semester and outlined how the rest of the semester would unfold. All students were encouraged to visit with the instructor on an individual basis, particularly anyone who had some concerns about the use of the technology. About 30% of the students availed themselves of this opportunity. The class was conducted primarily via WebCT and the students had a textbook, a PowerPoint presentation, study notes and an audio file for each week's work. Assessment and deliverables were based on each week the students partaking in a "chat" session, a contribution to a "discussion board", an assignment, and an on-line quiz on that week's prescribed textbook chapter. With the exception of the "chat" session, all of these were asynchronous. Other assessment components included on-line quizzes and a supervised exam conducted on WebCT.

There are obvious limitations to the findings from the data used in this study. These are discussed in more detail at the conclusion of this paper, however it should be noted (as outlined above) that prior research had suggested that on-line distance education would be best suited to only some students, for only some of the time. This was an attempt to determine whether an undergraduate course could be successfully run using students who *prima facie* seemed that they would be receptive to on-line distance education and limiting their exposure to just the one course.

RESULTS AND DISCUSSION

Advantages

Over 90% of the respondents agreed or strongly agreed that being able to choose the time to study and work on assignments was important to them. Other statements with which there was high agreement were that distance education would reduce travel and commuting costs, allow better management of work commitments, enable taking care of dependents, provide flexibility, and that fewer distractions in the home meant it allowed them to be productive distance students.

While the overall preference for distance education was neutral among these respondents, regression analysis, running the potential advantages against the preference for distance education, indicated that being able to choose the time for study, managing work commitments and being able to work at home (few distractions) were the predominant variables in that preference—$R^2 = .517$.

The respondents were also asked to rate what they saw as the most important (and least important) potential advantages of distance education. Almost all (95%) respondents rated being able to choose time to study and work on assignments as one of the three most important and 64% chose being better able to manage work commitments. Only 15% rated the latter as unimportant, none rated the former as unimportant.

The picture emerging here indicates that for this group of respondents, distance education provided a sought after alternative to their normal mode of study.

Disadvantages

When considering the potential disadvantages of on-line distance education, most students in this class had no real concerns. They did not see it as difficult to study at home due to less help, motivational problems, etc., they were not concerned about not being able to avail themselves of the resources on campus and did not see obtaining the necessary resources as difficult. They also agreed contact with the instructor was not difficult.

Stepwise regression, running the potential disadvantageous variable against the preference for distance education indicated that being unconcerned about missing out on the available resources was the most prevalent factor ($R^2 = .149$). The students also indicated that they saw the most important potential disadvantages as the diminished classroom experience and missing out on the professional interaction with other students.

Taking the advantages and disadvantages together, it seems that the driving factors in the preference for distance education are ($R^2 = .673$.):

- Being able to choose the time and place for study,
- Not being concerned about unavailable resources,
- Being better able to manage work commitments, and
- Fewer distractions at home allowed the student to be productive.

The limitations of the study in terms of the ability to generalise to the student population as a whole are clearly evident here. These students were mostly seniors, and many lived on campus or close to campus. Accordingly it might be expected that they would possess a level of maturity and ability commensurate with that required for such a course and in any case they had to come to campus (and its available resources) for other courses. Nevertheless an objective in conducting this study was to determine what factors might influence this particular type of student. These factors differ markedly from the factors as reported (Dick et al., 2001) for the wider student body.

Do Perceptions Change with Experience?

A series of Wilcoxon Signed Ranks tests (the non-parametric tests were used due to the small sample size and the non-normal distribution of the data) revealed virtually no differences in the perceptions of the students in respect of distance education over the course of the class. Only in one item was there a significant variation (at the .05 level) that of a potential reduction in living costs due to being able to live at home—the respondents were less likely to agree with this at the conclusion of the course than they were at the beginning. This is understandable, the respondents attended only one class via distance and would have continued with their normal living arrangements. It is also worthy of note that only two of the respondents had any previous experience with distance delivery and a series of independent sample t-tests, both parametric and non-parametric revealed no significant variations.

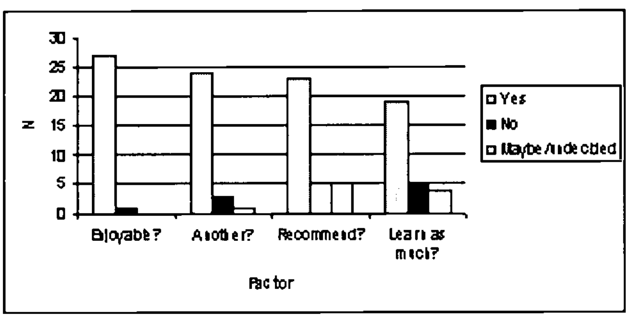
The respondents were asked to indicate their degree of agreement with the statement "I prefer distance education courses over traditional classroom based courses." On a scale of 1-5, where 1 indicated strong agreement and 5 indicated strong disagreement, there was a minor movement in student perceptions during the course. The mean moved from 2.8 (slightly on the "agree" side of neutral) to 3.3 (slightly on the "disagree" side of neutral). The movement was not statistically significant—$p = .084$, although certainly could be considered as trending in that direction.

Nevertheless, it seems reasonable to conclude that on the basis of this data, that after taking a distance education class, perceptions of distance education will remain the same as at the beginning. There is a potential qualifying factor here, due to a limitation in the data—by and large the students were very happy with this particular distance education class. Had this not been so, it is possible that some of the perceptions would have changed.

Satisfaction and Effectiveness

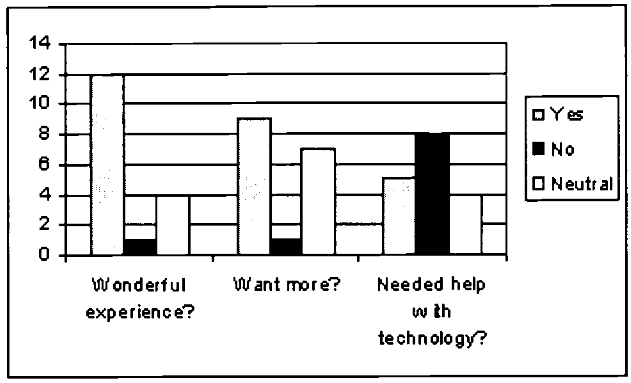
In an attempt to address these issues, a number of factors were considered. In addition, a separate set of data is included in the analysis—that collected anonymously and independently of the instructor by the Department at the time of the final examination. This comprised a standard course evaluation questionnaire, 4 extra questions specifically related to satisfaction issues and 2 open-ended questions that gave the students the opportunity to make general comments. The results of the four open-ended questions are given in Figure 1 below, details of the actual questions and the open-ended questions are given in Appendix B.

FIGURE 1
COURSE PERCEPTIONS
(INDEPENDENT EVALUATIONS)



There is considerable similarity between the results for the first two factors in Figure 1 and those in Figure 2—part 6 of the survey form (Appendix A), which was not anonymous. It would appear from this data that the students were less enthusiastic about the course on the forms where the instructor could identify them and more enthusiastic on the anonymous forms. Among other things, this finding gives some weight to the validity of samples from students where often the respondent can be at least partially identified. That aside, it seems there was widespread satisfaction with the course, at least as a learning experience.

FIGURE 2
COURSE PERCEPTIONS
(SURVEY RESPONSES)



In terms of learning outcomes, there were a number of relevant factors in the department evaluations—these invited the student to compare the course to other similar courses that they had taken. The results of these evaluations are given in Figure 3, but in general terms it seems that for most students the learning outcomes were about the same as for other courses, with the qualification that around 30% of students felt that they learnt more, it was more intellectually challenging and that it was more difficult. Against this, a small percentage (around 5%) felt that they learnt less, were less challenged and that it was less difficult.

The results shown in Figure 3 were compared with the results for other sections of the same course run in that and the subsequent semester. No significant differences were noted. That is, all students taking this course felt the same way about it in terms of effort, learning, challenge and degree of difficulty, regardless of the mode of delivery. There was perhaps an indication in the data that the online group felt slightly more challenged (a mean of 3.4 to 3.1 on a 5 point scale) however this is not considered to be significant given the limitations of data numbers and the question wording.

While not central to the learning issue, the result from the independent evaluation rating the course is given below (Figure 4)—it does indicate general satisfaction but may also be relevant when considering the general findings outlined in this section. It is also worthy of note that in response to the open-ended questions in Appendix B, most commented favourably on their interaction with the instructor and there were very few suggestions put forward for improvements.

FIGURE 3
LEARNING OUTCOMES
(INDEPENDENT EVALUATIONS)

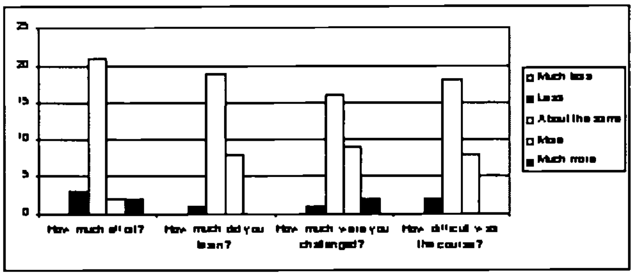
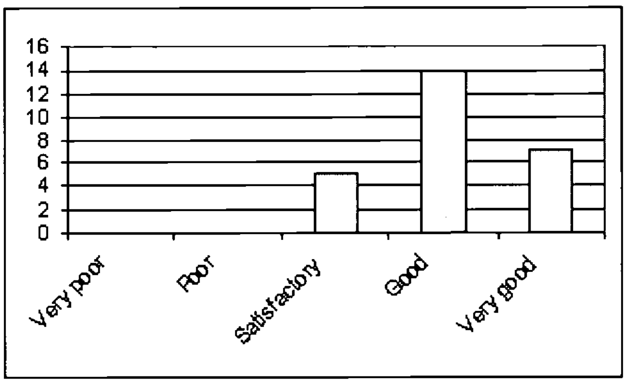


FIGURE 4
HOW WOULD YOU RATE THIS COURSE?
(INDEPENDENT EVALUATIONS)



CONCLUSIONS, LIMITATIONS, AND FURTHER RESEARCH

It seems reasonable to conclude that for some undergraduate students on-line distance education is a viable, attractive alternative. In this case, about 20% of the students taking the course were enrolled in the on-line class. Such students see the advantages and disadvantages of this mode of delivery in a different light to the wider student body. It also seems that such students are likely to be more senior, comfortable with the technology and have work or home commitments that make regular attendance at classes difficult or undesirable. On the basis of this study, it is reasonable to state that these perceptions hold up, for at least some time, with experience in such courses.

There is also evidence from this study that such courses can be satisfying and effective, from the student's perspective. Indeed this study provides evidence (self management issues and technological frustrations aside) that academically, the learning experience was very similar to that achieved by those in the more traditional mode *and* to that achieved by these students when undertaking traditional classes, perhaps enhancing its attractiveness to this particular group of students.

There are clear limitations to this study, as mentioned in several places above. These centre around the self-selection and small size of the sample, however given that one of the objectives was to assess such a group of students, the self-selection issue has less impact than might otherwise be the case. Care obviously needs to be taken in extrapolation of these results to the wider student body. A larger sample would improve the reliability of the results, too.

One measure not covered in this study was a comparison of student results with other students taking the course. It was felt that different instructors, different students and the small sample size would all work against meaningful findings, however it is suggested that in a further study this would be a useful comparison. Ideally, the same instructor would take more than one class, some (but not all) in on-line distance delivery mode. Results could then be compared across classes and with the student's results in other subjects.

Another area for further work relates to the role of the instructor—the effort involved, both in setting up the course/s, the time and work involved in dealing with queries and marking by distance, the administration of quizzes and examinations and the instructors' perceptions of the success of the course. This work is most likely to involve a series of case studies, as there are many different models of on-line distance education in use, which would cloud findings and make analysis difficult.

This study has taken a small step along the road of student responses to, and satisfaction with, such courses—there is still a long way to go.

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APPENDIX A
DISTANCE EDUCATION SURVEY

1. Please indicate the extent to which you agree that the following potential advantages of distance education apply to you:

		Strongly agree ->	-> -> ->	->	->-> ->	Strongly -disagree
a	Distance education allows me to reduce travel and commuting costs.	□1	□2	□3	□4	□5
b	Distance education allows a reduction in living costs due my ability to live at home, not on campus.	□1	□2	□3	□4	□5
c	Distance from home would make class attendance on campus impossible.	□1	□2	□3	□4	□5
d	I am better able to manage work commitments by not being required to attend class on campus.	□1	□2	□3	□4	□5
e	Distance education enables me to complete class work if disabled or taking care of dependents.	□1	□2	□3	□4	□5
f	I find the campus environment intimidating or undesirable.	□1	□2	□3	□4	□5
g	Personal reasons such as family, flexibility make distance education attractive to me.	□1	□2	□3	□4	□5
h	Fewer distractions for me at home allows me to be a productive distance education student.	□1	□2	□3	□4	□5
i	Being able to choose the time to study and work on assignments is important to me.	□1	□2	□3	□4	□5

PLEASE INDICATE UP TO 3 OF THE ABOVE THAT YOU SEE AS THE MOST AND LEAST IMPORTANT:

	Most important	Least important
1st	______	______
2nd	______	______
3rd	______	______

2. Please indicate the extent to which you agree that the following potential disadvantages of distance education apply to you:

		Strongly agree ->	-> -> ->	->	->-> ->	Strongly -disagree
a	I would find it more difficult to study at home due to less help, motivational problems, increased family conflicts, distractions.	□1	□2	□3	□4	□5
b	I feel that there is better help for me available on campus.	□1	□2	□3	□4	□5
c	I would miss out on benefits available on campus—resources, possible employment etc.	□1	□2	□3	□4	□5
d	The cost of procuring the necessary distance education equipment for my home would be expensive for me.	□1	□2	□3	□4	□5
e	I would miss out on the extra-curricular activities available on campus.	□1	□2	□3	□4	□5
f	Missing out on the professional interaction with one's fellow students would be a concern to me.	□1	□2	□3	□4	□5
g	There would be a diminished classroom experience— less discussion, interaction with professors.	□1	□2	□3	□4	□5
h	I find it very difficult to contact the instructor.	□1	□2	□3	□4	□5

PLEASE INDICATE UP TO 3 OF THE ABOVE THAT YOU SEE AS THE MOST AND LEAST IMPORTANT:

	Most important	Least important
1st	______	______
2nd	______	______
3rd	______	______

3. Thinking about your academic work, please indicate your degree of agreement with the following statements as they typically concern course related tasks you have to complete (study, assignment work, exam preparation etc.):

		Strongly agree ->	-> -> ->	->	->-> ->	Strongly -disagree
a	The final product of the tasks that I am assigned typically involves the completion of many different components.	□1	□2	□3	□4	□5
b	My tasks often require me to work with fellow students.	□1	□2	□3	□4	□5
c	Sometimes the task deliverables change over the duration of the assignment (e.g. the instructor adds or deletes one or more components).	□1	□2	□3	□4	□5
d	Tasks I am given are not always clear and may be interpreted in different ways.	□1	□2	□3	□4	□5
e	I am often uncertain about what to do to complete the final product.	□1	□2	□3	□4	□5
f	The tasks I am assigned are often dependent on at least one other student completing his work first.	□1	□2	□3	□4	□5
g	The task deliverables are clear, but can be accomplished in a number of ways.	□1	□2	□3	□4	□5
h	I would typically rather work on my own, than with other students.	□1	□2	□3	□4	□5
i	The tasks I am assigned require minimal resources (e.g. software, library, etc.).	□1	□2	□3	□4	□5
j	The tasks I am assigned allow me to work at my own pace.	□1	□2	□3	□4	□5
k	Assigned tasks require long periods of concentrated attention.	□1	□2	□3	□4	□5
l	Distance education enables me to concentrate on course related tasks for long periods.	□1	□2	□3	□4	□5
m	"Due dates" for tasks assigned are clearly stated.	□1	□2	□3	□4	□5
n	There is a need for a considerable degree of communication with my fellow students.	□1	□2	□3	□4	□5
o	There is a need for a considerable degree of communication with academic staff.	□1	□2	□3	□4	□5

4. Thinking about your ability to study via distance education, please indicate your degree of agreement with the following statements:

		Strongly agree ->	-> -> ->	->	->->	Strongly disagree
a	I am capable of making good decisions about the tasks I am assigned.	□1	□2	□3	□4	□5
b	I know where to get the relevant information I need to complete the assigned tasks.	□1	□2	□3	□4	□5
c	I have no difficulty determining when I should seek advice.	□1	□2	□3	□4	□5
d	I am good at self management, possessing the motivation, time management, etc. that is needed to deliver quality work on time.	□1	□2	□3	□4	□5
e	I have the computing and communications resources I need to be an effective distance education student.	□1	□2	□3	□4	□5

5. Please indicate the extent of your agreement with the following statements:

		Strongly agree ->	-> -> ->	->	->->->-	Strongly disagree
a	Distance education is of lesser quality than traditional class-room-based campus education.	□1	□2	□3	□4	□5
b	I only participate in distance education because I can't attend campus classes.	□1	□2	□3	□4	□5
c	The tasks associated with my course are suitable for the distance education environment.	□1	□2	□3	□4	□5
d	I should not have to pay as much for distance education as for traditional campus based education.	□1	□2	□3	□4	□5

		Strongly agree	-> -> -> ->	-> ->->->-		Strongly disagree
e	I would encourage most professionals to participate in distance education.	☐1	☐2	☐3	☐4	☐5
f	Instructors should not assign the same tasks to distance based students as they assign to campus based students.	☐1	☐2	☐3	☐4	☐5
g	Distance education courses are designed with the distance student in mind.	☐1	☐2	☐3	☐4	☐5
h	I believe I have the skills and ability to be a successful distance education student.	☐1	☐2	☐3	☐4	☐5
i	Distance education is attractive to Universities because it provides additional revenue without the need for additional resources.	☐1	☐2	☐3	☐4	☐5
j	I prefer distance education courses over traditional classroom based courses.	☐1	☐2	☐3	☐4	☐5
k	Distance education is an acceptable instructional delivery system, but it falls short of the traditional classroom experience.	☐1	☐2	☐3	☐4	☐5

6. Thinking specifically about the MGNT 4130 course you are now doing:

a	This course has been a wonderful experience for me.	☐1	☐2	☐3	☐4	☐5
b	I wish I could do/have done more courses in this way.	☐1	☐2	☐3	☐4	☐5
c	I would have liked more help with the "technology."	☐1	☐2	☐3	☐4	☐5

The best things about this course were:

The following areas need improvement:

7. Please provide the following general information about yourself:

   1. Are you : ☐ Male ☐ Female

   2. In which age group are you?
      ☐ 20 or younger ☐ 21 - 25 ☐ 26 - 30 ☐ 31 - 40
      ☐ 41 - 50 ☐ 51 - 60 ☐ over 60

   3. How many people in your household (including yourself) fall into each of the following age groups:
      _____ Under 2 years old _____ 2 - 5 years old _____ 6 - 15 years old
      _____ 16 - 20 years old _____ 21 - 65 years old _____ over 65 years old

4. How many courses have you taken by distance education (before this one)? 0 ☐1 1-3 ☐2 > 3 ☐3

APPENDIX B

1. Did you enjoy your distance learning experience?
2. Would you take another course that was taught by distance learning?
3. Would you recommend a similar distance learning course to a friend?
4. Do you feel that you learned as much as if you were in a traditional classroom?

1. What did you like best about this instructor/course?
2. How could this instructor/course be improved?

AN EVALUATION METHODOLOGY COMPARING LEARNING IN DIFFERENT INSTRUCTIONAL ENVIRONMENTS

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ABSTRACT

This research looks at the pedagogical implications and the characteristics of learning in three different instructional environments. Not only is the set of circumstances of the instruction delivery important, but perhaps more important is the content organization and information provision. Each of the three instructional environments is examined under nine instructional events and how they impact the learning process. The evaluation scheme and example presented in this paper are intended to represent a framework for evaluation in selecting instructional materials and developing an approach to teaching. Comprehensive evaluations of a learning environment should focus on the content organization and information provision, and only subsequently on the methods of instructional delivery.

INTRODUCTION

Computer-mediated instruction, either in the form of interactive Web-based instruction, electronic forum, synchronous discussion rooms, or simply self-paced interactive multimedia has become an important aspect of today's pedagogy. Through the spread of Web-based courseware packages, Universities have adopted user-friendly multiple-media based tools to create a more stimulating learning environment. Face-to-face instruction is supplemented with different forms of computer-mediated instruction in dissimilar disciplines and content areas.

Wirth and Amos (1996) identify different delivery methods of instruction (either stand-alone or supplemental to traditional instruction) and then rank these methods on an *intensiveness scale*. This scale is the set of circumstances of the instruction delivery. Although the mode of delivery is an important element of a comprehensive review of the effectiveness of the learning experience, there are other factors equally (or even more) important. Evaluation of a learning environment should be more focused on the content organization and information provision, rather than the methods of instructional delivery. Gagné's model (1992) details nine instructional events relevant to effective learning. This research uses Gagné's model combined with several other program criteria to evaluate how the content organization of different delivery methods may stimulate learning conditions and therefore, learning.

This study reviews specific learning conditions and presents a framework for evaluating the effectiveness of the elements of the learning environment used to engage students and increase performance. The adoption of a model to evaluate the content and delivery modes of instruction is a pre-requisite to understanding which elements of the students' learning experience are to be supplemented. Although the course studied in this research is introductory Project Management, the same reasoning may be applied to any subject area. Because of the availability and use of different instructional environments based on the same subject and developed by one instructor, this course was selected for this study.

Instructors and faculty can take the framework into account when evaluating the different components (synchronous or asynchronous) of their course delivery. Those areas in the instructional environment that best support learning and retention can be strengthened, thereby providing a better educational experience for students.

Initially, the paper presents an important evaluation framework that has been used in the literature to compare different methods of instruction (Wirth and Amos, 1996). Then a more comprehensive model (Gagné, 1992), focused primarily on cognitive processes, is introduced. This model is then applied to compare instructional delivery modes in an introductory Project Management course. By contrasting results obtained using Gagné's framework with conclusions from Wirth and Amos (1996), the authors explain the importance of focusing first on the evaluation based on criteria related to content organization, and only secondarily, on delivery types/media. Contrary to some authors (McLuhan and Fiore, 1967), the medium is not the message. The emphasis should remain on assessing content, and the comprehensiveness of its presentation.

EVALUATION OF DELIVERY METHODS OF INSTRUCTION

A review of project management instruction programs (Wirth and Amos, 1996) identifies over 20 distinct delivery methods of instruction. Wirth and Amos rank these programs on an *intensiveness scale,*[1] which they define as the set of circumstances of the instruction delivery. Interactivity[2] is a key element of learning (and, therefore, a key element of the intensiveness scale), with higher interactivity generally displaying positive impact on learners' performance and attitudes.

Wirth and Amos evaluate the intensiveness of different Project Management instructional programs (Figure1) and find that the most effective are *interactive seminars* (formal seminars with company specific emphasis, with case study discussion; generally 2-day duration), and *experiential seminars* (seminars involving discussion of training materials; topical emphasis on reviews and evaluation of project cycles; with a typical duration of 3 hours).

Classroom instruction (lecture/discussion; individual project reports and case studies; topical emphasis on project management competencies, and less on human skills; 16-week duration) ranks in the 6th position; closely followed by multimedia training programs (defined in as many as ten-30-minutes TV-series/ textbook, with exercises consisting in computer-mediated multiple choice tests, topical emphasis on generic project management) in the 7th place. Computer-based training (CBT—the automated version of programmed instruction by an interactive workbook for in-depth exploration of general project management topics) ranks in the lowest position (of the three environments evaluated) on the intensiveness scale (10th).

Overall, results of Wirth and Amos (1996) analysis indicate that face-to-face instruction is most effective. The use of multiple media (such as audio-tapes, visuals, text and other media—not necessarily synchronized) is the second most important. Last, the use of computer-mediated instruction (CM) is the least preferred as it entails lower level of intensiveness of the learning experience. Although these results may represent an important picture of the effectiveness of instructional programs, it is crucial to evaluate instructional delivery on several other parameters that take into account students' cognitive processes engagement. The authors of this paper argue that rather than focusing primarily on the delivery medium, the evaluation of learning needs to be based on the *organization and clarity of the 'content' of instruction, that is, its ability to initiate the conditions of learning (reception, reinforcement, retrieval, etc.) to stimulate long-term recall and retention.* Therefore, the authors propose an evaluation mainly based on Gagné's learning conditions and define the elements that should be evaluated to apply Gagné to different instructional delivery environments (i.e., face-to-face, textbooks, CBT). The evaluation model proposed should focus more on the content organization and information provision, rather than the methods of instructional delivery.

CONDITIONS OF LEARNING

Gagné (1992) identifies two types of conditions of learning. The *internal conditions* include the intellectual skills, cognitive strategies, attitudes, and other circumstances that the learners bring to the learning environment. The *external conditions* are the instructional events that influence the individual internal state (learning, thinking, and remembering) and contribute to knowledge creation. These external events of instruction correspond to specific cognitive processes that influence individual interactions with the information. Effective learning occurs when combining individual cognitive events with instructional strategies that maximize the impact of the external conditions on

FIGURE 1
EVALUATION OF PROJECT MANAGEMENT INSTRUCTIONAL PROGRAMS INTENSIVENESS

Program	Location	Instructor proximity	Instruction period	Interaction frequency	Interaction duration	Interactive type	Total Score	Delivery Tech-nology	Rank order
Interactive seminar	4	5	5	5	4	5	28	FF	I
Experiential seminar	3	5	5	5	4	5	27	FF	II
Symposium seminar	2	5	5	5	5	5	27	FF	II
Professional seminar	2	5	5	5	5	5	27	FF	II
Practitioner seminar	2	5	5	5	5	5	27	FF	II
Project team education	5	5	3	4	4	5	26	FF	III
In-house/OJT seminar	4	5	4	5	3	5	26	FF	III
In-house hybrid course	4	5	4	4	3	5	25	MM	IV
Audio-graphic systems	4	4	4	4	3	5	24	MM	V
Classroom instruction	3	5	2	4	3	5	22	FF	VI
Teleconferencing	4	4	4	3	3	5	22	MM	VI
Multimedia training	1	4	4	4	3	3	19	MM	VII
Electronic mail	1	3	4	3	2	5	18	MM	VIII
Correspondence course	1	4	1	2	2	5	15	MM	IX
Expert-system self-training	1	2	1	2	2	4	12	CM	X
Dynamic/interactive computer simulation	1	2	1	2	2	4	12	CM	X
Computer-based (CBT)	1	2	1	2	2	4	12	CM	X
Computer simulation games	1	2	1	2	2	4	12	CM	X
Audio-visual tape	1	2	1	2	2	4	11	MM	XI
Audio-tape	1	2	1	2	2	3	11	MM	XI

Legend: FF= Face-to-Face MM= Multiple media (not necessarily synchronized) CM= Computer-mediated

Scale: 1 (low)–> 3 (medium) -> 5 (high)

Source: Wirth and Amos (1996)

knowledge creation, storage and retrieval. Gagné's model (Figure 2) is an appropriate instrument to evaluate how instructional materials create the external conditions that promote students' learning. The internal cognitive processes are activated by the nine instructional events, which represent the fundamental blocks of a program (external condition) relevant to effective learning.

The evaluation framework presented in this paper uses a combination of techniques (descriptive general approach and specific software checklist) derived from the integration of the 'TECC and California Library Media Consortium for Classroom Evaluation of Microcomputer Courseware' and the 'National Council of Teachers of Mathematics (NCTM) Software Evaluation Checklist' (Appendix A). The TECC evaluation guidelines are used mainly to guide the descriptive evaluation. Gagné's model is finally added to the model to take into account how the program is capable of stimulating the learner's internal conditions.

In the remainder of the paper, sample evaluations are presented with reference to teaching introductory Project Management through different instructional deliveries (CBT with interactive multimedia, textbooks and face-to-face). Although all program evaluation criteria are assessed for each instructional delivery environment, the main focus of the evaluation is on the assessment of the 'effective use of the learning events' as identified in Gagné (1992).

FIGURE 2
CONNECTION OF INSTRUCTIONAL EVENTS WITH LEARNING

Gagné's (1992) Instructional Event	Learning Process
1. Gaining attention	Reception of stimulus and activating of sensory registers (Reception)
2. Informing the leamer of the lesson objectives and activating motivation	Activating of executive control (Expectancy)
3. Simulating recall of prior learning	Retrieval of informaiton to working memory (Retrieval)
4. Presenting the stimulus material	Emphasizing features for selective perception (Selective Perception)
5. Providing learning guidance	Semantic encoding; cues for retrieval (Semantic Encoding)
6. Eliciting performance	Activating response (Responding)
7. Providing feedback	Activating retrieval (Reinforcement)
8. Assessing performance	Providing cues and strategies for retrieval (Retrieval)
9. Enhancing retention and learning transfer	Repeat in subsequent lessons; provide additional diverse examples (Generalization)

Adapted from Shambaugh and Magliaro (1997, p. 197)

The criteria of evaluation of program cognitive effectiveness (and the questions they answer) are summarized in Table 1.

A SAMPLE EVALUATION

An example of how the evaluation questions are applied to assess the completeness of different Project Management teaching materials is presented. In this specific example, the purpose is to generally assess the overall strength of the instructional medium and present an overview of relevant classification criteria to quickly identify needed intervention areas to supplement the programs. The content being evaluated refers to two introductory Project Management book titles (Frame, 1994; 1995). Particularly, the textbooks, the face-to-face instruction based on the books, and the multimedia version of the textbooks are benchmarked. The interval scale of the sample evaluation uses Harvey-ball format (from very low to very high). Other scales may be substituted (i.e., Likert).

Evaluation of Interactive Multimedia

'Project Management in Organizations (PMO) CD-ROM' is the multimedia version of Frame, 1994 and 1995. The CD-ROM closely follows the books' organization: learning units mirror chapter titles and structure. The application is designed to teach the fundamentals of project management. Audiences vary from project managers, project team members, executives, or other stakeholders interested in learning project management. [ORGANIZATION]

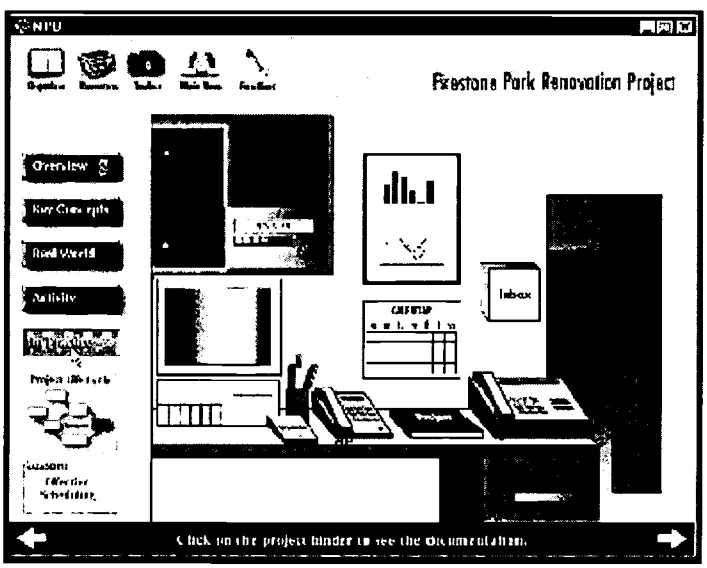
The CD-ROM provides a stand-alone tool for learning project management introductory topics. It is used as a support tool for distance learning, and requires little synchronous interaction. Users are expected to work with the software independently, at their own pace. The software includes practice tests and feedback features to self-assess the level of competency reached by using the application. [MANAGEMENT]

The strength of the software is in the use of video and audio to capture attention, provide simulations of real-world scenarios, and give feedback. Simulations reproduce office-like settings (Figure 3) (i.e., telephone on office desk, with blinking light indicating a new message, and presenting instructions on how to proceed). Navigational aids are available for the user in each step. Contextual instructions appear consistently at the bottom of each screen. The notepad and

TABLE 1
PROGRAM EVALUATION CRITERIA

- **Organization (TECC) [ORGANIZATION]**
  - Content
    - *Is content relevant, complete, and well developed?*
  - Objectives
    - *Are the objectives clearly stated and achievable throughout the program?*
  - Users interaction with the program
    - *Are the means of interaction between the learner and the content user-friendly?*
- **Management system (including scoring or performance) (TECC) [MANAGEMENT]**
    - *How well is the achievement of the learning objectives managed and measured?*
- **Special strengths [STRENGTHS]**
    - *Are there relevant characteristics/features that make the instructional program particularly strong?*
- **User orientation: instructor's point of view (NCTM) [INSTRUCTOR]**
    - *Is the role of the instructor marginal in providing learners' orientation with the content? Is the instructor freed from the need to intervene?*
- **User orientation: user's point of view (NCTM) [USER]**
    - *Is the learner able to independently access the content? Are directions self-explanatory?*
- **Motivation and instructional style (NCTM) [MOTIVATION]**
    - *Are there sufficient elements and reinforcement that engage the learners and maintain their interest in the lesson content? Is the instructional style engaging?*
- **Social Characteristics (NCTM) [SOCIAL]**
    - *Does the instructional approach provide cooperation or competition? Does it promote teamwork? Is the content appropriate for all audiences?*
- **Effective use of learning events (Gagné) [LEARNING]**
    - *Are the majority of Gagné's learning events achieved? Is the instructional style geared towards leveraging learners' cognitive skills?*

FIGURE 3
CD-ROM PRACTICE MENU



calculator shortcuts offer easy access to supporting tools. [STRENGTHS]

The program frees the instructor from the need to intervene; therefore, it is particularly useful for self-paced instruction. However, the CD-ROM does not allow for flexibility of instruction as related to skill levels. There is only one level for all users, which makes the software particularly useful for users with low prior knowledge of the topic, however, it may become tedious for those with some level of competency. On the other criterion established by the "National Council of Teachers of Mathematics' software evaluation checklist" there is an almost perfect freedom from need to intervene or to assist and the application can be used stand-alone (Appendix A). [INSTRUCTOR]

The software provides high quality directions (clarity), quality output (content and tone), pleasant screen design, freedom from the need of external information, and freedom from disruption by system errors. The software requires different forms of input. The user is often asked to provide a wide range of responses at different levels of interactivity: from typing full answers, to drag and drop, and to performing complex calculations. [USER]

The software uses graphics, videos, and audio clips that increase motivation. The simulations and case studies are organized as games to foster interaction, thinking and retention through reinforcement. The student is continuously engaged in new activities. Occasionally, some activities do not allow unlimited student control; the user is forced to complete each action, before being able to proceed. The problem-solving activities are very structured and software-led (as opposed to user-led). [MOTIVATION]

Because of its stand-alone nature (one user), the software does not allow competition or cooperation. Users can use the software while working in teams, but no formal mechanism is included in the design to facilitate team-usage. No specific navigational functions provide for more direct interaction between the narrator and the user. Therefore, no humanization of the computer is obtained. However, the software does provide a summary of students' performance (in the testing areas) and solicits value judgments related to managerial decisions. [SOCIAL]

The CD-ROM supports Gagné's instructional events through the use of multiple media, drill and practice, tutorials, and simulations. It provides a high level of interactivity, and immediate feedback. The use of 'drill and practice' and simulation solicits user input, maintains the presentation dynamic and, thus, motivates the users. Using the Harvey-ball format, examples of multimedia features that meet instructional conditions are presented in Figure 4. [LEARNING]

Evaluation of Supporting Delivery Materials (Textbooks)

The textbooks (Frame, 1994 and Frame, 1995) are among the most popular (number of sales, and reviewers' comments) in the project management literature. They are similar in design and layout features and they both address complementary topics. They use diagrams and drawings to reinforce understanding, offer several examples, and occasionally include mini-case studies to foster reflection and application. The case studies present problems, and offer solutions at the same time, to emulate a mechanism for feedback provision. [STRENGTHS]

The textbooks offer a table of contents, but lack outlines and glossaries. There are no special features associated with the textbooks (lack of mnemonics or other attractors). Instructor teaching materials (such as overhead transparencies, packaged in a notebook that guides comprehension and reinforce visualization and synthesis) are available. [ORGANIZATION]

The books cover a broad range of topics. Reading should be sequential in Frame (1995), which mimics the phases of the project life cycle. Readers can follow a non-linear approach (skipping or rearranging chapter reading order) in Frame (1994). There is a balancing freedom of the instructor to intervene, as directions, pace, and outcomes are easily determined by the readers. [INSTRUCTOR] and [USERS] There are no chapter summaries, but each section offers conclusions and chapter introductions addressing main points. No study questions are included in the textbooks, but case studies and examples can be used to guide study and reflection. The textbooks use a variety of visuals. [MANAGEMENT]

The graphics are accurate, and relevant to the objectives. They are likely to maintain user interest, since they provide examples of the diagrams, software tools, and cost curves discussed in the body of the textbooks. The graphics can be easily comprehended by reading the supporting explanations; they are simple and present a

FIGURE 4
INSTRUCTIONAL EVENTS IN MULTIMEDIA

Gagné's Instructional Event	Action in Multimedia	CD-ROM
1. **Gaining attention**	Show the user an attractor event. Text or graphic animation, audio clips to engage learners	◑
2. **Informing the learner of the lesson objectives and activating motivation**	Questions or statements identifying learning objectives. Textual reinforcement, graphics displaying topic organization, links to objectives and sub-content of each section	◕
3. **Simulating recall of prior learning**	Review topics relevant to the lesson. Simulations provide practice and experimentation with the skills to be learned Text, graphics, and video soliciting recall of prior topics, or repeating key points	◑
4. **Presenting the stimulus material**	Use tutorials to introduce the content material in a variety of media formats. Use sequenced instruction.	◑
5. **Providing learning guidance**	Show examples; offer overview of navigation, and overview of learning module. Graphics, text and video are suitable.	●
6. **Eliciting performance**	Use drill & practice, leading learners through practice exercises. Use questions and solicit actions. Appropriate to solicit accuracy.	●
7. **Providing feedback**	Provide guidance on actions and selections. Check correct/incorrect answers, and offer reinforcement. Any media format.	●
8. **Assessing performance**	Provide immediate-automated results. Encourage further reinforcement through text, graphics, and sound. Show mistakes and offer remedial support.	●
9. **Enhancing retention and learning transfer**	Use highly interactive activities. Use redundant media to repeat content in different formats. Show examples and stimulate concept mapping	●

Adapted From Gagné (1992) and Shambaugh & Magliaro (1997, p.202, 206)

Legend: Very Low ○ *to* Very High ●

unified design. The layout of the text is consistent. It is accurate, and generally up to date. The reading level is colloquial, and the topic presentation is user-friendly and easy to read. The text is likely to maintain readers' interest, provided that readers have an interest in learning the materials. [MOTIVATION]. The study of the materials is designed as an independent, self-paced experience, and does not involve working in teams. [SOCIAL]

The textbooks used in this study comply with only a few (3) of Gagné's nine instructional events (Figure 5). They succeed in gaining attention because of the writing style, and the use of visuals. However, there is no elaboration of the learning objectives of each chapter, nor any elaboration of how they are accomplished. Except for introductory chapter statements, there is no formal mechanism to summarize and stimulate recall of prior learning. There is no formal mechanism to assess performance, provide feedback or encourage users to complete the case studies, and build upon the information learned.

Although diagrams are used to facilitate explanations of complex procedures, there are no particular attractors (cues and mnemonics) that stimulate retention. Readers need to create their own concept maps and diagrams to establish the links within the materials presented. The cognitive load is rather high, regardless of the high degree of coherence of the material presented. The textbooks do succeed in providing learning guidance, and presenting stimulus materials through the examples,

FIGURE 5
INSTRUCTIONAL EVENTS IN TEXTBOOK INSTRUCTION

Gagné's Instructional Event	Action In textbook instruction	Textbooks
1. Gaining attention	Demonstration; Presentation style, examples	●
2. Informing the learner of the lesson objectives and activating motivation	Visual organizers, pointers, list of objectives/challenges	○
3. Simulating recall of prior learning	Summaries; recall questions; review of previous lessons	○
4. Presenting the stimulus material	Use of visuals; demonstration and testimonials	◕
5. Providing learning guidance	Textbooks provide examples; uses real-world scenarios; presents solutions	●
6. Eliciting performance	Activities and exercises; workbooks; individual and group activities, additional assignments	○
7. Providing feedback	Homework solutions; other feedback	○
8. Assessing performance	Self-evaluation strategies; contrasted with solutions	○
9. Enhancing retention and learning transfer	Repeat topics with diverse examples; encourage to apply skills to real situations	◔

Adapted From Gagné (1992) and Shambaugh & Magliaro (1997, p.202, 206)

Legend: Very Low ○ *to* Very High ●

cases, and anecdotes used throughout the topics presented. [LEARNING]

Evaluation of Face-to-Face Instruction

The entire project management course is designed to teach project management skills through case studies and hands-on exercises, and offers a broad variety of examples immediately applicable to real projects. There are discussions of the entire project life cycle, from the definition of project requirements (early stage), to the development of work-breakdown structures, to project change and closeout. [ORGANIZATION]

The lecture presentations are supported by the use of *overhead transparencies*. The transparencies following the organization of Frame (1994, 1995) display the graphical images of the textbook, and develop additional graphical representations. [STRENGTHS]

The instructor primarily uses markers to write on transparencies during the presentation. Occasionally, *display boards* are used to support explanations. The instructor offers several examples, asks frequent questions of the audience, provides feedback to responses, and encourages participation through face-to-face discussion of section problems. [INSTRUCTOR] and [MANAGEMENT]

Frequently, cases and other exercises are completed face-to-face, with limited instructor support. Students work in teams and/or independently to solve case studies, and to answer specific exercises. [USERS] and [SOCIAL]

Face-to-face instruction uses a variety of instructional models. The model suitable for teaching basic skills (which is the objective of the introductory project management course-modules used in this study) is *direct instruction*. However, since the instruction is offered in short-modules (specific time-constraint, expectations, and audience), it is also comparable to *workshop* models. Therefore, the characteristics of *direct instruction* and *workshops* are jointly considered in the evaluation of the face-to-face instruction in project management summarized in Figure 6.

FIGURE 6
INSTRUCTIONAL EVENTS IN DIRECT INSTRUCTION AND WORKSHOPS

Gagné's Instructional Event	*Action In Direct Instruction*	*Action in workshops*	*Face-to-face*
1. Gaining attention	Demonstration	Presentation style, examples	●
2. Informing the learner of the lesson objectives and activating motivation	Writing on board, verbal or handout	Visuals, organizers, handouts, materials mailed in advance	●
3. Simulating recall of prior learning	Teacher or student summary; questions	Addressing background of participants, review of previous lessons	◕
4. Presenting the stimulus material	Teacher, student, media	Presentation by leader or guest or team; demonstration, testimonials	◑
5. Providing learning guidance	Teacher provides examples on board, student attempts examples, teacher walk-around	Discussion, examples	●
6. Eliciting performance	Class suggestions; individual prompting	Individual activity in a workbook, group activities, volunteer activity; outside assignments	◔
7. Providing feedback	Class examples; lab activities; homework; verbal comments on work	Providing consultation after workshop	◑
8. Assessing performance	Comments, grading	Criteria provided by presentation, or in handouts	●
9. Enhancing retention and learning transfer	Repeat in subsequent lessons; provide additional diverse examples	Material to take home	◑

Adapted From Gagné (1992) and Shambaugh & Magliaro (1997, p.202, 206)

Legend: Very Low ○ *to* Very High ●

The face-to-face instruction completely meets several of the learning conditions, including the provision of assessment. Areas that need particular improvement are related to eliciting performance throughout the session, as well as including more opportunities for feedback. A method that may work in the direction of eliciting performance and enhancing retention might involve the presentation of materials from different sources, which would simultaneously improve the instructional event "*Presenting the stimulus material,*" currently evaluated at 50% of its full potential. The instructor might ask students to take the lead in presenting specific case findings, use additional guest speakers from industry, or resort to video testimonials.

SUMMARY

The summative evaluation of the instructional materials shows that CBT and face-to-face instruction are two environments complying with a high number of pedagogical and technical requirements for learning (Figure 7). The CD-ROM offers a variety of media and content representations that are key ingredients of learning. The face-to-face instruction is supported by visuals, communication skills, interaction strategies and delivery structures that keep the learners engaged in the content. Textbooks, which are ranked as the least compliant with Gagné's instructional events, lack the interactivity and feedback features that support effective learning and, as such, should be mainly used as reference to instruction, with a well defined role of supplementing learning.

Overall, the comparative results indicate that CD-ROM and Face-to-Face instruction each satisfy more than 70% of the instructional event in Gagné's model. Textbook instruction only meets 33% of the conditions of learning. The Project Management example of this review illustrates that independent, text-based learning (self-taught) may not be effective without strengthening mechanisms for feedback provisions, performance testing and reinforcement procedures (i.e., better clarifying lessons objectives and evaluating their achievement by eliciting knowledge transfer to similar problems/scenarios).

DISCUSSION

The results of this evaluation exercise specifically refer to the content / materials used in the introductory Project

FIGURE 7
SUMMATIVE EVALUATION RESULTS

Gagné's (1992) Instructional Event	CD-ROM	Textbooks	Face-to-face
1. Gaining attention	◑	●	●
2. Informing the learner of the lesson objectives and activating motivation	◕	○	●
3. Simulating recall of prior learning	◑	○	◕
4. Presenting the stimulus material	◑	◕	◑
5. Providing learning guidance	●	●	●
6. Eliciting performance	●	○	◔
7. Providing feedback	●	○	◑
8. Assessing performance	●	○	●
9. Enhancing retention and learning transfer	●	◔	◑
Avg. % of Instructional Event Met	86%	33%	72%

Adapted From Gagné (1992) and Shambaugh & Magliaro (1997, p.202, 206)

Legend: Very Low ○ *to* Very High ●

Management course. However, the same approach and assessment model can be easily extended in other subject areas. Undertaking a similar evaluation exercise prior to implementing any program is one way to assess which instructional delivery elements are most/less effective for enhancing the learning process and cognitive impact.

The actions listed in the evaluation tables for each instructional delivery mode (see Figures 4, 5, 6) provide suggestions on filling the program gaps. For example, to better "*elicit performance*" when using textbooks, faculty could require students to test their knowledge through:

- Using specific exercise/reading workbooks
- Completing case assignments
- Accessing students' resources web support pages (usually available with key textbooks)
- Opening real/on-line discussion on specific book chapters; etc.

This type of evaluation process may be useful in textbook selection, CBT evaluation or improving face-to-face instruction. Examination of textbooks is a yearly process in many disciplines and guidelines for acceptance may be created from this framework. Developers of CBT are creating software that recognizes the expertise level of the user, allowing them to by-pass subject matter already mastered, thereby avoiding tedious repetition. As mentioned earlier, faculty may incorporate presentations from different sources: guest speakers and student presentations or research. In order to successfully address all of Gagnè's criteria, it may be appropriate to include all three different instructional delivery modes.

Following an evaluation approach based only on the delivery medium and its characteristics does not provide the same level of feedback that is key to foster cognitive engagement with the materials. A classification of different types of programs on intensiveness/ interactivity or media characteristics provides information only on criteria such as technical quality, usability, navigation, number and type of media used; etc. For example, using Wirth and Amos (1996) intensiveness scale, one would rely on a classification of classroom instruction on an absolute rank of VI (see Figure 8), of correspondence course (a proxy for textbook-based) as rank IX, and of computer-based multimedia training (CBT) as rank X.

FIGURE 8
SUMMARY EVALUATION OF PROGRAMS INTENSIVENESS ON SELECTED ENVIRONMENTS

Program	Location	Instructor proximity	Instruction period	Interaction frequency	Interaction duration	Interaction type	Total Score	Delivery Tech-nology	Rank order
Classroom instruction	3	5	2	4	3	5	22	FF	VI
Correspondence course	1	4	1	2	2	5	15	MM	IX
Computer-based (CBT)	1	2	1	2	2	4	12	CM	X

Legend: FF= Face-to-Face MM= Multiple media (not necessarily synchronized) CM= Computer-mediated

Scale: 1 (low) -> 3 (medium) -> 5 (high)

Results from Figure 8 lead to different conclusions focused on Gagné's framework. This is obviously based on the use of different parameters as proxies for effectiveness. However, in the learning process, cognitive impact of instructional programs is the key objective, and the use of the best delivery mode that supports this objective, is only one of the means to an end. Therefore, it is critical to focus on the elements that directly impact learners' cognitive processes. Results from the 'program intensiveness' analysis give no or very limited information on which specific remedial actions should be put in place to improve learning. Evaluation of content organization based on Gagné's criteria provides information in a manner that easily tracks gaps and stimulates reinforcement (i.e., remedial action in objectives definition), retrieval (i.e., simulating recall of prior learning experiences), and guides the learning process as well as its transfer. Therefore, benchmarking different programs and delivery environments against these criteria can be an important and useful tool to guide the organization of any lesson content, a specific module, or an entire course.

ENDNOTES

[1]The intensiveness scale (considered as a proxy for effectiveness) is built on a set of variables: a) *Instructor location*: "High" intensiveness when instruction is delivered at the location of the project team, "medium" when it is held at conference or university premises; "low" when it is delivered at a distance (videotape, audio, correspondence). b) *Instructor proximity*: "High" intensiveness in face-to-face instruction; "low" in remotely guided self-teaching; and "medium" in multimedia and computer mediated (electronic mail) systems. c) *Instruction period:* "High" intensiveness when concentrated in 1-5day seminars; "low" in formal academic degree programs. Intensiveness is inversely associated with the duration of instruction (with short instruction segments being more intensive). d) *Interaction frequency*: Refers to the frequency of instructor/student sessions, with daily sessions being more intensive than sessions meeting only once a week. e) *Interaction duration*: "High" interaction is associated with 5-8 hr sessions, and "low" interaction is associated with 1-2 hr sessions. f) *Interaction type*: Two-way interaction (student-instructor) in a classroom is the higher level, whereas one-way video is the lowest level. The two-ways automated interaction of expert systems and multimedia is associated with medium scores.

[2]Wirth and Amos (1996) intensiveness scores use three measures of interactivity (frequency, duration, type), with the highest score given to "high" interactivity (5 points), and lower score to "medium" (3 points), and "low" interactivity (1 point).

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APPENDIX A
NCTM SOFTWARE EVALUATION CHECKLIST

PROGRAM NAME: *Managing Projects in Organizations*
SUBJECT AREA: *Project Management*
SOURCE: *ESI-International*
REVIEWER'S NAME: *xyz*
COST: *$$$$*
DATE: *DD/MM/YYYY*

1. INSTRUCTIONAL RANGE

_*Business audiences*_____________ Grade level(s)
*Basic computer and basic mgt skills* Ability level(s)

2. INSTRUCTIONAL GROUPING FOR PROGRAM USE

___X____ Individual

___X____ Small group (size_2_________)

________ Large group (size___________)

3. EXECUTION TIME

_40 x unit__ minutes (estimated) for average use

4. PROGRAM USE(S)

_______	Demonstration	_______	Programming utility
___X___	Drill or practice	___X___	Simulation
_______	Instructional gaming	_______	Testing operations
_______	Instructional management	_______	Tutorial
_______	Instructional support	_______	Whistles and bells
___X___	Problem solving	___X___	Word processing
		_______	Other (___________)

5. USER ORIENTATION: INSTRUCTOR'S POINT OF VIEW

Low				High	
.	.	X	.	.	Flexibility
.	.	.	.	X	Freedom from need to intervene or assist

6. USER ORIENTATION: STUDENT'S POINT OF VIEW

Low				High	
.	.	.	.	X	Quality of direction (clarity)
.	.	.	.	X	Quality of output (content and tone)
.	.	.	X	.	Quality of screen formatting
.	.	.	X	.	Freedom from need for external information
.	.	X	.	.	Freedom from disruption by systems errors
.	.	.	X	.	Simplicity of user input

7. CONTENT

Low				High	
.	.	.	.	X	Instructional focus
.	.	.	.	X	Instructional significance
.	.	.	.	X	Soundness or validity
.	.	.	.	X	Compatibility with other material used

8. MOTIVATION AND INSTRUCTIONAL STYLE

Passive				Active	
.	.	.	.	X	Type of student involvement
Low				**High**	
.	.	X	.	.	Degree of student control

none	poor				good	
.	.	.	.	X	.	Use of game format
.	.	.	.	.	X	Use of still graphics
.	.	.	.	X	.	Use of animation
.	.	.	.	.	X	Use of color
.	.	.	.	.	X	Use of voice input and output
X	.	.	.	.	.	Use of non-voice audio
X	.	.	.	.	.	Use of light pen
.	.	.	.	.	X	Use of ancillary materials
.	.	.	.	.	X	Use of ____*feedback*_________

9. SOCIAL CHARACTERISTICS

Present and negative	Not present	Present and positive	
_______	___X___	_______	Competition
_______	___X___	_______	Cooperation
_______	___X___	_______	Humanizing of computer
_______	_______	___X___	Moral issues or value judgment
_______	_______	___X___	Summary of students performance

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CONCEPT MAPS AS AN ALTERNATIVE TECHNIQUE FOR ASSESSING STUDENTS' UNDERSTANDING OF TELECOMMUNICATIONS

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Washington State University

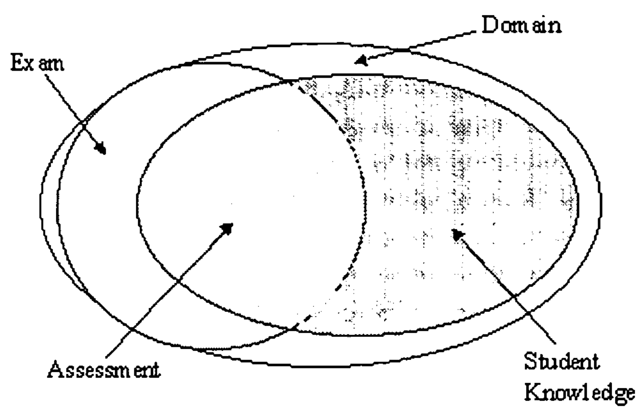
ABSTRACT

An alternative method of measuring the knowledge of students is to use mental models, and specifically concept maps. Concept maps provide a visual representation of conceptual and relationship knowledge within a particular domain. This study builds on previous studies and attempts to reduce their methodological weaknesses. Students in several undergraduate sections of an MIS Telecommunications course were asked to create concept maps of their Telecommunications knowledge at three distinct points throughout the semester. These concept maps were compared across all students at a single point in time, within students across the three time periods, and against the concept map of a domain "expert" at both the individual and composite levels. Findings indicate that the individual and composite maps increased significantly in size over time, and comparisons with the "expert" map show a significantly increasing overlap of concepts over time. Moreover, this study shows the applicability of this technique as an alternate assessment method.

INTRODUCTION

Information systems (IS) educators are tasked with preparing students with a broad education in business and IS, but measuring students' total knowledge can be difficult. Throughout a semester, students complete quizzes, tests, homework, and other assignments to demonstrate their mastery of the particular topic or domain of concern. When taken together, these measures of knowledge tell how much students know, and just as important, what they do not know. Still, most of these measures are very structured and limiting to the students—they may know 85% percent of the course's material, but the test, quiz, or homework assignment may only cover 50% of the material, including the 15% they did not know (see Figure 1). Moreover, these traditional techniques do not allow the students to demonstrate knowledge and mastery beyond the assessment technique. To increase knowledge measurement accuracy, these traditional assessment formats should be supplemented with alternative approaches.

FIGURE 1
TRADITIONAL ASSESSMENT



One alternative approach to knowledge assessment is the use of mental models, and specifically concept maps or concept webs. When a student creates a visual representation of his/her cognitive conceptualization of the IS field, viewers of that map get an inside look into that student's mind. The concepts and their relationships to each other are represented visually, showing the items that the student knows, their relationships, and the items that the student does not feel are important enough to be included.

The purpose of this research is to illustrate a potential use of concept maps as an assessment tool of students' conceptual knowledge of the IS domain (though applicable to other domains), and specifically Telecommunications. For the purposes of this research, Telecommunications (Telecomm) includes topics such as the Internet, networking, cabling, and communications, among others, and the regulations that govern them.

RESEARCH QUESTIONS

Previous studies involving concept maps and the field of information systems were limited in their findings (e.g., Freeman and Urbaczewski, 2001). This was mostly due to the methodology and a focus on concept maps drawn over a five-week period, and not as a snapshot within a short period of time. These studies did not utilize concept maps in a traditional assessment scenario, and, therefore, a clear insight into the usefulness and merits of concept maps has not been provided and there are a number of questions left to be answered regarding the use of concept maps as assessment techniques. This study attempts to answer the following research questions.

1. How does the knowledge of individual students change over time?

2. How does the composite knowledge of students change over time?

3. How does the knowledge of individual students compare to that of the "expert" over time?

4. How does the composite knowledge of students compare to that of the "expert" over time?

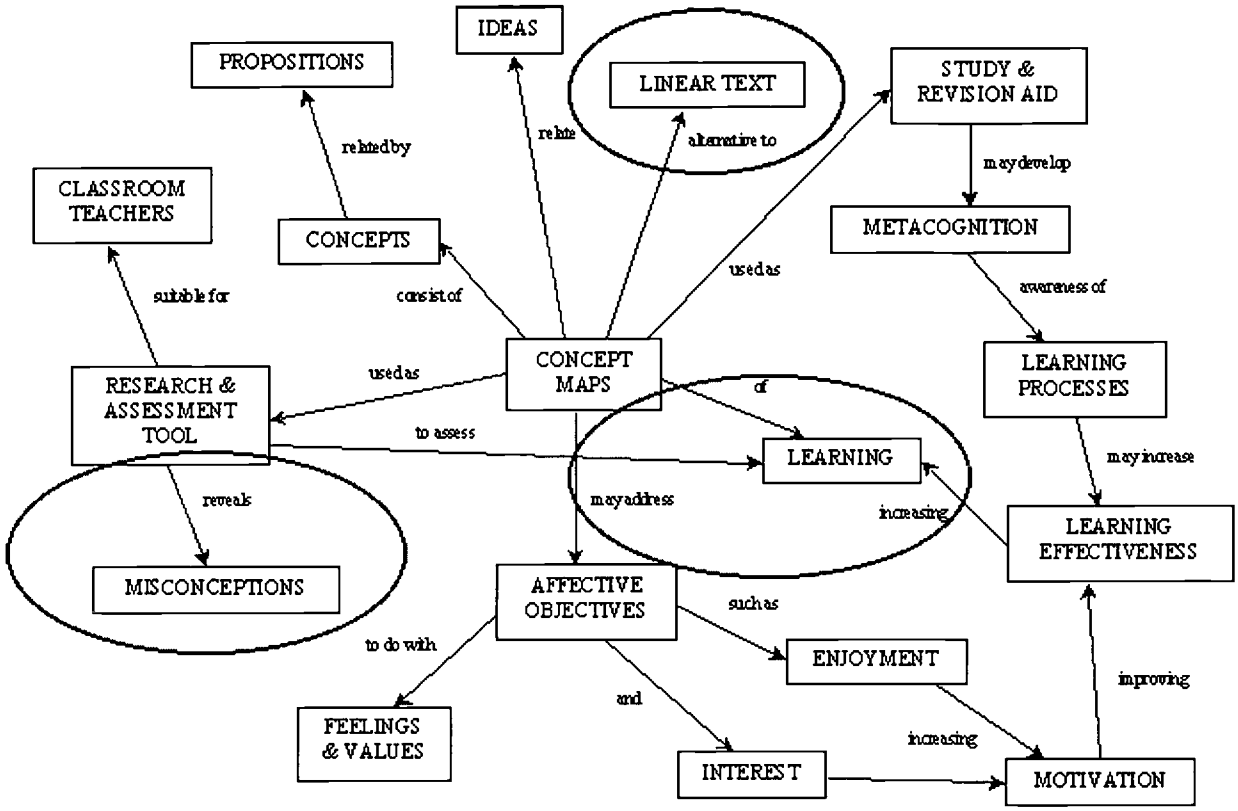
The analyses will provide insight into several issues. First, the concept maps will show what the students know (or at least feel to be important) regarding Telecommunications. Second, comparisons of the students' maps to an expert's map will provide information regarding how much is learned from the course and whether the concepts that are learned and included in the maps are done so "correctly" and as intended according to the expert – the faculty instructor. Third, comparisons of the three concept maps of individual students will provide a measure of how the student's knowledge of Telecommunications changes over time. Finally, if there are major differences between the student maps and the expert map, changes may be necessitated in the teaching of the Telecommunications class(es) so that the students have closer conceptualizations to the expert. These concept maps could potentially be used as an overall assessment of the department's teaching efficacy or simply as a view into the students' minds.

PRIOR LITERATURE

The use of mental models, specifically concept maps, can aide in the assessment of knowledge at a conceptual level (Fisher, 1990; Fisher et al., 1990; Gaines and Shaw, 1995; O'Neil and Klein, 1997). Concept maps provide a visual representation of conceptual and relationship knowledge of main concepts and major sub-topics within a particular domain (Hoover and Rabideau, 1995). Concept maps consist of nodes that represent the concepts and optionally labeled arcs that connect the nodes and represent the presence of a relationship. Concept maps look like a spider's web consisting of many concepts or nodes connected to each other by lines signifying the presence of relationships. Concept maps are typically assessed by comparing them to an expert's map in either quantitative or qualitative forms. Other assessment techniques include counting the number of concepts, the number of relationships, and the number of interconnections to determine the degree of complexity. See Figure 2 for a sample concept map.

Other forms of mental models such as cognitive maps, semantic networks, and schemata can also be used to represent relationships between concepts. However, they differ from concept maps in that they also include directionality to the relationship or causality between the concepts (Fisher, 1990). Concept maps were chosen as the assessment method because they do not require any temporal or cause/effect relationships between the concepts. In addition, concept maps support the notion of hierarchy, though they do not force a hierarchy.

FIGURE 2
SAMPLE CONCEPT MAP (TABER, 1994)



A general concept map showing the mapping of "concept maps" according to Taber. Note that the links are displayed as arrows showing the direction of the link (not causation), a convention not always used by others.

Concept maps have been used for many years as a means for communicating knowledge in fields such as education, biology, history, mathematics, engineering, computer science, and communications (Cliburn, 1986; Gaines and Shaw, 1995; Wallace and Mintzes, 1990; Williams, 1995). As seen in Figure 2, concept maps are an alternative to linear text, they help reveal misconceptions, and they increase learning. Freeman and Urbaczewski (1999) describe the use of concept maps as an "end-of-[academic] major" assessment technique to measure students' IS knowledge gained throughout their coursework. While there may be merit in creating and implementing some sort of assessment measure to be given to students after they complete all of their coursework, this would involve major cultural and pedagogical changes and is unlikely to happen at most institutions in the near term. Even so, this study was an initial attempt at using concept maps as an IS educational assessment technique. However, as described in Freeman and Urbaczewski (2001), there were a number of limitations and weaknesses associated with that first study.

First, there were no comparisons within individuals over time. Research suggests that concept maps indeed show the differences between novices and experts within a field (Markham et al., 1994; Wallace and Mintzes, 1990), so future studies should analyze the differences in concept maps from individuals drawn at different points in time. A second weakness was that the assignment covered a five-week period, as opposed to one or more snapshots in time. Concepts maps drawn over five weeks will likely be different from concept maps drawn within a time period of several hours, or shorter. Third, while the study focused on individual students and their individual concept maps, there was no control over the students to assure the researchers that there was no outside collaboration by the students during the five-week time period.

Finally, it should be noted that students have typically found concept maps to be fun (Freeman and Urbaczewski, 1999; Taber, 1994), an emotion unlikely to be expressed with regard to many other traditional assessment methods like exams and quizzes.

RESEARCH METHODOLOGY

This current study takes the composite knowledge of the above literature review and, with a focused effort based on the concept mapping literature from other disciplines, attempts to eliminate the weaknesses of this earlier work within IS.

Eighty-five students in an undergraduate MIS telecommunications course at a large U.S. university were the subjects for this study. At three different times throughout the Spring 2001 semester—during the first week of class, during the eighth week of class, and during the last week of class—a third party (not the instructor) visited the classes and witnessed the students as they created concept maps centered around Telecommunications. Prior to the first visit, the students were given a brief (15 minutes) introduction and training session on the subject of concept maps, how they can be drawn, and what they can show the reader. The students were given a blank sheet of paper to use in creating their concept maps, and they were given 20 minutes to create their maps. Students were not permitted to look at earlier maps in creating a current map, nor were they allowed to keep copies of the maps that they created.

As an incentive to participate, any student that completed all three concept maps during the semester received three bonus percentage points towards his/her overall course grade. Sixty-two students completed all three maps, and those sets of maps are the objects of analysis.

ANALYSIS

Analysis of the concept maps consisted of the following:

Coding Scheme

Each map was redrawn verbatim, but only focusing on and including the concepts and relationships regarding Telecomm. The cutoff for inclusion was to not include any concept and the associated relationships if that concept would not be included in a typical textbook chapter on telecommunications or internetworking. Therefore, "web-enabled database" would be included, but its relationship to "SQL" and "SQL" as a concept would be beyond the scope of Telecomm. Two outside coders, unaffiliated with the study, completed these redraws and the rest of the coding process to prevent any undue biases on the part of the authors from creeping into the analysis. Both authors independently compared the redraws for consistency and for concept categorization.

Following these redraws, the maps were randomly split into two groups. Using the maps from Group A, a set of consistent terms was developed to create a consistent coding scheme for all of the maps. In other words, if one map contained "employee" and another map contained "worker," or if one map contained "cabling" and another map contained "wiring," the coding scheme was necessary to select one term to be used in all instances of these synonyms to keep all of the maps consistent with each other. This coding scheme was then applied to Group B, and the maps from Group B were redrawn using the new coding scheme. Any concepts that were part of Group B, but not included in the coding scheme, were added to create a more robust scheme. The maps from Group A were then redrawn using this revised coding scheme. This process was repeated until all concepts from Groups A and B were accounted for in the coding scheme and all of the maps had been redrawn using the finalized coding scheme. Once the maps were redrawn with the finalized coding scheme, each concept and relationship from every map was entered into a software package for manipulation and analysis.

General Statistics

The final coding scheme contained 751 unique concepts, though there were over 1,600 total concepts (when including synonyms) used by the students. The 186 maps (62 students x 3 maps each) contained 5,000 total concepts in 2,606 unique relationship pairs, and over 5,100 total relationships. Across all maps from all rounds, there was a mean of 27 concepts and 28 relationships on each map. The smallest map had 7 concepts and the largest had 50. These same two maps also anchored the range of relationships with 6 relationships and 55 relationships, respectively. Of all 186 maps, only three had less than 10 concepts, and only 6 had less than 10 relationships.

Individual Maps

Prior research as well as everyday classroom experience indicates that the student concept maps should increase in size over time, representing greater domain knowledge. Fifty-seven (out of 62) students had larger maps in the second round than in the first round. Additionally, 49 students had larger maps in the third round than in the second round. For 48 students, their third round map was the largest of the three rounds, and for 44 students, each round's map was larger than the previous round. Overall, therefore, the maps of individual students did increase in size throughout the study.

Composite Maps

More details regarding the changes in the individual maps over time can be learned from analyses of the composite maps from each round. Table 1 presents descriptive statistics for each round.

TABLE 1
DESCRIPTIVE STATISTICS FOR COMPOSITE MAPS

	Round 1	Round 2	Round 3	p-value
Unique Concepts	380	418	459	n/a
Total Concepts	1175	1742	2083	n/a
Unique Relationships	841	1133	1271	n/a
Total Relationships	1196	1789	2147	n/a
Mean Concepts	18.95	28.10	33.60	<0.001
Mean Relationships	19.29	28.89	34.63	<0.001
Complexity	1.34	1.79	2.03	0.127

Overall, the maps were significantly larger in each subsequent round in terms of concepts and relationships. They also increased in complexity in each subsequent round (a measure of the number of relationships depicted in the map beyond the minimum necessary to connect all of the concepts linearly), though not at a significant level.

Based on the mean number of concepts and the mean number of relationships in each of the three rounds and overall, the following four tables (Table 2-Table 5) present the most common concepts and relationships for the respective rounds and overall. More concepts and relationships are included in all four tables in order to accurately represent the frequency distribution and not omit concepts or relationships with the same frequency. In other words, while Round 1 had a mean of 19 concepts, the top 22 concepts are shown in Table 2 to complete the frequency of all concepts appearing on 12 maps. Similar adjustments have been made to the concepts and relationships in Tables 2-5. These "amended means" will also be used below for comparisons to the expert's map.

The Expert's Map

In addition to the student maps, an independently-drawn concept map of an "expert"—the faculty member who taught these sections of Telecommunications—was collected for analysis and comparisons. The expert's map contained 86 concepts and 103 relationships, giving a complexity score of 18. For comparison, the largest student map contained 50 concepts and 55 relationships (also the maximum), and this map was in the third round. The maximum complexity score for any of the student maps was 10, but this was in the first round. Therefore, without any additional comparisons and analyses, it is already quite apparent that the expert's map is much larger and more complex than any map drawn by the students.

Even so, comparisons can be made with the individual maps against the expert's map, and with the composite maps and summary round data against the expert's map. Every student map had at least one concept in common with the expert's map, and some maps had up to 23 concepts in common. While these 23 concepts only represent 27% of the concepts on the expert's map, they represent 64% of the student's map. This indicates that while nearly every map was much smaller in size than the expert's map, some of the maps contained a substantial amount of overlap in terms of the concepts included.

Table 6 shows the number of concepts, on a composite level, contained in both the students' maps and the expert's map. The increasing overlap with the expert's map in each subsequent round was significant for all three measurements—actual number of overlapping

TABLE 2
ROUND 1 MOST COMMON CONCEPTS AND RELATIONSHIPS

Concept	# of Maps	Relationship	# of Maps
Telecommunications	63	Telephone:Telecommunications	23
Telephone	34	Telecommunications:Computers	18
Internet	33	Telecommunications:Networks	18
Computers	32	Telecommunications:Internet	17
Cellular	30	Telecommunications:Business	12
Networks	24	Telephone:Cellular	11
Email	22	Telecommunications:Communication	10
Business	21	Telecommunications:Fax	9
Cabling	21	Telecommunications:Technology	9
Individuals	16	Telecommunications:Individuals	9
LAN	16	Wireless:Telecommunications	9
Satellites	15	Telecommunications:Cellular	7
Wireless	15	Telecommunications:Information	7
Fax	13	Networks:LAN	7
Networking	13	WAN:Networks	7
Video Conferencing	13	Telecommunications:Satellites	7
WAN	13	Video Conferencing:Telecommunications	6
AT&T	12	Television:Telecommunications	6
Modem	12	Telecommunications:Cabling	6
Pagers	12	Internet:Computers	6
Speed	12	Telecommunications:Speed	6
Technology	12	Networks:Computers	6
		Telecommuting:Telecommunications	6

TABLE 3
ROUND 2 MOST COMMON CONCEPTS AND RELATIONSHIPS

Concept	# of Maps	Relationship	# of Maps
Telecommunications	63	Telephone:Telecommunications	22
Telephone	40	Wireless:Telecommunications	19
Wireless	35	Telecommunications:Networks	16
Fiber Optic	32	Transmission Media:Fiber Optic	13
LAN	32	Transmission Media:Telecommunications	13
Protocols	27	Telecommunications:Computers	12
WAN	27	Telecommunications:Networking	11
Internet	26	Telecommunications:Internet	11
TCP/IP	26	Telecommunications:Protocols	11
Transmission Media	26	TCP/IP:Protocols	11
Cellular	25	Networks:LAN	11
Star	25	Wireless:Cellular	11
Network Topology	24	Twisted Pair:Transmission Media	10
Networks	24	Telecommunications:LAN	10
Cabling	23	WAN:Networks	10
Twisted Pair	23	Star:Network Topology	10
Analog	20	Telecommunications:Network Topology	9
Data	20	Network Topology:Bus	9
Email	20	Telephone:LATA	8
Modem	20	Telecommuting:Telecommunications	8
Bus	19	Telecommunications:Data	8
Digital	19	Networking:LAN	7
Computers	18	Telecommunications:Data Sharing	7
Ring	18	Ring:Network Topology	7
LATA	16	Wireless:PDAs	7

Table 3
(continued)

Concept	# of Maps	Relationship	# of Maps
Microwave	16	WAN:Networking	6
Phone Companies	16	TCP/IP:Internet	6
Coaxial Cable	15	Telecommunications:Connections	6
Ethernet	15	WAN:Telecommunications	6
OSI Model Structure	15	Telecommunications:Technology	6
Voice	15	WWW:Internet	6
		Transmission Media:Cabling	6
		Telecommunications:Security	6
		Telecommunications:Communication	6
		Telecommunications:Switched Circuit Service	6
		Telecommunications:OSI Model Structure	6
		Telecommunications:Error Checking	6

TABLE 4
ROUND 3 MOST COMMON CONCEPTS AND RELATIONSHIPS

Concept	# of Maps	Relationship	# of Maps
Telecommunications	63	Wireless:Telecommunications	25
Wireless	51	Telecommunications:Internet	23
Telephone	44	Wireless:Cellular	22
Internet	43	Telephone:Telecommunications	19
Cellular	36	Transmission Media:Fiber Optic	17
LAN	36	Telecommunications:Networks	17
Fiber Optic	35	Telecommunications:Security	17
DSL	32	Security:Firewall	14
WAN	32	Twisted Pair:Transmission Media	14
Security	31	Transmission Media:Telecommunications	13
Bus	29	TCP/IP:Protocols	13
Twisted Pair	29	Telecommunications:LAN	12
Star	28	Star:Network Topology	12
Modem	27	Network Topology:Bus	12
Transmission Media	27	WAN:Telecommunications	11
Cabling	26	Wireless:PDAs	10
Network Topology	25	Telecommunications:Hardware	10
Networks	25	Networks:Network Topology	10
Email	24	Network Topology:Mesh	10
Ethernet	23	Networks:LAN	10
Ring	22	Ring:Network Topology	9
TCP/IP	21	Wireless:Satellites	9
Digital	20	Telephone:Switched Circuit Service	9
Mesh	20	WAN:Networks	9
Protocols	20	Telecommunications:Switched Circuit Service	8
Satellites	20	NICs:Hardware	8
Video Conferencing	20	Wireless:Bluetooth	8
Analog	19	Video Conferencing:Telecommunications	8
Firewall	19	Telecommunications:Network Topology	7
Hardware	19	Telecommunications:Data Sharing	7
Hubs	19	Telecommunications:Protocols	7
Router	17	Telecommunications:DSL	7
Microwave	16	Protocols:IPX/SPX	7
Coaxial Cable	15	Telecommunications:Cellular	7
MAN	15	Wireless:Microwave	7
Switched Circuit Service	15		

TABLE 5
OVERALL MOST COMMON CONCEPTS AND RELATIONSHIPS

Concept	# of Maps	Relationship	# of Maps
Telecommunications	189	Telephone:Telecommunications	64
Telephone	118	Wireless:Telecommunications	53
Internet	102	Telecommunications:Internet	51
Wireless	101	Telecommunications:Networks	51
Cellular	91	Wireless:Cellular	38
LAN	84	Telecommunications:Computers	36
Fiber Optic	76	Transmission Media:Fiber Optic	31
Networks	73	Networks:LAN	28
WAN	72	WAN:Networks	26
Cabling	70	TCP/IP:Protocols	26
Email	66	Transmission Media:Telecommunications	26
Computers	63	Telecommunications:LAN	25
Modem	59	Telecommunications:Security	24
Star	56	Twisted Pair:Transmission Media	24
Transmission Media	56	Star:Network Topology	22
Twisted Pair	55	Telecommunications:Communication	21
TCP/IP	53	Telephone:Cellular	21
DSL	51	Telecommunications:Business	21
Protocols	51	Network Topology:Bus	21
Bus	50	Telecommunications:Technology	20
Network Topology	50	Telecommunications:Networking	19
Security	47	Telecommuting:Telecommunications	19
Digital	46	Security:Firewall	19
Satellites	46	Telecommunications:Protocols	19
Video Conferencing	46	Video Conferencing:Telecommunications	18
Business	43	Telecommunications:Cellular	18
Analog	42	WAN:Telecommunications	18
Ethernet	42	Wireless:PDAs	18
Ring	42		

TABLE 6
OVERLAP BETWEEN INDIVIDUAL AND EXPERT MAPS

	Round 1	Round 2	Round 3	p-value
Mean Overlap Concepts	4.68	10.76	12.87	<0.001
Percent of Students' Maps	24.39%	37.76%	38.25%	<0.001
Percent of Expert's Map	5.44%	12.51%	14.97%	<0.001

concepts, percentage of the students' maps that overlap with the expert's map, and percentage of the expert's map contained in the students' maps.

There are two additional ways to compare the expert's map with the composite maps from each of the three rounds. The first is by comparing the most common concepts from each round to the concepts used by the expert. In Round 1, out of the 22 ("amended mean") most common concepts, only 6 (27.27%) were also a part of the expert's map. For Round 2, this number jumps to 21 out of 31 (67.74%). However, the number falls to 22 out of 36 (61.11%) for Round 3. Still, this does indicate a fair amount of overlap between the composite maps from each round and the expert's map. The second comparison is determining the number of concepts used by the expert that appear in any of the students' maps in a given round. Of the 86 concepts in the expert's map, 38 did not appear on any students' map in Round 1, 22 did not appear on any students' map in Round 2, 14 did not appear on any students' map in Round 3, and 6 never appeared on any students' map in any of the rounds, again indicating an overall overlap between the students' maps and the expert's map, especially in the later rounds.

Course Grades

The final analysis is the correlation between the students' final course grades (based on traditional assessments) and their concept maps from Round 3. The course grades were converted to a GPA based on a 4.0 being an A. Table 7 shows these correlations.

TABLE 7
CORRELATIONS OF CONCEPT MAPS WITH COURSE GPA

	GPA	p-value
Concepts	0.376	0.003
Relationships	0.370	0.003
Complexity	0.044	0.732

The positive and significant correlations between GPA and both Concepts and Relationships indicate that the students who performed well in the traditional assessments also produced concept maps that were larger with more relationships. While the correlation with GPA and Complexity was slightly positive, it was not significant as expected based on the relatively low complexity of the concept maps.

DISCUSSION

The results are fairly clear: as the students progressed throughout the semester, their concept maps significantly increased both in size and in similarity to the expert's map. We would expect any other assessment method to yield similar results, hopefully as a measure of learning.

One might wonder if the increasing number of concepts and relationships would be a self-fulfilling prophecy. That is to say, that certainly by the end of the semester, the students would have been exposed to more material and would have been able to express more of it on their maps. This is probably true to some extent. Of importance to us, additionally, is their ability to continue to recall basic topics that were primarily discussed in the beginning of the semester, as well as relate those topics to their understanding of Telecommunications before beginning the course. This demonstrates additive knowledge on the reshaping of prior knowledge.

If we look at the relationship between the average overlap of concepts, even at its highest (12.87 concepts: 38.25% of the students' maps, 14.97% of the expert's map), we may conclude that the transfer of knowledge is limited and that both the professor and students should be given failing grades. Is this so? We do not believe it is. We believe that this is rather a celebration of the educational system and the abilities of individuals to focus in areas that may not be of primary interest to the expert. This is the ability to inspire. Of course there must be some base level of knowledge in order for one to inspire, and we at least find that in the increasing number of concepts represented in the students' maps. But to suggest that the goal is to have the students repeating the course material as a mantra upon completion would imply that our universities are no more than memorization camps. These maps are one more tool in getting inside the minds of our students and observing the relative importance of certain concepts.

In the results, we find that course grade is positively and significantly correlated with both number of concepts and number of relationships in the individual maps. This can be attributable to a number of factors. First of all, and what we as educators are more likely to espouse, it is a demonstration of understanding of the subject matter. While it is true that the individual who does not know anything about the subject could not draw a concept map similar to an expert's map, the opposite relationship is not necessarily true. We also cannot say for sure that the primary cause of the correlation is increased knowledge. Other mitigating factors, such as motivation, attitude towards course, attitude towards instructor, or attitude towards the researcher could all play a role in identifying the reasoning behind the correlation. For the purposes of this paper, we make no claim beyond the existence of positive and significant correlations. Future research should attempt to measure these differences.

We find no relationship between grade in course and complexity. This is likely related to the low overall complexity of all student maps. Future research should also investigate the reasoning behind relatively low complexity and the mental model of the student. For example, does the student view knowledge as largely hierarchical, or as an interconnected web of concepts, and how does the student demonstrate that knowledge?

These concept maps allow the instructor to "check" on what students understand and know regarding the course and his/her expectations. Of course, quizzes and exams attempt to do just that, but they are limited in what can be conveyed and in what can be covered. Additionally, beyond the quantitative analyses that appear in this paper, there are several valuable qualitative analyses that can be performed on the concept maps. By looking for "strange" relationships within the concept maps, the instructor can clearly see what the students don't understand, or at least misunderstood at one point. For example, if the relationships "Network Topology:LAN" and "Network Topology:Client Server" appeared, it would be apparent that there is a misunderstanding of Network Topology within the class. These "strange" relationships are particularly helpful when uncovered in the middle of the course. In the beginning of the course, many students will likely have misunderstandings about concepts and relationships merely due to the fact that they have not yet been covered adequately, if at all. At the end of the course, the instructor may not have the time to properly correct the misunderstandings before the students take part in traditional, graded examinations. However, in the middle of the course, the instructor has not only covered a fair amount of the material, but also has the necessary time to clarify misunderstandings.

A second qualitative analysis involves the actual knowledge and understanding conveyed in the concept maps. Ideally, as the course progresses, the concept maps will contain concepts and relationships that indicate a deeper understanding of the material. These concepts and relationships will go beyond the basic terminology of the course, and the relationships will become more complex. These qualitative analyses go beyond traditional assessment techniques in providing the instructor with a much clearer view of what his/her students know, think, and understand.

A potential limitation with interpreting the data is that the researchers and coders were required to take the topics as they were printed on the paper. It is difficult from the writing to ask "is that what he/she really meant?" From the context and the relationships, it is easy to tell that in one sense "cable" may refer to a type of Internet access through a cable TV company, while in another sense "cable" may refer to a length of copper surrounded by insulation. However, this interpretation is certainly not perfect. The alternative, though, would be to have students pick words and definitions from an approved list. This would certainly defeat the purpose of this free association task and almost "force" the results.

CONCLUSION

This study is an attempt to better assess students' knowledge using concept maps, and an attempt to modify previous studies and eliminate their weaknesses. Several issues should be noted: the contributions of this study and the need for additional research. First, this study makes several contributions to research and to teaching. It informs the field of IS academics in general, and specifically Telecomm academics, of an additional method for the assessment of students that has gained support in other academic fields such as education and psychology. Granted, this method may not be appropriate to replace other assessment methods, but that will depend on the specific situation and the type of knowledge to be assessed. This empirical study also demonstrates the applicability of this assessment method in a real classroom situation and shows what can be learned.

While the concept maps of these students were compared to an expert, this expert was a single faculty member and not all of the faculty members that teach or have taught the Telecommunications class at this particular institution. Student maps could be compared to a "departmental" or "institutional" map or even to the map at a discipline level from the IS 1997 or IS 2002 requirements (available through the AIS website, http://aisnet.org/Curriculum/). Future research should also analyze concept maps created by groups as an alternative method for conveying knowledge. Another area for future research is the use of concept maps in other ways within the classroom, such as for organizing lectures and units, for brainstorming, or for bringing together diverse viewpoints.

The optimal means for assessing student knowledge may often seem like the quest for the Holy Grail. While concept mapping may not be the "silver bullet" that is all-encompassing and useful in every situation, it is one more "fly" in the teacher's "tackle box," and one that should not be ignored. This study attempts to show the usefulness of this tool in one situation, and its applicability to many other situations can be surmised from this study.

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MAKING THE CASE FOR REQUIRING MODERN DECISION ANALYSIS AT THE MBA LEVEL

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Extended Abstract

Nearly all MBA programs require that their graduates possess effective *decision making* skills, or a variation thereof, as one of the exit competencies. Yet, one would be hard pressed to find a required course on modern decision analysis in a traditional MBA curriculum. Now with the widespread use of spreadsheets in business and the newly developed decision analysis software add-ins, the time has come to introduce MBA students to the tools and techniques of this often overlooked science.

Almost all course descriptions, regardless the subject matter, include the term "decision making" or "decision makers." Moreover, almost all courses include improving managerial *decision making* in their subject area, whether it be finance, accounting, economics, marketing, human resources management, information systems management, operations management, statistics, or quantitative analysis, etc., as one of their objectives. Yet, none of these courses cover the topics of structuring, modeling, analyzing and solving decision problems. The exception is the quantitative analysis course, where a limited treatment of decision analysis using decision trees is presented. This treatment, however, lacks the depth needed to understand how decision analysis can help decision makers think hard about problems. It also lacks the breadth to cover the latest developments in decision analysis such as influence diagrams, value-focused thinking, and the use of spreadsheets for modeling and analysis.

If MBA programs expect their graduates to be effective decision makers, they need to provide them proper training in modern decision analysis. We propose such training using a book entitled "Making Hard Decisions with DecisionTools®", by Clemen and Reilly. DecisionTools is a suite of five software programs: PrecisionTree, TopRank, @Risk, BestFit, and RISKView, each designed as an add-in to Microsoft Excel. These programs allow the user to structure, model, analyze and solve complex decision problems using decision trees and influence diagrams.

Elements of decision problems include 1) values and objectives, 2) decision alternatives, 3) uncertain events, and 4) consequences. According to Clemen, "decision analysis provides structure and guidance for thinking systematically about hard decisions...and provides analytical tools that can make the required hard thinking easier." Why hard decisions? The answer is rather obvious. An easy decision requires little thinking and analysis. An easy decision is exactly that, easy! So what makes a decision hard? A decision may be hard because of its complexity, its multiple sources of uncertainty, its multiple and conflicting objectives, or because different perspectives lead to different conclusions.

We can find many hard decision problems in business and government. Using the tools and techniques of modern decision analysis, decision makers can structure, model, analyze and solve hard decision problems, while taking into consideration the decision maker's values and objectives, perceived uncertainties, and preferences.

Managers and people in decision-making positions need to study decision analysis to make better decisions. Making better decisions implies that we know what makes a decision good. A decision may be considered good if it results in the best outcome. We need to distinguish, however, between a good decision and a lucky outcome. A good decision may not always result in the best outcome, and the best outcome may not

always be the result of a good decision. Using the tools and techniques of modern decision analysis, managers can be confident the decisions they make are good, regardless of outcome. At the very least, managers can learn more about the structure of their problem, and gain deeper understanding of their values and objectives, the inherent uncertainties, and their preferences.

In the remainder of this paper, we describe the decision analysis process, we provide detailed descriptions of all tools and techniques including DecisionTools programs' capabilities, and we detail some of the application areas relevant to business decision making.

CONTINUING IMPROVEMENTS IN TEAM PROCESS: SOFTWARE ENGINEERING APPROACHES AND PEER INSTRUCTION INTERVENTIONS

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Extended Abstract

This paper reports current status of a continuing study of team process as applied to an undergraduate IS curriculum. This continuing investigation identifies and assesses methods for improving the team experience and team product in classes where teamwork is critical [1]. Current work focuses on two new dimensions: software engineering approaches and peer instruction interventions.

Why do we require team projects is so many IS courses? Most IS educators understand that industry projects are seldom conducted by individuals. Well-established curricular guidelines require substantial experience with teams in IS and CS classes. Varieties in student learning styles mean that some students will learn the concepts more effectively in teams [2]. And recent work concerning software development indicates that pair programming yields high quality software in shorter periods of time [3].

Given these powerful reasons, it is no surprise that IS educators seek to meet the following objectives with the assignment of a team project [1]:

- Increase student retention of course content such as methodologies.
- Teach students how to function effectively on a team.
- Improve the quality of project deliverables such as software and documentation.
- Prepare students well for the world of professional work.

This paper extends prior work by examining the use of software engineering techniques included in Software Engineering Institute's (SEI) Team Software Process [4]. SEI work over the last two decades has led to the development of a trilogy of models including the Personal Software Process (PSP), the Team Software Process (TSP), and the Capability Maturity Model (CMM). TSPi represents a slightly scaled-back version of TSP intended for college audiences. The focus is on quantifiable process, highly specified roles for each team member, and an eight-stage iterative system development life cycle (SDLC). Each role is specified in some detail and includes a script of tasks and responsibilities for each of the eight stages.

The TSPi approach to teamwork was applied in two upper division courses required of IS majors. The first course is a traditional system analysis and design (SA&D) course that is overflowing with course content such as the general SDLC, structured techniques, OO techniques, plus a team project intended to weave the concepts together. The abundance of material to cover in SA&D necessitated provision of an abbreviated introduction to the TSP involving primarily the specification of each team member's role and responsibilities.

TSPi was introduced and used on a more extensive basis in the second course that has the traditional SA&D course as its prerequisite. This second course is a senior-level capstone course where IS majors are introduced to their second programming language in order to develop a fully functional system involving programming, embedded SQL and graphical user interfaces. The first half of the term focuses on the new language (Visual Basic) and the second half focuses on a team project generating a fully functional piece of software with complete documentation.

The presentation of this paper will focus on the results from these two pilot classes using TSPi and peer instruction interventions. Data collected will be compared with results collected during prior studies [1],]5]. Due to the new dimensions explored in the current work, some additional questions have been added to the previously used questionnaire. In particular we will report on the role of TSP in determining students' assessment of the team experience. Data reported will include productivity (lines of code and time spent), as well as qualitative data measuring satisfaction with the experience and grades received for the software and documentation deliverables.

Peer instruction interventions include having students from the prior term conduct the first class of the following term, having project teams take "team quizzes" during the first two weeks of the term, and having student teams review the work of other student teams. Students who have been successful in the Systems Analysis and Design course show their project to the new class and explain what must be done to be successful in the course. The students present the syllabus as well. This intervention proved to be highly effective. Secondly, quizzes during the team formation period are taken on an individual basis and then as a team. Individuals receive an average of the two grades on the condition that the individual grade is a passing score. This activity increased team coherence and motivated students to study so that they could contribute to the team quiz session. Finally, student teams evaluate the systems request, feasibility study, and process models of other teams. Students agreed that this review helped them to see needed improvements in their own work. Furthermore, they found the work of peers more interesting than textbook examples.

In sum this presentation will focus on two new dimensions likely to impact the effectiveness of team process: software engineering approaches and peer instruction interventions. Results achieved along each dimension will be reported and compared with prior work. Recognizing the importance of teamwork in the professional environment, many IS educators require that students complete team projects. The overall goal of this research is to enrich and deepen the learning that occurs when IS students work on these team projects.

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IN SEARCH OF BETTER PROJECTS: AN OPEN FORUM

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Extended Abstract

The problem of bringing students' programming and system development abilities along from beginning to pre-professional levels is one which confronts most MIS programs.

In an introductory course, the emphasis tends to be on language syntax and individual projects. If students later undertake a capstone project, the assumption is likely to be that they have previously acquired a considerable variety of "hard" and "soft" skills. These range from technical issues, like database design, to softer—though by no means easier—skills, like requirements analysis and interface design.

The road between those levels is a long one. Students naturally need to increase their level of technical competence. At the same time, they need to learn a variety of other skills, many of which are more readily acquired in a practical setting than in a lecture context. Some examples include: the ability to interact with non-technical users, to work with incomplete or ambiguous program descriptions, to divide work among team members, and to design and manage projects so that their fit and finish can be adjusted based on project progress and schedule imperatives.

This forum is intended to offer participants an opportunity to share experiences and ideas about how such "intermediate" projects can be structured and managed to work more effectively for students. Areas of interest include, but are not limited to: topics and sources for such projects, how they should be managed, levels of project autonomy, types of users and interaction with them, and assessment methods.

TEACHING TEAM PROJECTS IN E-COMMERCE DEVELOPMENT COURSES: DESIGN, MANAGEMENT, AND ASSESSMENT ISSUES

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ABSTRACT

This paper examines issues concerning the design, management, and assessment of team projects in e-commerce development courses. The paper is composed of three parts. The first part examines the conceptual foundation in e-commerce and a user-centered Web engineering method. This concept and method form the content of an e-commerce development course. The second part presents a case study of how team projects can be designed, managed, and evaluated in the context of a graduate level e-commerce course. This section provides an in-depth analysis of the intent, deliverables, and process for each phase of the team project. Also discussed are insights and tactics about how to manage and appraise student teamwork. The third part of the paper presents a set of practical strategies. The appendix section includes a comprehensive checklist for assessment and a peer evaluation form for project teams.

INTRODUCTION

This paper examines issues concerning the design, management, and assessment of team projects in e-commerce development courses. Team project is an essential pedagogy in teaching e-commerce application development. This approach emphasizes the integration of business concepts and technology (Surendra, 2000). Through team projects, students learn a holistic set of skills required for Web development (Grundy, 2000). By building e-commerce projects and subsequently using the projects to simulate online retailing, students experience the Web development process as well as the operation of an e-commerce site in a virtual economy (Dhamija, Heller, and Hoffman, 1999; Rosenbaum, 2000). Team projects can also be used for teaching the concepts and process of Web design, programming, and usability in a non-profit context or for community service (Lazar, 2000).

Team projects for systems development typically follow the systems development life cycle (SDLC) and the joint application development (JAD) method. However, successful adoption of a team project approach for e-commerce courses may require different considerations. Compared with traditional systems development teams, the composition of an e-commerce project team involves a more diverse mix of skills and roles. A collaborative process is critical to a team's success (Burdmann, 1999). The dynamic interaction between technology and e-commerce strategies dictates a more interactive development process. Furthermore, a focus on user experience and usability issues introduces new requirements for design (Nielsen, 2000). These factors imply that e-commerce development courses need to consider different strategies, methods, and processes for team projects.

In this paper, I discuss the issues and strategies affecting the design, management, and assessment of student team projects for e-commerce development. The paper is composed of three parts. The first part examines the conceptual foundation in e-commerce and a user-centered Web engineering method. This concept and method form the content of an e-commerce development course. The second part presents a case study of how team projects can be designed, managed, and evaluated in the context of a graduate level e-commerce course. This section provides an in-depth analysis of the intent, deliverables, and process for each phase of the team project. Also discussed are insights and tactics about how to manage and appraise student teamwork. The third part of the paper presents a set of practical strategies. The appendix section includes a comprehensive checklist for assessment and a peer evaluation form for project teams.

ESSENTIAL E-COMMERCE TOPICS

Courses for e-commerce development need to cover both business concepts and the application of technology and tools (Surendra, 2000). This dual emphasis limits the range of business topics that can be introduced in such courses. Management oriented courses may cover a broad range of e-business strategies and models, incorporating even a multi-disciplinary emphasis (Schneberger, Parent, and Haggerty, 2000). In contrast, topics congruent to the application development process facilitate project success. Thus, the selection of relevant e-commerce topics for a project-oriented course is an important decision.

A framework or model for online retailing can guide the selection and organization of course topics. By now, most students have already experienced online shopping. It is easier for them to apply online retailing models than extranets in team projects. Building B-to-B solutions demands advanced knowledge of technology (such as XML, Java, and message queuing) and business strategies (such as supply chain management and e-marketplace). A consumer-centric model is useful, because it dissects customer/user behaviors and the interaction between the merchant's Website and its customers. Both the e-commerce value chain and the mercantile models, discussed below, focus on user experience. Topics relevant to these models can form the core content of a course. Furthermore, such courses should emphasize the shopping cart process and usability issues. Inattention to these issues could cause failure in online retailing.

The E-Commerce Value Chain Model

The e-commerce value chain can serve as a framework for organizing course topics. It presents a marketing perspective of customer relationship management. In this model, an e-commerce Website relates to its customers in four stages—attract, interact, act, and react (Treese and Stewart, 1998). Through marketing, advertising, and promotion, a merchant *attracts* potential customers to its Website. Through effective presentation of catalogs, products, and user interfaces, a Website *interacts* with its potential customers, with the hope of converting them from shoppers to buyers. Using a well-designed shopping cart, a Website *acts* on capturing the transaction. Through customer services, post-sale support, and personalization of customer data, a Website *reacts* to satisfy the customers' needs in order to build a sustained relationship with them.

Topics relevant to the value chain include business models, value propositions, consumer behaviors, security, encryption, digital payment, marketing, advertising, personalization, and privacy. Introducing these topics helps students develop a greater understanding about each link and the inter-relationships among the links of the value chain.

The Mercantile Model

The mercantile model, developed by Kalakota and Winston (1997), presents a customer perspective for online retailing. This model groups the consumer mercantile activities into three stages—pre-purchase interaction, purchase consummation, and post-purchase interaction. The pre-purchase interaction phase involves the search and discovery of products based on attribute comparison, pricing, and delivery. The purchase consummation phase specifies the flow of information and transaction between the customers and the merchant, including order placement, authorization of payment, and receipt of product. The post-purchase interaction phase addresses customer service, support, and return policies.

Compared to the e-commerce value chain model, the mercantile model focuses more on the customer's behaviors, but less on the conversion of the relationship from one stage to the next. It does not address the *attract* process and how a Website can leverage the information gathered from the *act* and *react* phases for building personalized services and repeat purchases. Therefore, one may use this model to supplement the e-commerce value chain in order to provide students with a fuller understanding about the steps involved in product search, comparison, and transaction processing.

A Focus on Shopping Cart

The design of shopping and checkout process merits a close look. Shop.org, the online group of the National Retail Federation, reports, "approximately 65% of shopping carts were abandoned before purchase" (2000). This high shopping cart abandonment rate represents lost sales. Ernst and Young's *Global Online Retailing Report* (2001) shows that 78% of shoppers reported they had placed products in an online shopping cart, but failed to complete the purchase. Among the reasons cited are complaints about the long and confusing checkout process. Students need to understand that a seamless and smooth shopping experience is critical to the success of online retailing.

Usability for E-Commerce

Usability for e-commerce has attracted increasing attention as many companies recognized the high cost of doing business on the Web. Even after the downfall of dot.coms, there is still fierce competition for impatient customers in cyberspace. Several industry oriented usability reports have focused on guidelines for e-commerce Website design. These reports propose a set of design guidelines for the category pages, checkout and registration process, product pages, and user's trust (Nielsen, Farrell, Snyder, and Molich, 2000a, 2000b, 2000c, 2000d). Students can learn the importance of e-commerce usability by applying specific guidelines when building e-commerce sites.

USER-CENTERED WEBSITE ENGINEERING

Methodology for Website development does not yet have the maturity of software or system development. Among various approaches in practice, a user-centered approach to Website engineering seems most prominent in supporting e-commerce needs. This approach augments a modified waterfall model of SDLC with user-centered design.

Website Engineering

The modified waterfall model is grounded in software engineering and resembles systems development. It involves six phases: (a) problem definition and concept exploration, (b) requirement analysis specification, (c) design prototyping, (d) implementation and unit testing, (e) integration and system testing, and (f) operation and maintenance. To support Web development, a spiral of iterations may be added during the early phases of the process (Powell, 1998). Nevertheless, Website engineering encompasses at least three interrelated sets of design—information design, interface design, and program design. Information design deals with the organization of a Website's content. Interface design refers to the navigation and user interaction at a Website. Program design involves constructing a site's functionality and interfaces with back-end information systems. Achieving a balance among information presentation, interface, and functionality is the key to a successful Website. In contrast, most software and system development focuses primarily on functionality.

User-Centered Design

Many companies developing e-commerce Websites have adopted user-centered design methodologies because a Website's success hinges on its being easy to understand and use. User-centered design emphasizes usability testing and design guidelines for the design of a Website's information architecture, navigation, interfaces, and functionality. By using user/task analysis and card sort techniques (Nielsen and Sano, 1994; Rosefeld and Morville, 1998), a Website can better reflect the mental model of its intended users. By using paper prototyping and following design guidelines, a site's navigation and interfaces can be easier to use. Therefore, incorporating the user focus in Website engineering makes the development process more productive for Website development.

Site Usage Analysis

The competitive nature of e-commerce solutions demands the collection and analysis of site usage and performance data. Inclusion of topics on the measurement and usage of such data helps students to understand the need for continuous monitoring the impact of a Website. Internet technology allows tracking of usage data through log files, cookies, and user registration. By requiring students to identify metrics of usage and business measures, students learn to identify how log files can be analyzed for data mining, and personalization purpose. They develop a better understanding about the advantages and limitations of common measures, and about how to tie marketing, sales, and promotion together by using various site measures.

Collaborative Process

Web development employs a collaborative process among team members of diverse skills. An ideal project team will include skills in graphic design, copy writing, marketing, project management, information architecture, usability testing, coding, database, network architecture, and business strategies (Burdman, 1999). These roles reflect different professional training and culture. The fast pace of Web development, the aggressive launching timelines, and the iterative design process of user-centered Web engineering method demand close collaboration among team members.

CASE STUDY

This section of the paper discusses how team projects can be structured and managed to support a graduate level e-commerce development course. I used the case study format to analyze the course that I have taught over the past few years at DePaul University's School of Computer Science, Telecommunications, and Information Systems. The pedagogy for student team projects in this course has evolved and refined over time to incorporate student feedback in project team peer evaluation (see Appendix B). Most of student results are qualitative and informative (in contrast to summative) in nature.

Course Overview

The course on e-commerce development is offered over eleven weeks in a quarter system. Students need to achieve three learning goals: (a) demonstrate an understanding of e-commerce models, strategies, and value chain with an emphasis on consumer-related issues; (b) apply the process of user-centered Website engineering method; and (c) integrate business strategies and solution development. Through team projects, students apply their knowledge in concepts, methods, tools, and technologies in building e-commerce solutions. Additionally, students have to conduct Website analyses, participate in class discussion, and complete exams. Each student receives a computer account to publish the Web analysis. Members of each team share a project account to set up a team Website for posting project deliverables, and use the same account to publish their e-commerce Web projects. A course server is provided, which supports ASP scripting and Access database. Students can choose their preferred software for development. Most students in this class have completed prerequisite coursework in systems analysis and design, HTML, Java Programming, JavaScript, and ASP programming. Some of them have taken courses in human-computer interactions. After completing the e-commerce course, they move onto advanced courses in usability, supply chain technology, data mining, intranet development, and e-business strategies. Within this context, the group projects provide students a structured process of team learning. The following discussion presents an in-depth analysis about the intent, deliverables, and the process for each phase of the team project. Also discussed are insights and tactics about how to manage and assess student teamwork.

Team Projects

The ultimate goal of team projects is to prepare students to work as Web developers in the e-commerce environment. Accordingly, students form project teams and function as Web consulting groups contracted by clients to develop Web solutions. As shown in Table 1, each project consists of eight phases. Each phase needs to follow prescribed process and produce specific deliverables. The end products include the prototype version of a fully functioning Website for e-commerce, along with complete documentation of each step of the development.

Specifically, each project includes the following components:

- Develop a business case for consumer–oriented Internet commerce. The project can be a dot.com case, a click-and-mortar case, or a site for non-profit organizations.

- Analyze client requirements, including strategies, intended customers, content organization, business process, functions, and branding.

- Provide the Website's information architecture.

- Design site layout, content presentation, user interfaces, and transaction processing.

- Implement the proposed Website. Each Website must include database-driven functions, such as a shopping cart, search functions, and membership registration. The completeness of each site will depend on the complexity of the proposal and a team's experience and size.

- Prepare a feasibility report that includes technical and budgetary considerations.
- Propose evaluation criteria to measure the success of the Website.

Team Formation

Students form project teams of five or six members *during* the first class. Each team includes members performing roles of project lead, analyst, designer, media/graphic designer, programmer, database developer, information architect, usability consultant, and recorder/scribe. Sometimes one of the team members also serves as a representative user or client. Team members play multiple roles, especially during the production phase. Each team posts a team organization statement (Deliverable A) on their team Website, which lists the names, skills, experience, roles, and responsibilities of each team member. They may sign up for the Blackboard discussion forum or use email as the communication protocol.

TABLE 1
PHASES, DELIVERABLES, AND PROCESS FOR TEAM PROJECTS

Week	Project Phases	Deliverables	Process
1	1. Team Formation	A. Team Organization Statement	Establish communication protocol. Sign up for Blackboard discussion group. Build a team Website.
2-3	2. Business Case	B. Business Case Statement	Identify potential clients. Develop business cases. Perform user and task analysis.
3-4	3. Analysis	C. Requirements and Specification Report: information architecture chart, transaction flowchart or data flow diagram	Conduct card sort (optional). Expand requirement details. Chart the steps for transaction process.
5-6	4. Design	D. Design Report: Sketches of layout, navigation, and templates, ERD, and data tables	Revise information architecture chart. Prepare page descriptions. Sketch alternative designs and templates. Perform data modeling. Gather content and graphics.
7-8	5. Feasibility and Site Evaluation and Promotion	E. Technical and Budget Feasibility Report: technical solutions, cost projection, and metrics for measurement E. Evaluation Criteria and Promotion Strategies in Feasibility Report.	Gather cost data and prepare estimates. Compare technical solutions and hosting options. Identify usage metrics and impact measures. Identify promotion strategies.
7-11	6. Development and Prototyping and Testing	F. Prototype Website: Codes and database.	Reach consensus on templates and layouts. Prepare paper prototype for user testing. Develop cascading style sheet. Code applications. Prepare database. Test applications and performance.
11	7. Presentation	F. Presentation of Project and Demo of the Website.	Prepare presentation.
11	8. Documentation	G. Final Documentation Folder and Project Team Website	Revise and finalize deliverables in print and online version.

Team composition is the first issue to address. Small size, complementary skills, commitment to a common purpose, performance goals, and approach are critical to successful teamwork (Katzenbach and Smith, 1993). Based on my experience in teaching this course, the optimal size for productive teamwork is four or five members. Six would be the maximum size. E-commerce projects require a broader range of skills (Burdman, 1999). A small team usually cannot capture skills for usability testing and graphic design. There are two ways to form teams—self-selection or assignment by the instructor; each has its pros and cons (Wells, 2002). In either case, clear requirements regarding the roles and tasks to be perform by each team helps students to find appropriate partners. Starting the team formation at the onset of the course signals the energy and the pace required for Web development. Creating a team Website helps project teams build a common identity. Some teams have even created sites that resemble boutique Web consulting shops, and turn this task into an effective vehicle for building teamness.

Business Case

Each team has two weeks to identify potential clients and explore project ideas. Once the team confirms a project idea, they need to analyze the business proposal, user profiles, and tasks. They then prepare a business case (Deliverable B) to explain the proposed project in terms of its business models, value propositions for the client and the target customers, competitors in the market, the rationale for using the Internet solution, and how the Internet channel relates to other established channels.

Creating a high-level business case encourages students to identify key issues early. Before students engage in the business case, they have to complete an individual assignment analyzing a pair of Websites. In this assignment, students compare the business models, value propositions, target customers, market competition of two Websites, and how these two sites implement the e-commerce value chain. Even with this preparation, students still often have difficulty articulating value propositions for customers, but they have an easier time defining the benefits for the client organization. The instructor should address this issue early because a clear understanding of the user profile and goals facilitates the modeling of the user's mental model. Gathering information from representative users can help teams to define their projects with a clear focus on users.

There are three approaches to the selection of a candidate project: (a) working with a real client, (b) working with a pseudo client, and (c) creating a fictitious client. A real client provides students realistic scenarios and a well-defined project scope and content. In the pseudo client approach, students can collect information from a potential client to build the case but don't have to work directly with the client afterwards. If students do not have access to real clients, they can build a fictitious business case using existing business models, such as a bookstore, a travel agency, or by creating an innovative solution. There are pros and cons of working with a real client or creating a fictitious client, as discussed at the end of the paper.

Requirement Analysis

Each team then expands the business case into a requirement statement (Deliverable C). In the requirement statement, students provide details about the proposed projects in terms of measurable goals, the tag message for the site, sources and categories of content, site structure and interpretation, sensorial design considerations, and methods for market testing. They also prepare two charts: an information architecture chart to show the organization of pages on the site; and a flowchart to map out the steps of the shopping cart process.

Several issues often surface during this phase. Students tend to create an information architecture chart from the developer's or the organization's perspective. Therefore, the chart reflects database functions and an inward view of the site. Sometimes, they confuse the logical structure of a site with the site navigation. The instructor should encourage students to find representative users (both novice and experienced users) to help shape the site's information architecture. The card sort technique (Nielsen and Sano, 1994; Rosefeld and Morville, 1998) can help to capture a user's mental model of the information being placed on a site. A complete information architecture chart should include all the pages to be produced for the proposed site. Later on, the chart is used for estimating the amount of work and helping the division of labor during the production phase of the project. Some students feel more comfortable using the DFD to chart the information flow for the shopping cart. However, a detailed flowchart is more suitable because of the document-centric nature of Websites. A flowchart, presenting each step of a shopping cart (order creation, order capture, payment authorization, order fulfillment, and order confirmation) or registration, facilitates the programming task.

Detailed Design

If the information architecture chart and the flowchart for transaction processing are complete, a team can proceed to develop detailed descriptions of each page on the information architecture chart. The graphic designer should provide sketches of site layout, color choices, navigation systems, and templates. The database designer should perform data modeling and prepare data tables. The result of these tasks constitutes Deliverable D. Revisions for the information architecture chart and the flowchart are submitted along with Deliverable D.

A recurring observation during the design phase is students' reluctance to prepare sketches and paper prototypes. Instead of a pencil-and-paper version, many students, using Photoshop or one of the graphic tools, are inclined to produce a lab version of the layout and templates as the first draft. This makes revision time-consuming, and often discourages creativity. The instructor should encourage teams to present alternative designs. A team may not agree on a template until several iterations of redesign in sketches. The instructor should formally approve the final version of the template before allowing the team to proceed with programming. Otherwise, different team members may work off competing templates or argue about layout and colors during the production phase.

Technical and Budget Feasibility

At this stage of the project, each team has clear ideas about the scope of work and technical solutions to prepare a feasibility report (Deliverable E). The feasibility report addresses the requirements for software, hardware, and the hosting service. A pro forma budget includes the costs for technical solutions and labor for site development and maintenance. Each team needs to research the costs for the proposed solutions and scope. The report should also include strategies for site promotion and evaluation, and at least five criteria for measuring the site's impact and usage.

Textbooks on systems analysis and design always place the feasibility study early in the development process. I have found that without a thorough understanding of the Web development process and technology requirement, students cannot produce a meaningful feasibility report. Only at this stage of project development, can students grasp the project scope and the necessity for the mix of talents required for implementation. The purpose of a feasibility study is to help students see the financial and technical requirements for implementing the proposed project. Therefore, the completeness of the items identified in the report is far more important than the accuracy of the estimates. The inclusion of site metrics helps students to explore the potential use of such data for site maintenance and improvement.

Development and Testing

Before entering the programming phase, students can negotiate with the instructor to re-scope the project. Once the scope is set, each team engages in building the prototype e-commerce site as specified in Deliverables C and D. Development and testing take place during the last four weeks of the term, so the project lead has to coordinate the team work with vigilance. A cascading style sheet needs to be developed first to allow several programmers to work concurrently with a consistent look and feel for the site. Database programmers have to build and test the ASP functions. The usability consultant has to test the consistency of navigation and site performance across different browsers and bandwidths.

Several problems occur in this phase. In spite of the emphasis on the shopping cart process, students tend to ignore the design guidelines and details in programming. Edit masks and feedback are not consistently provided. Search functions do not follow usability principles. To ensure project success, I had to set very specific criteria for the shopping cart process, the registration process, search functions, cookies, cascading style sheets, and ASP scripts (see Appendix A). To make testing efficient, students only need to test their sites using the Microsoft IE and Netscape browser, but they do have to specify the browser setting, version, and display setting for testing. Version control is a challenge for group work. Under time pressure, team members may work off different versions of site, thus wasting valuable time. Students have reported "it was challenging to write code without version control. Our group wasted precious time trying to figure out what code was correct or incorrect." Advanced development tools, such as Visual Studio, support teamwork through version control. However, most basic tools do not support version control. A project lead would have to set clear communication rules to avoid collusion among multiple developers.

Presentation

The presentation at the end of the class gives each team an opportunity to demonstrate their Website and share their development experience with the rest of the class (Deliverable F). Each team member is required to participate. The presentation highlights the information in Deliverables B through E. The focus is on the project Website itself.

The final class is often filled with excitement. Students enjoy the intense experience and the interactive process of Web development. Many students are surprised at how much teamwork can lead to very professional Websites. For the presentation, project teams should be encouraged to use their team Websites (for deliverables) and the project Websites as the basis to present a story of their business case. These two Websites provide rich information for an interactive presentation. They should be discouraged from producing separate Power Point presentations.

Documentation

Each team presents the project documentation in two forms—the online version and the print version (Deliverable G). Students can make necessary revisions on any deliverables.

Documentation is an important element of team projects. Students should develop good habits early. An online version of the project deliverables expires after the class is over. The print version provides students with a good material for their job search. In both versions of the project documentation, each team includes the first draft and revised copies of information architecture charts, the flowchart, and the site templates to document the iterations that took place.

Assessment

The assessment of e-commerce Web development projects needs to consider several factors. First, the assessment should encourage iterative designs. Instead of grading each deliverable throughout the term, I only provide feedback to teams during the process, and grade the project as a whole at the end of the term. This grading method motivates students to explore different options and collaborate. Second, the assessment should balance the quality of the products (deliverables and the final project) and the quality of the process. Active participation in the process of e-commerce Web development leads to effective Websites. As shown in Table 1, a clear definition of the process leading to each deliverable is important. Third, the assessment should reward individual and team contribution separately. Assigning one grade to everyone in the team is unfair to those who have made extra commitment; it also breeds the passive participation of individuals who fail to carry their share of responsibilities.

I have developed two instruments for assessment. Appendix A includes a comprehensive checklist to guide the grading of team projects at the end of the term. This checklist includes 65 items that correspond with the process and product aspects of each deliverable. It is particularly useful for guiding the prototype development because many design guidelines are built into the evaluation criteria. Appendix B includes a peer evaluation form that every team member fills out at the end of the term. The evaluation form asks students to rate their own performance and contribution. They also evaluate their peers by distributing 100 points among teammates. In addition, each project deliverable specifies contributions made by each team member. Therefore, project grades are assigned based on these three sources of data.

Over the years, I have adjusted the weight assigned to individuals and to the team (see Table 2). Now individual contribution accounts for 30%, instead of 15%, of a student's project grade. Using data of project grades of 24 project teams (122 students) over four terms, there is a noticeable change in how peer evaluation is reflective of individual students' effort. When individual contribution accounted for 15% of the project grade, only 9.4% of students (among 64 students or 13 project teams) received less than full grades for team contribution. When the weight of individual contribution was raised to 30%, 34.5% of students (among 58 students or 11 project teams) failed to attain the full score for individual contribution.

TABLE 2
EVALUATION CRITERIA FOR TEAM AND INDIVIDUAL PERFORMANCE

Team Performance (70%)	Individual Performance (30%)
Team effectiveness	Timely attendance at meetings
Clarity of project scope and objectives	Timely completion of assigned tasks
Completeness of analysis	Useful contribution to projects
Consistency and creativity in design	Supporting other team members
Sound technical and budget solutions	A fair share of responsibilities
Working prototype system	Extra share of responsibilities
Effective presentation	Peers' allocation of 100 points
Completeness and quality of documentation	Documented contribution

Student Feedback

According to student response to the peer evaluation form (in Appendix B), team projects in this course have provided students unique insights about e-commerce Website development. They learned a great deal about "working with people of varying degrees of skill and experience," "virtual collaboration methods due to differing schedules and availability," and "the challenge associated with developing a user-centered Website." One student stated "the project provided me with insight into the entire Website design process, something that was new for me. It was interesting and informational to invoke the waterfall method in this capacity and watch the site developed accordingly." Many students acknowledged, "the development of an e-commerce Website is very extensive and requires the cooperation from many different fields." Furthermore, "proper planning and design are important before starting a task. It is better to spend more time on planning than making changes later." Among factors contributing to a project's success, most often cited are teamwork, communication, a broad mix of skills, and effective project management. Teamwork involves "a good share of responsibilities," "a willingness to help each other," "ability to work both as individuals and groups," and "everyone finished his/her responsibilities on time and was able to attend every team meeting." Effective communication involves "constant communication via email, phone, and meetings," and an "open-mindedness shared amongst the team which allowed each member to learn something new." Students also indicated that their ability to "put to the best uses of the broad mix of talents and skills on various parts of the project " was critical. Students emphasized the importance of project planning and having "extensive to-do lists" to ensure "continued communication with the team on issues and deadlines." The aggressive project schedule dictates "everyone is up to date with his/her responsibilities," and effective project leadership can "make or break" a team. As to team leadership, ability to "assign people based on their talents or skills can get the job done quickly and have better results."

PRACTICAL STRATEGIES

Working with Real Clients

Working with real clients is well worth the time and effort involved. Students gain valuable experience in learning how to work within constraints to meet the business needs of the client. Websites designed for real clients often reflect a well-defined scope and overall design. However, real clients may expect different outcomes from what the instructor expects. If their expectation is too high, students may not be able to complete the project within the allotted course time. More often, real clients are uncertain about going online and hence only want a brochure ware site. In the first case, student teams should build a prototype project to satisfy the course requirement and complete additional enhancement after the course is over. In the second case, the instructor's expectation defines the complexity of the project. Students need to present the proposed site as a prototype to illustrate how an interactive online retailing site may help the client to achieve its long-term goals. Working with non-profit organizations presents different challenges from working with commercial or corporate clients. Students learn to focus on novice users as well as organizations with less technological savvy. Design and usability decisions have to sustain waves of progression as the organization and its staff goes through their learning curves. Nevertheless, students should always seek opportunities to work with real clients for Website development.

Web for Project Management

A team project Website is an effective tool for project management and team communication. Having a central place to publish all the project deliverables makes it easier for team members to achieve a common performance goal. The interactive nature of hypertext documents allows a site to link all deliverables and supporting documents easily to show the progress of iterative designs. Writing project deliverables in hypertext documents is a good exercise for students to practice active and succinct presentation. Students gain experience in learning how to link texts with graphics, charts, references, and the project site to form a convincing story of their e-commerce project. Because the brevity and the multi-media potential for a team Website, students can explore creative ways to use the site for project management. For teams that have to collaborate across distance, the team Website facilitates virtual project management.

A Gallery of Projects

The instructor can set up a gallery Website to exhibit exemplary team projects. The gallery page should include the name of all the team members, their project deliverables, and the project site. Students not only enjoy the public recognition of their work, but can also direct potential employers to the URL's as part of their online portfolio. The gallery site also serves as a valuable instructional resource. However, when real clients launch their official sites, the prototype site developed for the course should be removed to avoid confusion. Otherwise, the search engines' robots may index both sites and lead real customers to the wrong sites.

Managing Team Progress with Assessment Tools

A clear definition of the structure and process for team projects increases the chance of the projects' success. An assessment tool, like the checklist shown in Appendix A, makes students attentive to the process of e-commerce Web development. Assessment criteria for the production and programming phase are especially useful. Instead of expecting students to incorporate appropriate design guidelines during programming, detailed assessment criteria remind students to implement easy-to-use interfaces and functions. Instructors should discuss the assessment tool at the beginning of the project to set proper expectations. Therefore, the assessment tool is an effective means for managing student teams.

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APPENDIX A
A CHECKLIST FOR EVALUATION OF TEAM PROJECTS

1. Team Effectiveness (10 points)

- ☐ 1.1 The project team has a clear definition of roles and responsibilities for each team member.
- ☐ 1.2 Team members have complementary skill sets and experiences.
- ☐ 1.3 The Project Lead exercises effective leadership in conflict resolution and project management.
- ☐ 1.4 There is an even distribution of responsibilities among team members throughout the project.
- ☐ 1.5 The team has regular and open communication and records resolutions for each meeting.
- ☐ 1.6 The team posts project deliverables in a timely manner on the team's Website.

2. Clarity of Project Scope and Objectives (10 points)

- ☐ 2.1 The project has appropriate business models and measurable goals.
- ☐ 2.2 The project demonstrates clear value propositions for the organization.
- ☐ 2.3 The project demonstrates clear value propositions for the users and customers.
- ☐ 2.4 The project provides a clear profile of intended users.
- ☐ 2.5 The project provides an analysis of market competition.
- ☐ 2.6 The project has a reasonable scope for implementation.
- ☐ 2.7 The project demonstrates clear justification for an Internet solution.
- ☐ 2.8 The project provides a profile of the client organization.

3. Completeness of Analysis (15 points)

- ☐ 3.1 The information architecture supports the business goals and value propositions.
- ☐ 3.2 The site's structure supports the goals and tasks for both novice and experienced users.
- ☐ 3.3 Each page on the site is clearly defined and represented in the information architecture chart.

- ☐ 3.4 Details of the site's transaction process and interactive processes, such as shopping cart and registration, are clearly mapped out in flowcharts and/or Data Flow Diagram.
- ☐ 3.5 The project provides appropriate sensorial design requirements.
- ☐ 3.6 The project identifies technical and organization constraints for implementation.
- ☐ 3.7 The information architecture chart reflects user task analysis.
- ☐ 3.8 The information architecture chart incorporates results from card sort with users.

4. Consistency and Creativity in Design (20 points)

- ☐ 4.1 The project provides an ERD model and data definition for the site.
- ☐ 4.2 A sketch of site template and page layout is developed first before implementation
- ☐ 4.3 The team explores alternative design templates and design concepts.
- ☐ 4.4 The site uses consistent templates, interfaces, and navigation placement.
- ☐ 4.5 The site's navigation follows usability guidelines.
- ☐ 4.6 Users can access the site's main pages and functions within three clicks.
- ☐ 4.7 The site uses special interfaces to personalize feedback, services, or content presentation.
- ☐ 4.8 The site uses effective graphics (low download time) and colors (browser safe colors).
- ☐ 4.9 The site uses creative design to enhance branding and usability.
- ☐ 4.10 The project team performs a paper prototype before implementation.

5. Sound Technical and Budget Solutions (10 points)

- ☐ 5.1 The technical solutions for this site provide appropriate recommendations for hardware, software, and hosting services.
- ☐ 5.2 The budget solutions provide detailed costs and resources for implementation and maintenance.
- ☐ 5.3 There are clear criteria for measuring the project's success.
- ☐ 5.4 The project team identifies appropriate site usage metrics.

6. Prototype Site (20 points)

- ☐ 6.1 Users can view the shopping cart at any time during the shopping process
- ☐ 6.2 Users can remove and update projects in the shopping cart.
- ☐ 6.3 The shopping cart is emptied once checkout is done.
- ☐ 6.4 All the product information is populated from database.
- ☐ 6.5 Users can continue shopping before checkout without losing the content of the shopping cart.
- ☐ 6.6 User registration supports novice and experienced users.
- ☐ 6.7 Novice users can register at the checkout point during the first time shopping at this site.
- ☐ 6.8 Order confirmation provides personalized online feedback.
- ☐ 6.9 Order confirmation provides e-mail notification.
- ☐ 6.10 Search facilities match the content and the format of data returned.
- ☐ 6.11 Advanced search facilities provide instructions and examples.
- ☐ 6.12 Negative search results pages include information on why a query failed
- ☐ 6.13 All the data entry functions provide edit mask and feedback.
- ☐ 6.14 All the hyperlinks work properly.
- ☐ 6.15 All the ASP scripts function properly.
- ☐ 6.16 All the sound/video features and plug-ins work properly.
- ☐ 6.17 There are no typos in content.
- ☐ 6.18 The prototype project uses cascading style sheets for consistent presentation.
- ☐ 6.19 All the CSS rules work correctly and consistently in the IE and Netscape browser.
- ☐ 6.20 The prototype site uses cookies to track repeat users.
- ☐ 6.21 The prototype site includes a privacy policy about the user of cookies and personal information.

7.0 Presentation and Demo (10 points)

- ☐ 7.1 The prototype site works successfully with all data input and feedback.
- ☐ 7.2 Every tem member participates in the presentation.

- ☐ 7.3 The presentation provides a clear business case and site design/development process.
- ☐ 7.4 The presentation materials are well organized.

8.0 Completeness and Quality of Project Documentation (5 points)

- ☐ 8.1 The project deliverable site is well managed, complete, and easy to navigate.
- ☐ 8.2 The final project folder includes the final version of all the deliverables.
- ☐ 8.3 The final project folder also includes the original copy of informationarchitecture chart and screen layout (sketches).
- ☐ 8.4 The final deliverables lists the tools and technology uses for development and testing.

APPENDIX B
PROJECT TEAM PEER EVALUATION

List each member's first name. Fill in the number that best describes each team member's contribution.
1 = rarely met expectation; 2 = met expectation; 3 = exceeded expectation

	Self				
1. Attended project meetings on time.					
2. Completed assigned tasks on time.					
3. Made useful contribution to the project.					
4. Supported other team members.					
5. Took a fair share of responsibilities.					
6. Took an extra share of responsibilities.					

1. List your contribution to the team projects in terms of specific tasks and deliverables.

2. How would you distribute 100 points among members of your team (excluding yourself) on the basis of each person's contribution to the project?

3. What factors have contributed to your team's success?

4. What lessons have you learned from this project experience?

THE OTHER SEMI-VIRTUAL TEAM: USING COLLABORATIVE TECHNOLOGIES TO FACILITATE STUDENT TEAM PROJECTS

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Colleges of business are particularly known for assigning large-scale team projects as a means of enhancing learning. Though students may assemble in one location for "traditional" classroom-based learning, time and distance may create challenges as students attempt to fulfill requirements associated with large-scale team projects. This study explores the use of collaborative group tools found in common course management systems (e.g., Blackboard© and WebCT©) and community sites (e.g., MSN Communities©) as a means to address logistic and project material organization problems associated with large scale team projects in colleges of business. We investigate relationships among social and technical factors to enhance the learning outcomes that can result from student project teams deploying collaborative group tools. Specifically, this study uses qualitative inquiry of team stakeholders to compare perceptions of use of collaborative group tools from both a user and non-user perspective and develop a causal model identifying potential net benefits from the use of collaborative tools and antecedents to benefits to facilitate current understanding as well as future research. Additionally, this study provides prescriptions for use of collaborative group tools to facilitate successful application of collaborative group tools to student group projects.

INTRODUCTION

If only it was as easy as a simple math problem:

  Addend 1-Team projects in business courses
\+ Addend 2-Team time, logistic, and project organization challenges
\+ Addend 3-Team access to virtual group collaborative technologies
= Net Gains (Well, maybe!)

Globalization, the distribution of team members, technology support, and a quest for efficiency, has propelled the existence of both successful and unsuccessful virtual and semi-virtual team structures in professional organizations and a resulting viable research stream. In a similar fashion, technological advances (and access), the distribution of members, and a quest for efficiency, are propelling a new context for semi-virtual or virtual teams in an academic setting, namely the business student group project.

Colleges of business are particularly known for assigning large-scale projects (extending the duration of a semester or multiple semesters) as a means of enhancing learning. Students may congregate in one place to attend class sessions; however, logistical and schedule barriers may impede project team assembly outside of the classroom meeting time. The barriers may be exacerbated in situations where a team project is assigned in a distance-learning context or where a project connects distributed team members from different universities or geographic locales. As such, the use of collaborative technologies to support student group projects provides a situation of virtual or semi-virtual teams existence as well as a means to further explore technology-mediated learning (particularly in the development of computer mediated communication skills in the context of teamwork).

Common course management tools like Blackboard© (http://www.blackboard.com/) and WebCT© (http://www.webct.com/) allow instructors/course managers to create group sections on the course web site to facilitate project work. The features of such group sections typically include threaded asynchronous communication (e.g., group discussion board), synchronous communication (e.g., group virtual classroom), file storage, and group e-mail capabilities. Additionally, publicly available sites, such as MSN Communities© (http://communities.msn.com/) can provide students with web site space providing community message board, calendar, link, photo albums, lists (e.g., to do list), and custom web pages in addition to all of the features associated with the course management tools.

When faced with a team project in a distance education course or in a classroom based course, instructors may make these collaborative technologies (hereafter, project team tools will be referred to as collaborative technologies) known and available to students or students may independently seek such collaborative technologies. Collaborative technologies may be used as an alternative to some or all face-to-face meetings, to facilitate communication among team members, and/or as a means to organize course project materials.

RESEARCH OBJECTIVES

These collaborative technologies hold the promise of facilitating what seems to be an immediate need for project teams in colleges of business - communication convenience, member access, and project organization. As well, exposure to collaborative technologies may prepare students for virtual team arrangements they may face in the future in the work place. However, it seems little is known regarding situational propriety and the antecedent factors to fulfilling technological promises (Izard & Reeve, 1986; Patel & Russell, 1999). In a recent article addressing the status of technology mediated learning research in IS, Alavi and Leidner highlight a void in research studies that "focus on forming relationships among technology and relevant instructional, psychological, and environmental factors that will enhance learning outcomes" (Alavi & Leidner, 2001). In response to this void, we seek to investigate relationships among social and technical factors to enhance the learning outcomes that can result from student project teams deploying collaborative technologies in colleges of business.

Specifically, this research seeks to satisfy three objectives to enhance understanding of this phenomenon and facilitate successful application of team collaborative technologies to student group projects.

- Compare perceptions of use from both a user and non-user perspective.

- Develop a causal model identifying potential net benefits and their antecedents to facilitate current understanding as well as future research.

- Provide prescriptions for use based upon qualitative inquiry of team stakeholders.

Our basic research question can be stated as, "What social and technical factors are necessary to make web-based collaborative technologies a viable resource to students in project teams?"

To attend to these objectives, we provide the theoretical and logical foundation serving as an underpinning to field inquiry, present the interpretive fieldwork performed in this study and the emerging model, and provide insight to guide research and practice.

THEORETICAL FRAMEWORK

Contextual Domain

Researchers engaged in the study of IS success urge the academic community to pay careful attention to domain context in defining and measuring each component of success included in studies (DeLone & McLean, 2002; Seddon, 1997). Research also indicates that users prefer to tailor constructs and measures to the type of system under evaluation to facilitate understanding and application (Jiang & Klein, 1999). Though research in virtual teams in a professional context may provide some insight, it is our position that the deployment of collaborative technologies in education is a context with innate idiosyncrasies that merits distinct research to develop a comprehensive model that identifies situational relevant variables and relationships. Professional projects staffed by distributed teams exist in a multitude of forms; conversely, there is general consistency in form that distinguishes the academic project deploying the collaborative technologies. Traditional idiosyncrasies in the student team project context follow.

- Academic project teams are short lived (typically not exceeding a semester) and have inflexible deadlines.
- Team members do not have predefined roles in entering the project.
- Team members may not have history with or even knowledge of other members.
- Team assignment is an informal and perhaps even arbitrary process.
- Outside of perhaps class time, team members do not have a predefined work location and hours for team activities.

Furthermore, it is difficult to equate the motivators (e.g., the motivation of grade pressure) of student team members to the motivators (e.g., the sustenance and embitterment of a livelihood) of professional team members.

In response to these unique characteristics, we seek to explore the phenomena of interest from a ground-up, context specific perspective using an interpretive paradigm recognizing the socio-technological nature of the phenomenon.

Socio-technical System

The deployment of collaborative technologies to support a distributed (or semi-distributed) work arrangement is undeniably a socio-technical system as the system is a composition of technology, human interaction, and the environment. As such, we must look beyond the technology in attending to the purpose of this study.

Computer mediated communication technologies (CMC) have been employed facilitating distance communication in synchronous, asynchronous, and multi-media forms. CMC technologies—electronic mail, computer conferencing, distribution lists, and chat rooms—have all been employed to enable and support distributed work arrangements. However, ambiguity regarding whether these technologies create richer and more meaningful communication exist (Kraut, Rice et al., 1998). Kraut refers to this ambiguity as the computer-mediated communication paradox. The basic assumption of CMC theories is that CMC does not transmit the same level of vibrancy and interaction that exists in face-to-face interaction (Lisetti & Bianchi, 2002). Therefore, users of CMC systems are thought to adapt to their CMC technology and therefore to exhibit fewer of their natural communication behaviors.

These findings render it increasingly important for researchers interested in virtual collaborations and collaborative technologies to take a *socio-technological approach* to their studies. This provides guidance to process as well as product as a product's success could be enhanced by developing technology that adapts (or co-adapts) to social processes (such as a medical visit) at the center of human lives (Lisetti & Bianchi, 2002).

User Based View

To address the socio-technical perspective adequately, we adopt a user-based view. It is important to understand what users perceive to be important, because it is these issues that underpin their perceptions of information system success (Whyte, Bytheway et al., 1997). According to the user-based approach, end users are the ultimate judge and jury regarding the technology. As stated by Whyte, the difficulty with the user-based approach is to find the set of variables that strongly and positively correlate with the perceived performance of successful information systems. To deal with this difficulty, we query users and non-users as respondents to identify the issues, variables, and relationships associated with the deployment of collaborative technologies in this academic context.

Voluntary Use

We restrict the scope of this study to the use of team collaborative technologies as a supplement to a "traditional," classroom based business course to support project teams (hence, the possibility of semi-virtual teams). We specifically sought contexts of voluntary use during the course of this study where students plausibly have the option to meet face-to-face during the course term to work on project activities. We select this context in order to explore both use and non-use given otherwise equal parameters (e.g., potential users enrolled in the same course). We feel voluntary deployment would provide the greatest insight into the research objectives as indicated by prior IS research on technology acceptance (Venkatesh & Davis, 2000).

METHODOLOGY

Procedures

We used open-ended survey instruments as a means of qualitative inquiry to explore student perceptions and experiences with using collaborative technologies to support group projects. Open-ended survey instruments versus structured interviews were used to allow respondents to reflect on their response, provide information at a convenient time, and to access the collaborative tool with project team content for reference purposes. Two forms of survey instruments were used—one for students that opted to use collaborative technologies and one for students that did not.

Items on the two instruments were the same or closely parallel where possible to facilitate comparison between the use group and the non-use group. Survey instrument items were derived through analysis of transcripts related to five semi-structured interviews with instructors requiring a major course project that enable group features in their course web system (e.g., Blackboard© or WebCT©) or present the use of publicly available tools like MSN Communities© and the experiences of one of the authors in using these tools in classroom settings. The interviews began with a digest of the research intent. There were two basic questions guiding the interview process.

- What questions would you recommend asking students to learn more about the application of these tools to their course projects?

- What do you believe are some of the high-level issues in using these tools? How would you recommend inquiry into these issues?

These questions sparked further interview probes and discourse. Four instructors (two of whom had participated in the interview process) served as a pre-test panel to review open-ended questions developed. Open-ended questions were piloted using five students. Pilot and pre-testing resulted in minor revision to items and instructions. Open-ended questions included in the instruments are provided in Appendix A.

Context

Given our objective of explorative inquiry, we sought a context which would provide a breath of use situations (courses, instructors, and collaborative technologies) to enhance the potential for comprehensive study. We chose to conduct this study within a College of Business at a large metropolitan university in the southeastern United States. This site was conducive to the study as the university academic computing system supported:

- multiple forms of course environments (Blackboard© and WebCT®), through technology, training, and "customer support," for at least three years prior to the study (utilization of these tools was at the discretion of the professors),

- instructors in various departments who had chosen to use various tools,

- free dial-in Internet access for students, and

- many on-campus computer labs for students.

We spoke with instructors from various departments to identify those courses that included a large-scale (semester duration) group project and those instructors who apprised students of and afforded students the opportunity to use collaborative technologies in some form. We specifically sought situations where the instructor had taught the identified course before and had repeatedly used the same form of group project. We primarily addressed undergraduate courses as an attempt to focus our study to users/non-users not already using parallel tools in a work setting. However, we did collect information from a team of graduate IS students working on a project for comparative purposes.

Research Process

We contacted instructors teaching relevant courses before the start of a semester requesting participation. Instructors teaching screened courses and willing to participate were identified in the Information Systems, Finance, and Marketing Departments. Students in four upper-division undergraduate courses participated in the study along with one graduate project team. Each of the instructors confirmed they apprised students of collaborative technologies available throughout the course as an elective means to facilitate group projects.

At the close of the semester, instructors discerned which student teams used collaborative technologies and which did not and proceeded with data collection. Information regarding the study was not provided to the students prior to this point in time. After announcing the topic of study, students were asked to complete the appropriate survey instrument. The instructor distributed respective surveys and related instructional materials to students. Students were directed by their instructors and survey instructions to return the surveys to the researchers via campus mail in the provided self-addressed envelope. Assurance of anonymity was conveyed both through verbal instructions from participating instructors and through the survey instructions. The response rate was 92% (113 of 123 surveys distributed were returned). Table 1 provides the distribution among disciplines and user versus non-user. Table 2 provides a brief participant history broken down by user/ non-user.

Responses to open-ended questions were analyzed to discern antecedent and consequence factors of effective use by one researcher using an inductive method for developing a coding scheme described by Boyatzis (1998). A second researcher analyzed the responses using the developed coding scheme noting suggestions for refinement/ improvement to the schema. Two additional researchers apprised of the study reviewed the coding schema and coding details. An iterative process of review between the researchers continued until thematic convergence and an agreement on labels and definitions was reached. The model presented in Figure 1 resulted from this iterative process among researchers.

The final model is represented in Figure 1. Each of the constructs is supported by a preponderance of evidence resulting from this analysis process of respondent comments. Once the model was finalized, responses were then reanalyzed by two researchers to determine if statements supporting the construct were from users, non-users, or both (see Table 3).

TABLE 1
PARTICIPANTS BY DISCIPLINE AND USE/ NON-USE

Discipline	Collaborative Tool Users	% Collaborative Tool Users	Collaborative Tool Non-Users	% Collaborative Tool Non-Users	Total
Information Systems	14	56	11	44	25
Finance	0	0	16	100	16
Marketing	18	24	56	76	74
Total	**32**	**27**	**83**	**73**	**113**

TABLE 2
PARTICIPANT HISTORY—USER/NON-USER

	Users		Non-Users		Total	
History Item	**Yes (%)**	**No (%)**	**Yes (%)**	**No (%)**	**Yes (%)**	**No (%)**
Did you participate in group projects in college of business courses prior to this course?	13 (41)	19 (59)	43 (53)	38 (47)	56 (50)	57 (50)
Have you used course web sites in the past?	26 (81)	6 (19)	56 (69)	25 (31)	82 (72)	31 (27)
Have you used group features of course web sites or web communities in the past?	4* (36)	7* (64)	17* (37)	31* (65)	21* (36)	38* (64)

*This question was added to the survey after 54 surveys had already been collected.

FIGURE 1
COLLABORATIVE TECHNOLOGIES TO SUPPORT STUDENT TEAM PROJECT MODEL

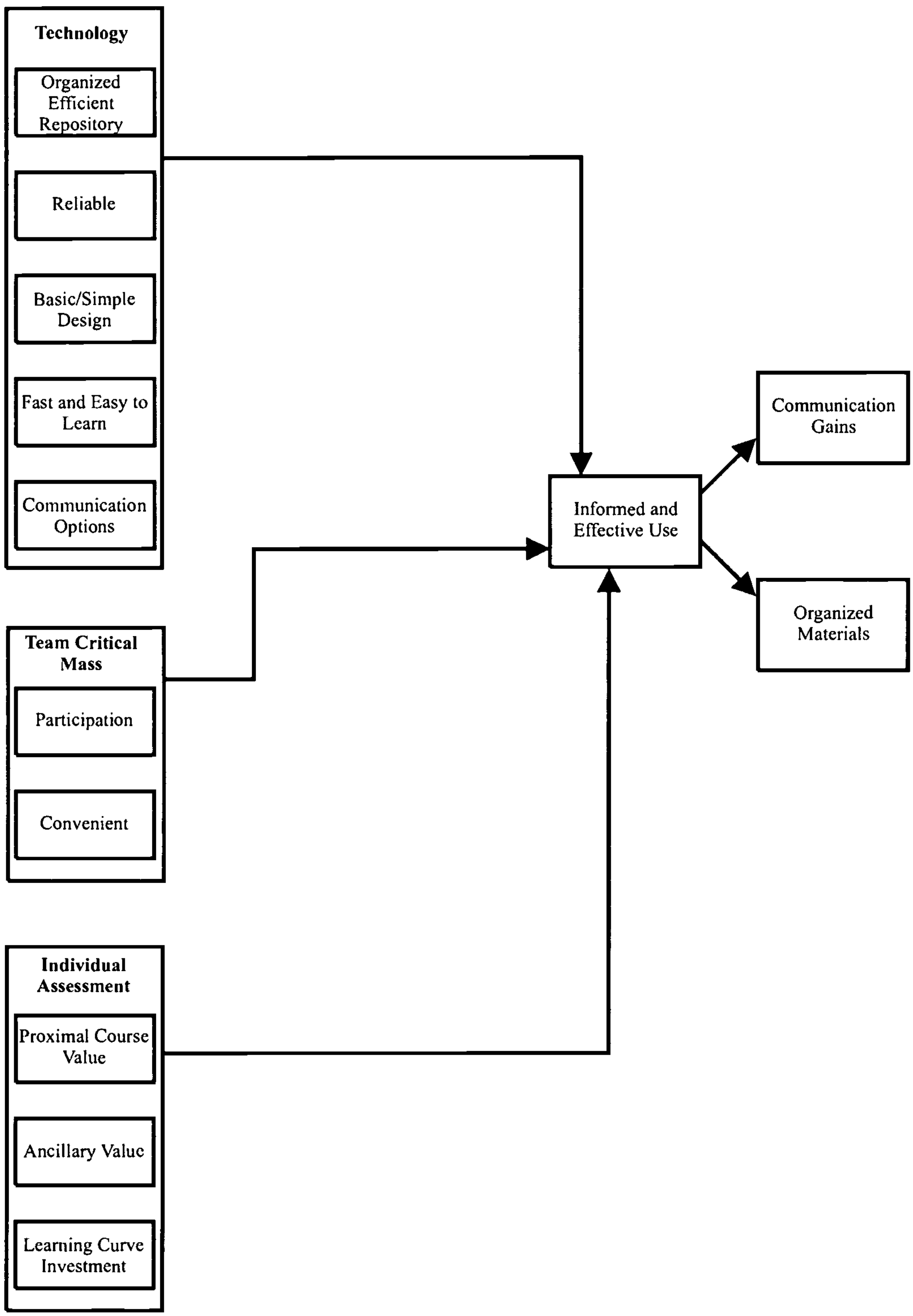

TABLE 3
DISTRIBUTION OF CONSTRUCTS INDICATED BY USERS AND NON-USERS

Model Constructs	Users	Non-Users
Technology		
Organized efficient repository	x	x
Reliable	x	x
Basic/Simple Design	x	
Fast and Easy to Learn	x	x
Communication Options	x	x
Team (Critical Mass)		
Participation		x
Convenience		x
Individual Assessment		
Learning Curve Investment	x	x
Proximal Course Value	x	x
Ancillary Value	x	x
Informed and Effective Use	x	
Communication Gains	x	
Organized Materials	x	

DISCUSSION

Based upon quantitative data analysis, informed and efficient use depends upon three dimensions of issues: the technology itself, individual assessment, and team critical mass. This section defines each of the model constructs associated with these dimensions, provides a trail of evidence via quotes and paraphrases from respondents, and addresses differences between users and non-users.

Antecedents to Informed and Effective Use—Technology Related Constructs

Organized, efficient repository. Both users and non-users asserted that the collaborative technologies should provide effective file management features. Respondents noted collaborative technologies should provide a/an "place to organize one's work," efficient (storage) system," and "place to organize and store materials."

Reliable. Reliability encompasses failures of the system as well as problems encountered in accessing the system through log in. Both users and non-users expressed the need for dependable technology. There seems to be reliability issues with some existing systems in use as users noted that the "*site was not always working*" and referred to "*mechanical failures of the site.*"

Basic/simple design. Interestingly, only users expressed the need for a basic and simple design. Perhaps non-users did not spend enough time in exploration to make an evaluation or design issues were best discovered through the course of use over the semester. Design complexity issues were particularly noted in user responses to collaborative technologies disadvantages through comments such as, it was "confusing about where to post messages," and the site was "difficult to understand." It seems that designers of collaborative technologies specifically designed for educational use should be judicious in adding features as students noted there were "too many tools to use."

Fast and easy to learn. To facilitate informed and effective use, the technology must accommodate an efficient learning process. Both users and non-users indicated that the collaborative technologies introduced initial learning challenges through such remarks as, the technology is "too hard" and "takes too long to learn to use." Comments indicate that initial challenges during the learning process dissuaded further use for the project.

Communication options. Communication options refers to the availability of various features provided by the technology to aid communication and discussion among group members as well as supporting technology infrastructure to provide access from any location at any time. As stated by one respondent, the technology provided "easy communication among group members at all times." Regarding communication feature set, users indicated the desirability of discussion board, meeting scheduler/calendar, and e-mail. Conversely, virtual classroom, chat rooms, and ironically e-mail were stated as being the least useful features in the sites.

Antecedents to Informed and Effective Use—Individual Assessment Constructs

The deployment of these technologies involves an individual assessment as well as the collective assessment of group use. We will first address the individual assessment constructs.

Learning curve investment. Users reported an average time required to feel comfortable in using the collaborative technologies of 36 minutes. On the surface, this would not seem to be a substantial learning curve for a new software tool. However, one user noted a "long learning curve" was an issue. It seems most non-users may have assumed a substantial learning commitment was required without actually investing the time as represented by a failure to report an exploratory time investment and comments such as it is "too time consuming to learn a new technology" and there is "not enough free time" to learn a new technology. Communication from instructors informing students of learning curve estimates may allow students to perform a more accurate individual assessment of time requirements.

Proximal course value. From a negative perspective regarding the project itself, some students noted the use of the collaborative technologies to be "information overload" or "unnecessary." As would be expected in a decision process of voluntary use, students assess whether the technology will add additional value to project outcome. Additionally, students noted collaborative technologies can actually enhance pedagogy as represented by the comment that the collaborative technologies "facilitated class learning."

Ancillary value. Ancillary value in terms of personal enjoyment was expressed in reference to "love of computers." Additionally, a positive assessment regarding the use of the tools may encompass an expectation of use beyond the course. Both users and non-users indicated that collaborative technologies should be of beneficial use for future courses and even future work. Though there may be justified reasons some colleges allow choice in the course site technologies (e.g., Blackboard© versus WebCT©), comments regarding ancillary value for future courses imply the use of collaborative technologies within a specified institution would benefit from homogeneity. Respondents indicated the potential of ancillary value regarding a work setting through the comments related to "beneficial for all types of work," "useful to know for business and industry," "helpful in all facets of future jobs," which seemed to facilitate a positive assessment and use.

The innate nature of some disciplines, such as information systems, may indirectly convey the utilization of technology through the educational process will benefit future work settings. Individual instructors may inform the individual assessment process by communicating potential future value related to future courses and work settings.

Antecedents to Informed and Effective Use—Team (Critical Mass) Constructs

The collective assessment of the group does not seem to require an absolute positive individual assessment by all group members. However, it seems critical mass is necessary if collaborative technologies are to be used effectively.

Participation. Students identified challenges faced in using the collaborative technologies when a critical mass of group members do not employ the technology or reluctantly use the technology. As stated by one respondent, I "cannot use site because not all group members use (the site)," Statements by users indicate a lack of collective participation can definitely cause a group to abandon use of the collaborative technologies.

Convenience. Collectively, the group needs to determine the collaborative technologies provide a convenience that will address situational barriers. In a semi-virtual team situation, face-to-face and telephone meetings may be alternative means of communication. Group communication dynamics (and skills), geographic dispersion and schedule issues will influence perceived communication conveniences among choices. Situational factors indicate collaborative technologies do not provide a convenience when members find "other methods of communication easier" and "prefer meeting in person."

Consequents to Informed and Effective Use

Organized materials. Users stated collaborative technologies provide a means to organize materials used, safeguard files, and increase the overall organization of the project. In describing the value of collaborative technologies, one student stated it "provided information pertaining to the project at all times."

Communication gains. Communication gains can be thought of as enhancements to the communication process that would not be realized barring the use of the collaborative technologies. In communicating the communication values of collaborative tool use, users noted the technology both facilitated "ease of communication" and afforded "multiple forms of communication."

General Reactions

Though the aforementioned discussion provides indications that non-users reported barriers to using the web site, the majority (68%) indicated they would use the collaborative technologies in the future. As such, there does seem to be some recognized value though a technology may not be utilized for a particular course project or by a particular group.

Users also indicated they experienced some issues during the deployment process. However, a holistic review of user comments indicates they found the use of collaborative technologies to be positive. Furthermore, users indicated (97%) that they would use the collaborative technologies to facilitate future projects.

CONCLUSION

Technology is increasingly sought as a means to address distance, scheduling, and student volume in higher education as well as a means to complement classroom learning. If we are to understand and realize the potential of such technologies in education from a learning and access perspective, we must understand the perceptions of both users and non-users as well as recognize the nuances of the educational context in deploying tools that may also find use in professional contexts. From a research perspective, this study acknowledges these issues in explaining and modeling a particular existing phenomenon which has received little attention in literature, but seems to be growing in use, namely the availability of collaborative technologies to support group projects in college of business courses. Further work may explore the peculiarities of group dynamics especially in the initial stages of group formation that may affect the successful use of these tools, which was not particularly addressed by this study.

The results of this study provide prescriptive insight for various stakeholders in practice. For the designers of web-based technologies for classroom use, Bauhaus philosophies seem to hold, namely less is more in the eyes of the user. The short-lived nature of the project and the team may not provide the conditions where extensive functionality can be fully exploited and may even deter utilization. For college computing support infrastructures, the perceived ancillary advantages of using the same collaborative technologies/on-line course system in all courses deploying systems merit consideration. Likewise, there appears to be an apparent need for the reliability of collaborative technologies and implicitly course web sites that may be accessed by students 24/7. Additionally, computing support and/or instructors may want to consider providing some basic "training" on using collaborative technologies that includes coverage of virtual communication skills.

Finally, instructors should recognize that like many professionals, students may also face distance and scheduling issues which complicate the execution of group project tasks. The availability and information regarding the use of collaborative technologies may provide a viable option to mitigate issues for some project teams and could enhance the learning process intended by the project assignment.

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APPENDIX A
OPEN-ENDED SURVEY QUESTIONS

User Questions

Questions were customized to the course project and the collaborative technologies made available to facilitate question clarity.

1. What did you like (advantages) about using the *name of collaborative technologies* for the *name of project assignment*?

2. What did you dislike (disadvantages) about using the *name of collaborative technologies* for the *name of project assignment and course*?

3. Approximately how long did it take before you became comfortable in using *name of collaborative technologies*?

4. What facilitated your learning process and comfort level in using *name of collaborative technologies*?

5. What difficulties did you encounter in using *name of collaborative technologies*?

6. What hampered your learning process and comfort level in using *name of collaborative technologies*?

7. Explain any effects on team dynamics you noted by using name *of collaborative technologies* (positive and/or negative).

8. What features did you find most useful?

9. What features did you find least useful?

10. What changes in use would you recommend to the design or method of using *name of collaborative technologies*?

11. How do you feel using a *name of collaborative technologies* to facilitate a business course project differed from your academic project experiences that did not use a community site?

12. What information did you add/contribute *to name of collaborative technologies*?

13. Would you use a community site in the future? If so, in what context?

Non- User Questions

1. What did you like (advantages) about the idea of using the name of collaborative technologies made available associated with the *name of collaborative technologies made available* for the *name of project assignment and course*?

2. What did you not like (disadvantages) about the idea of using the name of collaborative technologies made available associated with the *name of collaborative technologies made available* for the *name of project assignment and course*?

3. Did you try to use *name of collaborative technologies* for the *project assignment and course?* If so, approximately how much time (hours and minutes) did you spend in exploring the *name of collaborative technologies*?

4. What discouraged you from using *name of collaborative technologies* for the *name of project assignment and course*?

5. Did you find the group feature set in *name of collaborative technologies* was lacking? If so, what additional features would you have liked (for example, file directory/subdirectory structure, assignment list capabilities, group calendar, etc.)?

6. How did your team members react to using the *name of collaborative tool* (positive and/or negative)?

7. Do you think the *name of collaborative technologies* have any value for student group projects? Please explain your response.

8. Would changes would your require to use *name of collaborative technologies* in the future (e.g., demonstration, instruction sheet)?

9. Would you use *name of collaborative technologies* in the future? If so, in what context?

EXPLORING DISTANCE LEARNING ENVIRONMENTS: A PROPOSAL FOR MODEL CATEGORIZATION

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SUMMARY

This article proposes a categorization model for online distance education environments, based on two different aspects: interaction and content. The proposed categorization, which was based on the experience acquired in developing, implementing, and operating different remote training courses, is aimed at providing evidence to help educational professionals in choosing online environments that are more appropriate to their educational goals and strategies.

INTRODUCTION

Web-based online education environments are now becoming very important educational tools [Schrum, 2000 and Farrel, 1999]. These online environments can be educational software packages available on the market, such as Lotus Learning Space [IBM Corporation, 2000] , WebCT [WebCT Inc, 2002], or experimental products developed by Universities, such as AulaNet [AulaNet Project, 2002] and WebCurso [Reinhard, 2000]. In addition to these online education environments, collaboration environments, such as eRoom [eRoom.Net, 2002], have also been used as virtual tools to support remote education.

Most of the Internet-based virtual environments that can be applied to remote education were developed through the integration of synchronous and asynchronous communication tools, such as chat, discussion forums and lists, and electronic mail. These projects range from developing specific tools that are fully integrated with the virtual education environment to using separate tools to create an on-line environment. WebCurso [Reinhard, 2000], Virtual-U [Harasim, 1999] and Lotus Learning Space [IBM Corporation, 2002] are examples of environments that are based on the integration of their own communication tools and the environment. Microsoft, for instance, adopts the separate tool-approach, which, although does not offer virtual application environment specifically directed towards remote education, provides all the required tools to create such environment.

These environments can include several tools and different features. *Appendix I – Functionalities of Web-based online education environments* presents a (incomplete) list of features that can be fully or partially found in most of the environments. Our proposal, which is presented below, states that these functionalities or features actually define how the virtual environments can be used within the remote education and training context.

This article presents a categorization for distance education environments, based on the educational purpose and two different dimensions:—interaction and content. The proposed categorization was based on the experience acquired in developing, implementing and operating different distance education environments and training courses that will be used as examples. The proposed categorization is aimed at helping education professionals to select the most effective environment to meet their teaching-learning goals and develop educational strategies.

OTHER AUTHORS' PERSPECTIVES ON THE TOPIC

According to Sherry [1996], several researchers assign the same meaning, both to remote education and remote training, based on the idea that the main component is the distance—both in terms of space and time—between the teacher and the student and the teacher-student communication process is mediated by technology. Other writers, such as Valente [2002], assign different meanings to "remote training" and "remote education," that is, "training" means to provide information, and "education" means to capture information and allow knowledge building.

Harasim [1990] summarizes the characteristics of online courses as (1) time and place independence; (2) peer-to-peer communication, and (3) dependence on text-based communication to stimulate learning through understanding and reflection. The main strengths of such environments would be using synchronous and/or asynchronous communication, reaching a wide range of students regardless their location, and creating learning communities.

However, there are innumerous examples in the literature showing that the benefits of online courses are not easily reachable, considering that:

- Online courses are effective mainly for motivated students [Schrum, 1998] or previously educated students (able to process information) [Valente, 2002];
- Developing educational material for online courses can be a tremendous challenge, given the fundamental role it plays in the learning process [Schrum, 1998]; and
- Creating learning communities is a complex task, and the integration among students is always less intensive than expected [Wiesenberg and Hutton, 1996 and Reinhard, 2000].

Reid and Woolf [1997] have already discussed the different features of the online environments, such as access capability, student control, increased communication and the potential for creating a student-centered environment. Heeren and Lewis [1997] suggest that special attention should be paid to selecting the appropriate feature to each specific educational task, matching the media with the task.

Therefore, we are led to discuss environment-related features and technologies and their relation to educational activities. Estmond [1998] proposes three different types or sets of technologies that can have diverse impacts on the teaching-learning process:

- **Type 1—Traditional remote education supplemented by Internet-based activities**. The education process is based on printed material delivered to the students, self-study, and the Internet is used as a supportive resource, which includes e-mails, chats, conferences. As the Internet is not fundamental to the process, technology knowledge is not extremely important.
- **Type 2—Computer-based conference.** In this category, the Internet plays the main role in the communication and education processes. Although printed material can be used, the emphasis is on computer-based communication resources, such as chats, forums and boards, providing the students with synchronous and asynchronous communication opportunities. Written communication skills are important for the process, as well as technical knowledge of computer and Web resources. This type of technology requires great interaction among students and between the student and the teacher.
- **Type 3—Virtual courses.** This is an extension of Type 2, but the Internet plays the role of unique source of training material. Type 3 technology-based courses, which involve deep immersion in computer and Web resources, can provide constructionist learning and create learning communities. Remote interaction with the teacher (and the classmates) helps to provide alternative views and understanding of the learning process.

Another categorization proposed by Valente [1999 and 2002] is based on different distance education pedagogical approaches, which are defined by the different interaction modes provided by the environment and adopted by the educational professional:

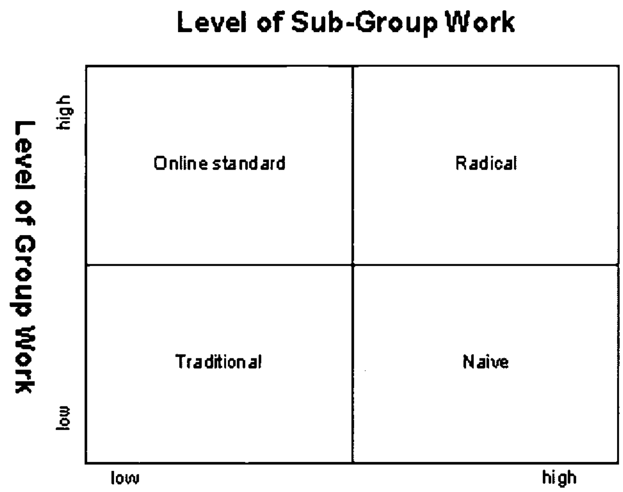
- **Broadcast.** Technology is used to provide information to the learners. The main characteristic is that, instead of interacting with the teacher, the student interacts with the material (content) prepared by the teacher. The teacher receives no (or little) feedback from the student, and has no idea on how the information has been interpreted or processed by the student. The cost of this category per student is extremely low; therefore, it is highly efficient for spreading information to a great number of students. The main role of the teacher is to prepare the educational material (or content).

- **Traditional school virtualization.** Technology is used to reproduce educational activities adopted by traditional classroom education. Here the main characteristic is the teacher-centered nature of the activities; the teacher possesses the information and provides it to the students. The interaction between the teacher and the student is intensive, allowing the teacher to deeply monitor the student's progress. This kind of interaction significantly reduces the number of students involved and increases the teacher's activities. The main role of the teacher is to create and deliver the educational material to the students as well as to provide feedback on the students′ activities.

- **Virtual "get together."** Technology is used to present problem situations or projects to the students. The students try to solve the problems individually or within the group, and count on the teacher's coaching. Internet-based interaction aims at accomplishing "learning cycles" [Valente, 1999], which maintain the students involved with innovative activities, allowing knowledge generation. This approach was also called "learning network" [Harasim, et al, 1995]. According to Valente [2002], this approach is extremely complex because it implies high costs—the number of students is limited and the approach requires a supportive team of teachers—and, most important, it demands deep changes in the educational processes. The main role of the teacher is to create educational material, support the learners, and create and maintain a learning environment that is appropriate to knowledge building.

Considering the level of cooperation among students and between students and teachers, Roberts, Romm and Jones [2000] proposed a different categorization model to the Internet-based collaborative learning. For this purpose, they defined two levels of activities that can be accomplished within the online environment: the "group level" involves both the teacher and his/her students—and everybody participates in the activities and can benefit from the work developed by other classmates—and the "sub-group level," which includes small groups of student within the same class. These two kinds of activities define four different categories:

ILLUSTRATION 1
CATEGORIZATION MODEL FOR THE INTERNET-BASED COLLABORATIVE LEARNING



- **Traditional**. It is originated from traditional classes, that is, text material and explanations are used to transmit the content to the students. In the virtual world, the three main characteristics of this model are: the content is delivered through files and text, there is no interaction among students, and the interaction between the students and the teachers is usually through e-mails. The students have no (or few) opportunities to learn from their classmates, and the learning process strongly depends on the teacher's knowledge and skills.

- **Naive**. The group is divided into sub-groups with 3 or 4 members; the sub-groups operate as individual units, and are independent from other sub-groups. This method reduces the large groups of students so they can effectively interact with the teacher; therefore, it is often adopted for practical reasons.

- **Online standard**. It is based on the workgroup model, rather than the sub-group approach. All the students in the group are involved in the activities: discussions, projects, chats, etc. Therefore, the students have the opportunity to learn both from the teacher and their classmates. During the development of the activities, the students tend to form sub-groups spontaneously.

- **Radical**. While the "online standard" and "naive" categories can use either the group or the sub-group model or both, in the "radical" approach, groups and sub-groups are always involved in all educational activities. The activities are accomplished at sub-group level, based on the interaction among the sub-group members, but are also developed at group level. The approach also includes activities developed among different groups. This category has very distinct characteristics:

  - Mandatory use of environment lists and/or e-mail as the only communication alternative available;

  - Online presentations prepared by the students and available within the environment;

  - The teacher divides the students in sub-groups, and all course tasks are accomplished by the sub-groups;

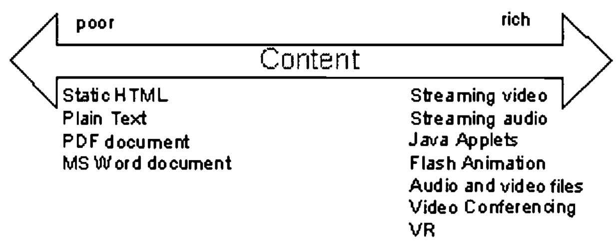
  - Evaluation is based on sub-group presentations and student activities.

OUR CATEGORIZATION PROPOSAL

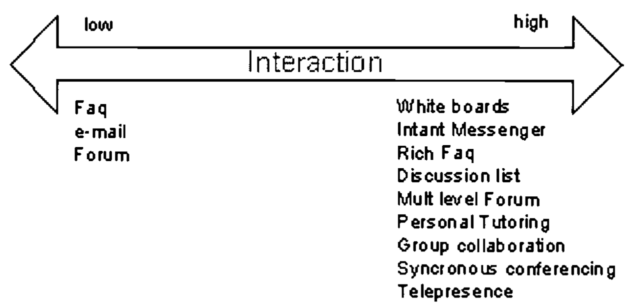
Although distinct, the three previously described approaches have one main common aspect: the interaction among students and between teacher and students. Also, they all state that to create a distance education environment to involve and stimulate the students requires intensive involvement of the teacher. Individual attention from the teacher is also required through private messages and continuous involvement within discussion group environments, in order to coordinate and direct the discussions toward the course goals.

We herein propose a different categorization model for Internet-based distance education environments. In addition to the interaction aspects, the proposed model considers the potential of the Web technology to create rich education material and classifies the environments based on two different dimensions: content and interaction:

- **"Content"** is herein defined as the subset of educational materials available to the students. This dimension is justified by the large range of resources provided by Web technology. These resources would allow the development of virtual educational contents that go far beyond the traditional textbooks. The content can be presented in different digital media formats, such as hypertext documents, streaming audio and video, animations, simulations, improving the materials with interactivity between students and the environment.

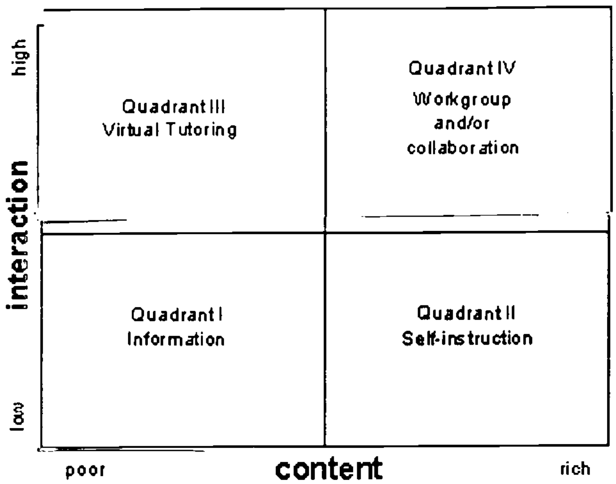


- **"Interaction"** is the mutual relationship among the students (peer-to-peer) and between students and teacher. Interaction can be herein understood as the frequency, as well as the volume of information exchanged among the students and/or between students and teacher.



Therefore, based on the two previously mentioned dimensions— interaction and content—and adopting two basic measures—low and high (Illustration 2)—we herein propose a distance education virtual environment classification based on the interaction level among the participants and the richness of the content available to them.

ILLUSTRATION 2
DISTANCE EDUCATION VIRTUAL ENVIRONMENT CLASSIFICATION MODEL



Quadrant I— Information (Low Interaction and Poor Content)

This category is characterized by the availability of simple text or files (.doc or .pdf). There is no interaction among the participants or the interaction is limited to common resources such as FAQs. This category includes remote training initiatives or standard information delivery. The student is fully responsible for the learning process.

As an example of this category, we implemented a Public Policies (http://www.msco.com.br/cpp) web site. The environment aimed at providing information on decentralized and participatory management to the members of Municipal Councils. The content includes only Word text files (or .pdf files) that can be downloaded to the student's computer. The content was a manual on the rules that regulate decentralized management. The interaction level is low and exclusively based on FAQs. The environment is a delivery tool to provide specific information on a specific topic.

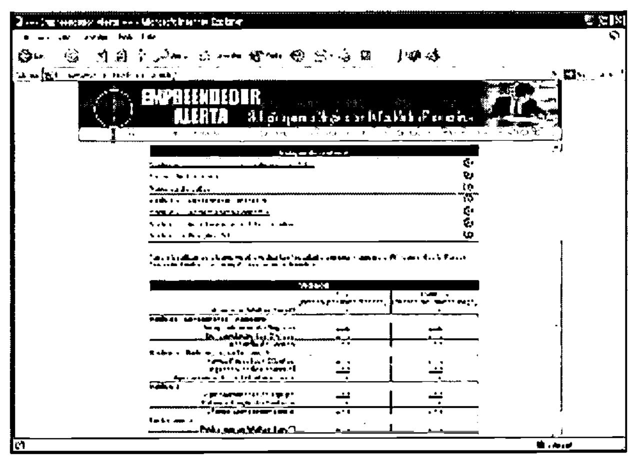
Quadrant II—Self-Instruction (Low Interaction and Rich Content)

It is characterized by rich and diverse content in different formats, but low interaction among the students or between the students and the teacher. It is appropriate to learning strategies aimed at providing the student with a rich virtual environment that allows him/her to learn by him/herself, guiding him/her through a previously defined sequence of actions. This kind of environment is appropriate to large group training initiatives, with fixed content and low feedback levels.

As an example of this category, we implemented two different projects: *Empreendedor Alerta* and *3Com Learning Center*. Both offer rich content using different communication tools.

The *Empreendedor Alerta* project is aimed at offering to small business owners different contents that teach them how to overcome eventual financial difficulties. The environment offers Adobe PDF manuals and Microsoft .asf streaming video files (*Advanced Systems Format* for Windows Media Technology)—see Illustration 3. The participant also receives a course kit by mail, including a course manual and videotape.

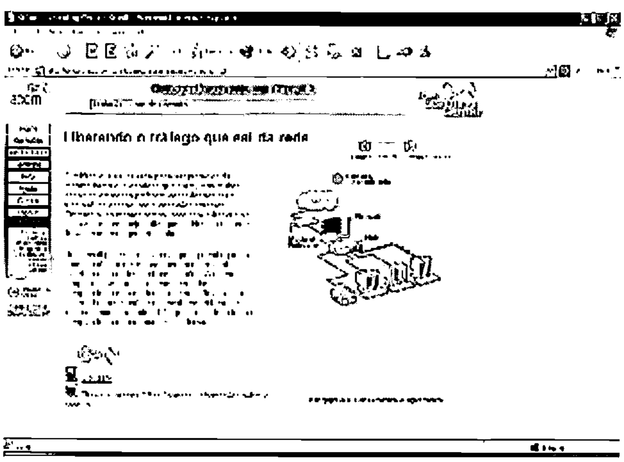
ILLUSTRATION 3
DISTANCE EDUCATION ENVIRONMENT—EMPREENDEDOR ALERTA
http://www.msco.com.br/empreendedor



The environment counts on limited interactive supportive tools—a discussion forum and a specific area for receiving the student messages directed to the instructor or to the supporting team. In spite of environment limitations, 9,293 people registered for the course as of April 2001. Concerning the interaction among the students, only 57 message topics and 94 message answers have been included in the Discussion Forum. Considering both the interactions between students and the teacher team, 324 messages have been registered. These figures show low interaction between the students and the teacher team and also among the students—we can notice low interaction among the students and between students and teachers, that is, 0.05 messages per participant.

Another example of a distance education virtual environment that would also be included in Quadrant II is the *3Com Learning Center Brazil P*roject (figure 5). The environment is mainly aimed at offering basic training on network technology; this is, teaching the basics of network technology. The environment is an adaptation of the equivalent program currently available at the 3Com University-USA web site. The environment includes 15 different courses on computer networks. The exhibition mode is standardized, and includes few different, but rich, content formats, using hypertexts and animations developed in Macromedia Flash. The interaction between the student and the environment consists of sequential navigation through the course HTML pages, enriched by Flash animations.

ILLUSTRATION 4
DISTANCE EDUCATION ENVIRONMENT—3COM LEARNING CENTER—BRAZIL
http://www.msco.com.br/3com



The only interaction available is provided by a sophisticated FAQ system, that is, the answers to the proposed questions can go far beyond the traditional FAQs, and can be enriched by file attadimentes and illustrations. The student can also directly contact 3Com: by hotline or e-mail, although no contact is provided through the educational environment.

The *3Com Learning Center Brazil* is operating since June 2001. In April 2002, the number of enrolled students was 5.335. Over this period, only 35 student messages have been sent to the teacher team. The teacher team has sent 6 messages to the students. A series of questions presented at the end of each course allows the students to evaluate the courses. Course evaluation grades range from 1 (poor) to 5 (excellent), and are used to measure the students' perception of the course. Based on this evaluation tool, we know that 33.8% of the students consider the courses to be excellent, and 46.92% think the courses are good! Only 16.54% of the students think the courses are regular, and less than 3% classify them as poor. These figures show that student satisfaction levels concerning this kind of environment are high.

Quadrant III—Virtual Tutoring (High Interaction and Low Content)

The virtual environments included in this category are characterized by intensive coaching activities and some group work. Considering that the focus is on the interaction between the students and the teacher, the content does not have to be highly sophisticated in terms of audio and video resources. The focus is on tutoring actions, that is, providing the student with effective support during the learning process. Interaction becomes a critical success factor. Communication tools are intensively used by teachers, pedagogical coordinators, or facilitators to reinforce the learning process. Group activities can be adopted to increase the interaction and information exchange among the participants. Feedback is frequent and highly important in this kind of environment, requiring specific tools to monitor course activities and student progress. Small and mid-size groups—40 to 80 people (considering only one teacher)—can be appropriate to work within this kind of environment, considering that interaction between the students and the teachers tends to be high.

As an example of this kind of virtual environment, we can mention two remote education projects, VirtualCurso and Virtual-U. VirtualCurso (VC) is the most current implementation of WebCurso [Reinhard, 2000]. The environment offers several synchronous and asynchronous communication tools to be specifically applied to remote education. The environment can be configured according to the strategies applied by a specific teacher to a specific course.

From April to September 2001 a remote education program was offered to Mathematics teachers (at Primary and High School), mainly aimed at training them in using spreadsheets to teach Math. The course content, which included a spreadsheet tutorial program specially aimed at developing the proposed content, was presented through Microsoft Word text files and HTML hypertext files, using ."gif" pictures and screenshots from the spreadsheet application. The main strategy consisted of:

- Proposing basic and individual tasks or activities, in which the teacher and/or the student would develop a series of activities using calculation spreadsheets (in this specific situation, Microsoft Excel) and present them to the pedagogical coordinator; and

- Proposing tasks, wich include how to create spreadsheet activities related to everyday life, and follow the same principles and contents used to guide the proposed activities. These files were stored in a transfer area (called the "Group Window"), creating a database that could be accessed by all the students.

- Helping to develop the interaction between the coordinator and the students. After the evaluation, the students were stimulated to improve their spreadsheets thorougt the addition of new data and the discovery of different alternatives to correct eventual mistakes.

The chosen strategy significantly increased the number of interactions among the students and between the students and the pedagogical coordinator. The course started with 120 students, was later reduced to 72 students, and ended with 51 students. Most of the interactions were made through e-mail and discussion forums, both directly integrated to the VC environment. The students sent 1.523 messages to the coordinator and 590 to other students. The coordinator sent approximately 2.500 messages to the student. Considering that 51 students concluded the course, the average number of messages was as follows: 29 student-to-coordinator messages, 12 student-to-other-student messages, and 49 coordinator-to-student messages. The Forum included 101 topics and 1328 answers to the proposed topics, that is, approximately 13 answers per topic.

At the end of the course, answering the course evaluation questions, the students said that they had learned a lot, including mathematical, pedagogical and computer-related content. All of the 51 students that concluded the course answered the evaluation questions. Forty-nine of them, (98%), said that participating in a virtual environment-based course was a pleasant experience, and they would participate again in a remote training course.

Quadrant IV—Collaboration (High Interaction and Rich Content)

This kind of environment is based on peer-to-peer collaboration, teacher-student cooperation, and work-group activities. Differently from quadrants I, II and III, which are aimed at a more individual learning process, quadrant IV is based on collaboration activities that support the group learning process. This situation requires a high level of interaction among the participants. Synchronous communication tools, such as audio and videoconference, are emphasized in this kind of environment, as well as online document sharing (e.g. shared white board). Asynchronous communication tools, such as discussion forums and lists, or even other tools that allow sending and receiving files (file download and upload area) to common areas are important within this context. This kind of environment allows the students to freely create groups and sub-groups. There is a wide variety of contents available because, in addition to the material provided by the teacher, the students also develop and provide course materials.

Java Collaborative Virtual Workplace (CVW) and PauliWorld [Su, 2001] are examples of collaborative virtual environments. CVW is used for distributed system analysis and distributed collaboration and offers a set of resources that allow synchronous and asynchronous collaboration through text mode-based chats, audio and videoconference, and shared whiteboard. According to Maybury [Maybury, 2001], CVW implements session persistence, which allows recording user interactions as soon as they occur within the "shared virtual room" context.

VirtualTeam also belongs to this category. This environment was created and developed aiming at facilitating the virtual integration among groups of students involved in traditional classroom courses. Although the environment does not include synchronous communication tools, such as audio and video-conference, to deliver sophisticated content, it offers a large set of tools to facilitate virtual interaction and communication. Its main characteristic is allow sub-groups while maintaining privacy. The material shared among different groups is based on a resource called "window." Operating since August 2001, it is currently being used by over 150 students registered in Internet Technology MBA courses at Faculdade de Economia e Administração, USP. The tool can be seen at http://www.virtualteam.com.br.

DISCUSSIONS AND CONCLUSIONS

Before presenting our conclusions, we think it is important to reiterate Valente's statement [2002], that the categorization approach is not the only alternative available and does not represent preferred technologies. The division into categories is just a useful resource to help educators choose the most effective environment, according to their educational purposes, their target audience (number and characteristics), and the related social and economical circumstances.

Concerning the categorization herein proposed, the following topics present indications for each of the presented categories (see Table 1).

It is not simple to classify the environments only on a single quadrant. The environments may cross quadrants boundaries. Illustration 5 shows some of the virtual environments mentioned in this paper.

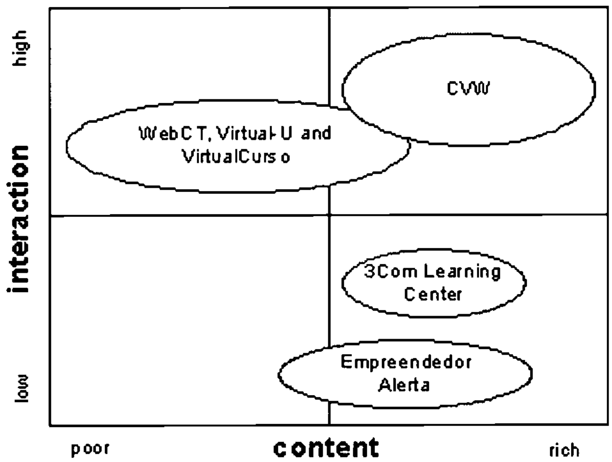
Each environment includes several features, and a specific feature can be implemented in different ways within different environments. For example, a FAQ system can vary from a simple list of answers in text format to a sophisticated multimedia tool associated to complex searching mechanisms.

All the examples presented to illustrate the different categories herein mentioned can be considered to be successful distance education applications. Although completely different, each one is appropriate for the intended educational strategy. Therefore, the educators are responsible for examining the characteristics of different educational environments and finding the most adequate to their pedagogical purposes, reach, resources and cost per student.

TABLE 1

Category	Indication	Example of use
Information	Large groups. Simple and specific topics. Requirement of low cost per student Appropriated to "continuous delivery." Content could be updated periodically.	Explain the new administrative procedures of a company.
Self-Instruction	Large groups. More complex topics. Low interaction between the students and the teacher. Adequated to "continuous delivery." Indicated for information courses.	Training on computer network basic concepts, or training on use of an administrative information system.
Virtual Tutoring	Small size groups. Focus on the teaching process. Interaction between the student and the teacher is the most important element. Indicated for development courses.	Teaching the use of Web on education and creation educational material for use on classroom
Workgroup or Collaboration	Small/Medium size groups. Focus on peer-to-peer collaboration. Adequate to knowledge exploration activities. Constant information exchange is required.	Teaching how to create and develop a business plan.

ILLUSTRATION 5
ENVIRONMENT
CATEGORIZATION EXAMPLE



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APPENDIX A
FUNCTIONALITIES OF WEB-BASED ONLINE EDUCATION ENVIRONMENTS

Resource	Description
Manual	Environment User Manual in text format or "contextual help" format.
Course material	Area for providing material to the students. Course material includes text, software, animations, e-books, etc.
Chat	Synchronous communication (text-based) for groups, with choice of persistence.
Instant Messaging	Synchronous communication (one to one), private, sensitive to presence within the system
Forum	Moderated or edited asynchronous communication.
Management Tools	Allow creating and monitoring groups and sub-groups, with controlled privacy to be managed by teachers.
News	News publishing system to be used by teachers/tutors.
Files (Database)	File storage system, including upload and download, also allowing the creation of private folders.
Message box (e-mail)	E-mail internal system for internal and external use.
Task Management	Assignment and control of student tasks.
FAQ – Technical	Frequently Asked Questions sub-system on environment technical issues, which shall serve as off-line technical support environment.
FAQ – Content	Frequently Asked Questions sub-system on pedagogical issues related to the modules.
On-line support	Through Instant Messaging, both text and voice.
Statistics	Statistics sub-system on environment usage by students.
Resource repository	Includes all the required plug-ins so the students can use the resources.
Evaluation of the Participants	Evaluation sub-system that implements "Student Activity Control Card," including Notes, Evaluations and Comments.
Bulletin Board	Sub-system that allows both searching information published by participants, and entering information to be provided to other participants.
Links	Area that allows entering URLs to be used by students, teachers and tutors; also including comments.
Latest Events	Environment monitoring system that allows providing updated information to the students, as of the latest entries.

TELECOMMUTING: EXPERIENCES FOR TWO SAMPLES IN MEXICO AND UNITED STATES

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ABSTRACT

This paper analyzes and compares telecommuting in the United States and Mexico. The objective of the paper is to answer two research questions related to a framework of telecommuting. The research questions assess the productivity, performance, satisfaction, and extent of support by organizational policies for telecommuters in the two countries. The tests are done on a questionnaire sample of 177 employees in the U.S. and Mexico. The statistical method is crosstabulation analysis.

Results show that telecommuters in the U.S. sample report that telecommuting improves their productivity. However, telecommuters in the Mexican sample do not consider that telecommuting improves productivity. On the other three questions, the results show no difference between the two samples regarding job performance, job satisfaction, and the extent of support by organizational policies. The findings have implications for telecommuting policies of corporations and governments in the two nations.

INTRODUCTION

This paper presents the results of an investigation on the practice of telecommuting among corporate employees, focusing on the differences in experiences and perceptions among telecommuters and non-telecommuters in Mexico and the United States. Telecommuting, or the ability of employees to work at sites other than their corporate office, has been an issue of ongoing interest to researchers and practitioners since its introduction in 1976. Many factors have contributed to keeping this issue current, as well as controversial. Initially, telecommuting was thought of as an alternative to reduce traffic congestion and pollution in large cities by keeping employees from commuting from their home to their offices (Nilles et al., 1976). Later on, organizations realized its potential for cost reduction—by eliminating needs for office space (Apgar, 1998). Some also noted productivity increases, due to elimination of work distraction and commuting time for employees (Apgar, 1998). Highly skilled individuals realized the personal gains of engaging in this working arrangement (i.e., autonomy, money savings, and reduced stress) and some demanded it as a condition for employment. More recently, telecom-muting was invoked as the only alternative to resume operations for some businesses affected by the September 11, 2001, terrorist attack in New York City (Kistner, 2001).

The many benefits of telecommuting have led many individuals and organizations to adopt it. However, there have also been reports on the problems that this alternative work arrangement brings to individuals and organizations. These problems include workers' feelings of isolation by staying away from the office, work-family conflicts due to the inability to separate work and family issues, and management's inability to deal with the new mechanisms for controlling and evaluating employees. Similarly, other reports find evidence of a decrease in productivity among telecommuters due to their lack of commitment to the organization or to increasing levels of stress brought about by working at home. Most likely these adverse reports have kept many businesses and individuals from adopting telecommuting.

Recent and more rigorous studies have provided explanations to alleviate the controversy, and have contributed frameworks to promote further analysis, evaluation and discussion of the actual outcomes of telecommuting. The work of researchers such as McCloskey and Igbaria (1998, 2001) and Belanger (1998, 1999, 2001), who conducted extensive literature reviews and provided research agendas, have set the stage for continuing research on this important issue.

Building on the work initiated by these researchers, this paper explores the state of the practice of telecommuting and the experiences and perceptions of telecommuters and non-telecommuters. The study analyzes two samples, one in Mexico and the other in the United States, to empirically measure whether or not telecommuters in both countries are indeed more productive, better performers, and more satisfied with their working arrangement. The study also analyzes whether or not organizations support teleworking arrangements in both countries.

Knowing the differences in perceptions and experiences among telecommuters will help in:1) promoting adoption of this working strategy in both countries, 2) designing telecommuting policies in global organizations with branches in US and Mexico, and 3) policy making regarding the IT industry in Mexico and among the Hispanic community in the United States. For example, Kramer and Dedrick (2000) recommend that developing countries such as Brazil, Turkey, India, and Mexico should establish a strategy to utilize IT to support government policies and development strategies.

Based on the objectives of the study, a questionnaire was developed and tested using a sample of 177 corporate employees: 111 in the United States and 66 in Mexico. The experiences and perceptions of these employees were captured in their answers to 49 survey questions. A preliminary analysis on the data shows that, in concert with recent literature, about 20 percent of the sampled population actually telecommuted in the U.S. Further analysis on the data indicates that: telecommuters perceive themselves as more productive than conventional, non-telecommuting workers. In the case of Mexico, the number of telecommuters turned out to be too high (45 percent of the sample). A more detailed analysis showed that unemployment rate in Mexico explains part of this finding, since 50 percent of Mexican telecommuters sampled do not work for a corporation or other institution.

LITERARTURE REVIEW

In the almost thirty years in which telecommuting has captured people's attention, the literature has grown substantially. Many important reports on telecommuting have been publicized in practitioner-oriented journals and books. Although practitioner-oriented literature is very useful in exploring the dimensions of telecommuting, it has also stimulated debate and controversy.

The virtue of practitioner-oriented literature lies in the recounting of the experiences of pioneering organizations that implemented telecommuting initiatives, the outlining of its benefits and drawbacks, and success factors that these organizations found throughout their adoption processes. For example, Apgar (1998) discusses the experiences at IBM and AT&T. Davenport and Kerin (1998) present the results of a survey of Fortune 500 companies describing the benefits and losses of telecommuting for organizations. The results of these and others studies are summarized in Table 1. The telecommuting benefit touted the most among organizations is the reduction of real estate cost since fewer employees occupy less office space. Additional benefits for businesses as well as for individuals are higher productivity and work satisfaction.

However, problems with telecommuting have also been reported in the research literature. At the organizational level, telecommuting leads to weakened organizational culture, lowered commitment, and burdens in managing and supervising telecommuters. At the individual level, studies report that respondents experience isolation and work-family conflicts stemming from telecommuting initiatives. Table 2 summarizes disadvantages to telecommuting.

TABLE 1
BENEFITS OF TELECOMMUTING

Apgar, 1998	• Cost reduction (IBM is saving more than 100 million annually through its Mobility Initiative) • Potential to increase productivity (At IBM 87% of employees in the Mobility Initiative believe that productivity and effectiveness have increased) • Opportunity to capture government incentives and avoid costly sanctions. (Clean Air Act and tax deductions for home office costs). • Employee recruiting and retention • Employee efficiency (fewer distractions and less downtime) • Increased personal time and control

Adam and Crossan, 2001	*Organization level:*
	• Reduced overhead (total office space)
	• Rare skills retention
	• Geographical flexibility
	• Motivation and loyalty
	
	Individual level:
	• 30 to 100% increases in productivity (due to reduced commuting stress, flexibility, and appreciation of responsibilities)
	• High satisfaction among teleworkers
	  • Uninterrupted concentration
	  • Freedom from time constraints
	• Lower living costs: reduced travel costs, stress and time

Pinsonneault and Boisvert, 2001	*Positive impacts on individuals:* • Reduction or elimination of commuting time (Baruch and Nicholson, 1997) • Potential to alleviate high levels of stress (McCune, 1998) • Increased flexibility is associated with higher levels of satisfaction and productivity.

TABLE 2
PROBLEMS WITH TELECOMMUTING

Adam and Crossan, 2001	*Organizational level*: • Weakening corporate culture • Difficulties in remote supervising and management • Burdens in communication • Feelings of isolation • Work-family conflicts • Lack of technical and social support • Communication burdens
Fitzgerald, 1994	Employees who choose to telecommute are: • Not considered serious • Receiving less interesting and visible assignments • Receiving less feedback • Receiving little or no mentoring

Overall, the practitioner-oriented literature is contradictory in findings (McCloskey, 1998). Some studies state that telecommuting is a way to balance work-family conflicts and reduce stress, while other research reports that telecommuting leads to family conflicts, increased stress, and decreased productivity. Similarly, other studies report that organizations have not realized the much-anticipated cost reduction. In much of this literature these contradictions are a result of ambiguity in the definition of telecommuting, and in the research questions being investigated.

To respond to these contradictions, researchers have highlighted the elements that should be described when studying and reporting telecommuting arrangements. McCloskey and Igbaria (1998), for example, state that the elements for studying telecommuting are: location, use of technology, employment relationship, and time. Location refers to the actual place from which an individual is telecommuting, such as his/her home, or a customer's premises. Table 3 describes these components in further detail. Combining these different elements results in a different type of telecommuting, and thus in a different experience for telecommuters. For instance, the experience of a part-time employee who telecommutes to his office every day from a customer premise by means of computer access is different from the experience of a full-time employee who telecommutes two days a week from home. Consequently, these experiences cannot be compared without risking contradictions.

TABLE 3
COMPONENTS OF TELECOMMUTING DEFINITION

Telecommuting Parameter	*Description*
Location	Work done at a satellite location, branch office, customer premises, home.
Use of Technology	Technology use to maintain the link with the office, such as telephone only, computer only, fax, e-mail, or videoconferencing.
Employment Relationship	Type of contract between organization and employee such as full-time, part-time, self-employed, etc.
Time	Amount of time that employees telecommute such as everyday, one day a week, two days a week, or other

McCloskey and Igbaria urge researchers to specify the type of work arrangement that they are investigating to allow the comparison of research findings and the proper interpretation of results. Following this advice, recent academic researchers have narrowed down the definition of telecommuting and have often stated it as follows: telecommuting is *working at home one or two days a week using computer and communication technology to maintain a link to the office* (Belanger, 1999; McCloskey, 2001). This present study adopts this definition.

Academic researchers have also initiated efforts to empirically measure telecommuting outcomes and experiences while at the same time controlling for methodological issues that impair the comparison of results. One of these efforts is that of Belanger (1998) who contributed the following research framework for telecommuting (Figure 1).

This model begins with four determinants for telecommuting success. Success can be analyzed by measuring the outcomes at three different levels. The determinants of success are: characteristics of the organization, characteristics of the individual, the type of work performed by the individual, and the type of technology required to do their work (see Figure 1 and Table 4). Belanger argues that these determinants must be matched to ensure succesful outcomes of telecommuting. For example, in another research project, findings supported the matching of computer and telecommunications technology to telecommuters, based on their needs to communicate with teammates (Belanger, Collins, and Cheney, 2001).

Regarding the outcomes of telecommuting, Belanger states that telecommuting has impacts at three different levels: society, organization and the individual. At the individual level, she observes that telecommuting can provide "increased schedule flexibility, improved quality of work life, reduced commuting and clothing costs, increased job satisfaction, and reduced stress" (Belanger, 1999, p. 142). All these benefits combine to increase productivity, satisfaction, and performance of individuals. At the societal level, telecommuting is beneficial because it may help reduce pollution and traffic congestion, two important concerns for people living in large cities. Finally, at the organizational level, telecommuting can reduce facilities and overhead costs, and increases productivity (Belanger, 1999).

FIGURE 1
BALANGER'S FRAMEWORK FOR STUDYING DISTRIBUTED WORK ARRANGEMENTS

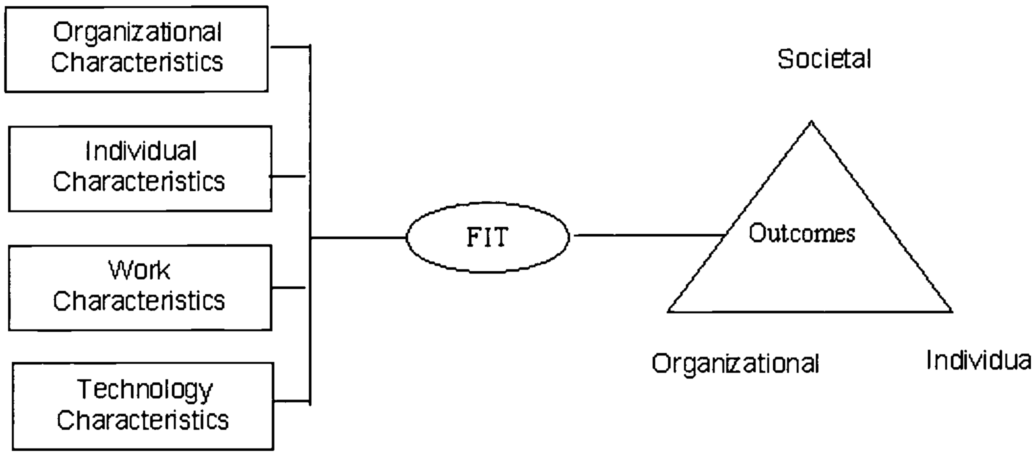

TABLE 4
VARIABLES THAT MAY IMPACT SUCCESS OF TELECOMMUTING

Organizational	Objective for establishing program ** Culture ** Control mechanisms
Individual	** Objectives for participating ** Skills
Work	** Communications requirements Coordination mechanisms
Technology	Actual technologies ** Physical environment (homeoffice) Security issues

Variables marked with (**) will be included in the present research (Belanger, 1999).

Belanger tested this research framework in two cases and has developed survey instruments to measure the impact of telecommuting mostly at the individual level. In one case, she compared the perceived productivity, performance, sense of personal control, and satisfaction between telecommuters and non telecommuters. She measured these outcomes using questionnaire items, and found evidence to support that telecommuting positively impacts productivity and personal control as perceived by telecommuters. She did not find evidence that telecommuting improves performance and satisfaction of telecommuters.

Other studies have explored the outcomes of telecommuting as well. Some have studied outcomes and individual experiences such as career advancement prospects, work-family conflicts, organizational commitment, and autonomy among others (McCloskey, 2001). McCloskey found that telecommuters experience more autonomy, less work family conflicts, and less career support than nontelecommuters, but that they do not experience any differences in terms of organizational commitment, satisfaction, and career advancement. Others have investigated additional outcomes such as turnover intentions, and have found that telecommuters are more likely to stay in their current jobs (McCloskey and Igbaria, 1998).

McCloskey's and Belanger's studies are relevant to the present investigation. Both studies have measured the difference in outcomes between telecommuters and non telecommuters using the experiences of corporate employees working for a single organization. Moreover, both researchers acknowledged the limitations imposed by the samples they studied. Following the same research model and using a similar instrument, the present project investigates the difference in outcomes between telecommuters and non-telecommuters in samples from two different countries. The project uses a sample with different characteristics to expand the previous findings. For instance, McCloskey stated that the findings of her study might have been influenced by the fact that the organization from which the sample was drawn encouraged the practice of telecommuting among its employees. Since Belanger's respondents were mostly managers and professional employees, she recommended in further investigation the broadening of the sample to include other types of employees. Following these authors' recommendations, this study targets corporate employees working for different organizations and performing different types of work within their organizations. The objectives are to investigate similarities in organizational support for teleworking in both countries and the effects of telecommuting in terms of productivity, satisfaction, and performance also in the two nations.

RESEARCH QUESTIONS

Overall, the literature indicates that the most significant benefit of telecommuting is increased productivity. Writers and researchers report findings on individual productivity gains from telecommuting in the range of 30 to 100 percent (Adam and Crossan, 2001). Belanger (1999) also found evidence to support that telecommuters "do more at home than at the office" (p. 149). Hypothesis 1 is important because of:

- The importance of improving productivity and performance for organizations and individuals;
- The amount of evidence reported in other studies of developed countries; and
- The lack of research in telecommuting in Mexico.

H1. Telecommuters in Mexico and the U.S. will report different telecommuting experiences regarding productivity, performance and satisfaction.

Similarly, since organizational characteristics influence the organizational support or rejection of different telecommuting alternatives, this project tests how much organizational support is found in Mexico and in the U.S. for telecommuting settings. The more organizational support the higher the number of telecommuting experiences we can find. To study this alternative the project tests the following hypothesis:

H2. Telecommuting in the U.S. receives more organizational support than telecommuting in Mexico.

METHODOLOGY

A questionnaire measuring the real and perceived outcomes of telecommuters was developed and tested using two samples. One comprised 111 employees of corporations in Southern California, and the other consisted of 66 employees in firms in Mexico City. The sample was drawn from senior and graduate students and from employees at four major universities. The participants were asked to provide answers to a total of 49 items in a survey handed in class. Before administering the questionnaire in Mexico, it was translated into Spanish, tested in both languages, and adjusted and modified according to the feedback from three experts in the areas of telecommunications, information systems and management. It is worth mentioning that the authors are bilingual.

The survey questions were grouped into six sections, four of them with answers on a 5-points-Likert scale that ranged from strongly disagree to strongly agree, while the other two sections asked participants to select their answers from a list of possible responses.

The responses to the survey were recorded and analyzed using SPSS version 8.0. The analysis of the data was conducted in three stages. First, the demographic characteristics of both samples were explored; second, the responses were divided into four groups (U.S. and Mexico and telecommuters and non telecommuters) and analyzed separately as independent groups. Under this design, analyses of the telecommuters' perceptions on productivity, performance, and satisfaction was carried out. Two-way cross-tabulations were applied to test associations of categorical variables. Pearson Chi Square was used to test for the significance of associations.

ANALYSIS OF RESULTS

Sample Characteristics

In the case of the U.S. sample, the proportion of telecommuters in the total sample is 19.8 percent (22 out of 111) and for non-telecommuters is 80.2 percent (89 out of 111). With respect to gender and age, the majority of individuals in the total sample were males (74 percent) with an age-range between 18 and 25 years (67 percent). Chi-Square test shows no difference in the U.S. sample with respect to age and gender. In the case of Mexico, the proportion of telecommuters in the total sample is 45 percent (30 out of 66) and for non-telecommuters is 55 percent (36 out of 66). Similarly to the USA sample, the majority of individuals were males (50 out of 66). With respect to the age distribution, the Mexican sample is older, in particular the frequency of individuals in the range of 23 to 30 years old is much higher for Mexico versus the U.S. More relevant for the purpose of this project is the difference between telecommuters by country. Table 8 shows the that the two samples are significantly different in work arrangement.

TABLE 8
TELECOMMUTERS BY COUNTRY, INCLUDING UNEMPLOYED RESPONDENTS

	No Tele	Tele	Total
USA	89	22	111
Mexico	36	30	66
Column Total	125	52	177

Chi-square = 13.109 df = 1 Prob = .000

A more detailed analysis of the Mexican sample showed that 15 telecommuters out of 30 are unemployed, and they rather belong to a category of work at home than a telecommuting setting. This is a cultural difference, since during times of recession in Mexico, many middle class workers leave the formal labor force and join the informal labor force as self-employed workers. Sometimes, these self-employed workers form networks and alliances with each other. The survey was conducted in early 2002 at a time of economic recession in Mexico. Table 9 presents the result of a cross-tabulation, excluding unemployed individuals. The Chi-Square test shows that the difference between both telecommuting samples remains significant.

Table 9
Telecommuters by Country, Excluding Unemployed Respondents

	No Tele	Tele	Total
USA	89	15	104
Mexico	35	14	49
Column Total	124	29	153

Chi-square = 4.340 df = 1 Prob =.037

Telecommuters' Productivity, Performance, and Satisfaction

The second stage of the analysis of results presents the tests for differences in productivity, performance, and satisfaction between telecommuters in Mexico and telecommuters in the U.S. According to Tables 10, 11, and 12 telecommuters in the U.S. differ from those in Mexico in their self-ascribed productivity. Telecommuters in the U.S. consider themselves as being more productive than those in Mexico. On the other hand, there are not other differences between telecommuters in Mexico and in the USA.

TABLE 10
CROSSTABULATION OF TELECOMMUTERS' SELF-ASCRIBED PRODUCTIVITY BY COUNTRY

	Disagree	Agree	Neutral	Total
USA	6	58	20	84
Mexico	14	13	7	34
Column Total	20	71	27	118

Chi-square = 20.469 df = 2 Prob = .000

TABLE 11
CROSSTABULATION OF TELECOMMUTERS' SELF-ASCRIBED PERFORMANCE BY COUNTRY

	Disagree	Agree	Neutral	Total
USA	1	13	6	84
Mexico	4	18	8	34
Column Total	5	31	14	51

Chi-square = 2.378 df = 3 Prob = .498

TABLE 12
CROSSTABULATION OF TELECOMMUTERS' SELF-ASCRIBED SATISFACTION BY COUNTRY

	Disagree	Agree	Neutral	Total
USA		16	5	21
Mexico	4	21	5	30
Column Total	4	37	10	51

Chi-square = 3.187 df = 2 Prob = .203

Organizational Support in Mexico and the U.S.

Another important factor in the telecommuting decision is whether or not the organization supports different working arrangements. To test this research question on organizational support, the survey asked respondents to indicate the level of management support to telecommuting and whether or not there were other employees working under teleworking settings. Tables 13 and 14 show that there is no difference in the extent of organizational support for telecommuting between companies in Mexico and the U.S.

TABLE 13
CROSSTABULATION OF PRESENCE OF ORGANIZATIONAL SUPPORT FOR TELECOMMUTING BY COUNTRY

		Disagree	Agree	Total
USA	Count	31	31	62
	Exp. Count	28.7	33.3	62.2
Mexico	Count	20	28	48
	Exp. Count	22.3	25.7	48.0
Total	Count	51	59	110
	Exp. Count	51.0	59.0	110.0

Chi-square = .756 df = 1 Prob = .385

TABLE 14
CROSSTABULATION OF PRESENCE OF ORGANIZATIONAL PRACTICES FOR TELECOMMUTING BY COUNTRY

		Disagree	Agree	Total
USA	Count	35	47	82
	Exp. Count	37.0	45.0	82.0
Mexico	Count	25	26	51
	Exp. Count	23.0	28.0	51.0
Total	Count	60	73	133
	Exp. Count	60.0	73.0	133.0

Chi-square = .519 df = 1 Prob = .475

Table 15 summarizes the research findings. According to this table telecommuters in the U.S. and Mexico show no difference in telecommuting performance, telecommuting satisfaction, and to the extent to which organizations facilitate teleworking arrangements. Only hypothesis 1, that telecommuting productivity varies by country, is supported.

TABLE 15
SUMMARY OF FINDINGS

Outcome	Chi-Square	Sig (2-tailed)	Supported
Performance	2.378	.498	
Productivity	13.10	.000	✓
Satisfaction	3.187	.203	
Org. Supp	.765	.385	
Org. Prac.	.519	.475	

DISCUSSION

This investigation explored the differences between telecommuters in the U.S. and Mexico in terms of productivity, performance, satisfaction, and presence of organizational support. Telecommuters in Mexico and the U.S. report similar perceptions in their telecommuting performance and satisfaction, but not for productivity. There were not country differences in organizational support and the practice of telecommuting. Telecommuters in the U.S. consider that they are more productive due to their working arrangement. Mexican telecommuters disagree that telecommuting enhances their productivity. This result is even more contradictory if we consider the proportion of telecommuters in the Mexican sample.

Differences in economic development, information technology infrastructure, availability of computers, and education suggests a higher proportion of telecommuters in the U.S. sample than in Mexico. However, the number of telecommuters in the Mexican sample is higher, proportionally, than the number of telecommuters in the U.S. one, and yet the Mexican telecommuters do not consider themselves more productive.

Lack of difference in the organizational support for telecommuting between the two nations is another important finding. From the Mexican perspective, Mexican legislation and Mexican culture promote a tight relationship between employees and managers. The apparent support for flexibility in this relationship was unexpected. There are two potential explanations: (1) cultural change due to economic liberalization policies and (2) high unemployment has generated new labor relationships in Mexican organizations. Kramer and Dedrick (2000) suggest that changes in economic policies have promoted the development of the IT industry in countries like Mexico, Brazil, Turkey, and

India. In the case of Mexico, economic liberalization programs started in the late 80s. A decade later, there was more IT infrastructure, computers, telephone lines, and IT specialists. This factor may explain the new attitude of organizations toward telecommuting. The other trigger of new organizational structure may be the high rate of unemployment at the time of the survey. This unemployment rate has likely triggered new organizational structures.

LIMITATIONS AND RECOMENDATIONS

Previous researchers have acknowledged limited generalizability of their findings due to the fact that samples were drawn from a single organization or because sampled individuals performed the same type of work. This investigation tried to address these limitations by surveying individuals who work for different organizations and who perform different types of job. However, this investigation is not exempt from limitations.

One limitation is the restricted demographic profile of the samples. Many of the individuals in the sample were individuals with age-range of 18 to 30 years, and had limited working experience. The International Telework Association and Council' annual survey reported that

> the typical teleworker ...is a college-educated white male between the ages of 35 and 44, married and earning at least $40,000 per year... .

Therefore, also targeting this population would provide broader information on the outcomes of telecommuting. Findings in the Mexican sample point toward this direction. A sample with major average age prompted a bigger telecommuters population.

Another limitation was imposed by definition of telecommuting utilized. This research framed telecommuters as individuals who work from home one or two days a week using computers and communications technology to maintain links to their offices. Some individuals in the sample reported being left out of the telecommuter category because, although they work from home one or two day a week, they did not use computers at home. Without a doubt the proportion of telecommuters would have been greater if these individuals were included as telecommuters.

Lastly, a major drawback to this project is that the Mexican sample may be non-representative of the telecommuting phenomena in Mexico. The rationale behind the sampling procedure was to avoid sampling limitations for telecommuting in Mexico, due to lack of education, of computer skills, and of access to computers. Sampling senior undergraduate and graduate students succeeded in neutralizing those factors. However, the Mexican sample characteristics are not representative of the entire national population of Mexico.

CONCLUSIONS

The results of this investigation concern the differences in outcomes resulting from alternative working arrangements. Telecommuters were found to perceive themselves as having higher levels of productivity than for the U.S. sample. No evidence of difference between the Mexican and the U.S. samples regarding satisfaction and performance were found. Also the results found no difference between the U.S. and Mexican organizational support for telecommuting arrangements.

Additionally, this research used the framework developed by Belanger for the study of telecommuting in samples belonging to two countries. This project's findings encourage future research comparing telecommuting arrangements in Mexico and the U.S.

Telecommuting has been shown to be a challenging research issue due to the many factors involved in its practice (i.e., organizational characteristics, individual characteristics) and the many levels this arrangement may impact (i.e., society, organization, individual), as well as to the difficulty in targeting the right population. Additional delimitation of the individual characteristics of telecommuters needs to be emphasized to make them the target of further investigation. Much has been said about the rise and demands for knowledge workers and the benefits of expanding corporate boundaries to reach further workforce and skills. Telecommuting and the use of information technology to eliminate physical commutes have been demonstrated as viable options to increase productivity and corporate reach. Identification of the circumstancess that have led Mexican telecommuters to ascribe themselves as less productive should be investigated further.

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PROPORTION, PEDAGOGY AND PROCESSES: THE THREE P'S OF E-LEARNING

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ABSTRACT

There is a tendency to equate electronic learning or e-learning with distance learning. In fact, e-learning covers a broad spectrum, from learning which is primarily contact based to learning which is 100% distance. Thus, each course can be measured by the proportion of learning and teaching that is intended to be conducted electronically. The principles of course design applied to the development of a given course should be influenced by the position of a course on this spectrum. Furthermore, there is a relationship between the proportion of e, the design strategy and the pedagogic model adopted by the designer. In this context we juxtapose didactic and constructivist models of learning. The substantial recent development of web based learning has sparked renewed interest in constructivism and the way in which web based technology can facilitate engagement. Whilst the relationship is not linear, we argue that the greater the proportion of e-learning used, the more developed the active learning components that are required. Finally, the development lifecycle adopted, and therefore the processes used in the development of the course and the software used for implementation of the course, will differ according to the proportion of e-learning anticipated. This argument is developed in the context of e-learning in higher education.

INTRODUCTION

We can define e-learning simply as learning facilitated through electronic means. Research and development in e-learning in higher education has been well established for decades although the term e-learning is relatively new. In the 1980s and 1990s terms such as Computer Based Learning (CBL) and Courseware were widely used, yet fit the definition above. There has been a substantial increase in interest in higher education in e-learning since the establishment of the World Wide Web (Web) in 1991, and especially since the late 1990s as a result of the widespread adoption of the Web as a universal interface. Thus a contemporary definition of e-learning should probably include the use of the medium of the Web since this is how the term is now used colloquially.

At the same time we cannot ignore the use of other terms used in this context. The well established term online learning has to some extent been superseded by terms including virtual learning, web based learning, open learning, flexible learning, mixed mode learning and blended learning. Although these terms are well established their definitions are not. We use e-learning simply because it is probably the most widely used of a number of terms with similar meanings.

Today we are in the midst of a stampede to embrace e-learning with significant investment being made by Universities and other organisations throughout the world. Major alliances have been established, such as Universitas 21. Universities are both keen to defend and extend their empires. There has been a rush to place learning materials on the World Wide Web for fear of 'missing the boat.' Most Universities have appointed staff with titles including the terms used above. Since this initial rush, there has been a substantial body of opinion questioning the educational benefit of this development, subjecting e-learning to a level of scrutiny not experienced by more traditional means of dissemination of knowledge. Pedagogical quality has become the litmus test of e-learning and the quantity and calibre of interaction has become one of the main measures of this quality.

WHAT PROPORTION OF E

It is valuable for the course designer or lecturer to decide upon the proportion of both the delivery of their course and the student learning experience that will be conducted by electronic means. This decision depends upon a great number of often conflicting issues including course objectives, stakeholder views and resources.

The great majority of higher education includes some use of electronic materials. This can range from the use of copies of electronically produced lecture notes, to the use of slides projected through computer equipment to entire courses on the World Wide Web. A simple horizontal rule can be used to indicate the proportion of the delivery of a course that is intended to be conducted electronically (Figure 1). Note that this line may be applied to either a measure of the proportion of electronic delivery or the proportion of the student learning experience: no distinction is drawn in this paper. By definition a course which includes e-learning may also fall anywhere on the line in Figure 1.

We can attempt to add to this scale different terms, whose use to some extent can be distinguished by their proportion of electronic delivery. We can call this a spectrum of e-learning.

Unlike the spectrum of light the scale in Figure 2 has no rigid scientific basis since terms such as flexible learning, open learning, online learning and distance learning tend to be used interchangeably and receive meaning only through their useage. For instance a course whose content is in the main delivered electronically may well be described as flexible learning. It is not the intention of this paper to provide a classification of these terms.

Whilst it is important for course developers to determine where their course falls on this scale, clearly in practice many courses evolve along the scale from left to right or right to left. Courses which are described as 'full time attendance' or contact teaching may include a substantial and growing element of distance learning by electronic means. Courses that are described as 'distance learning' may include the introduction of substantial face to face contact such as regional tutorials. The process of courses moving along the scale is gradually blurring the distinction between contact and distance learning.

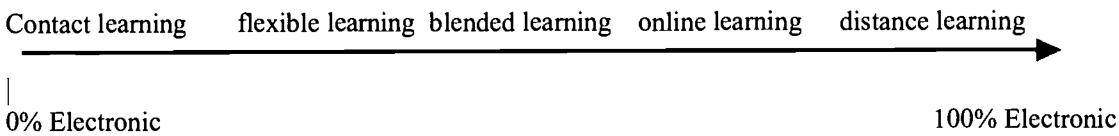
SHOVELWARE

The use of electronic media is not new: the development of the World Wide Web (Web) has simply extended the range and functionality of facilities used. The Web has, however, made the development of e-learning much more widely available.

There has been a tendency amongst early adopters of Web based learning to use the Web as a simple huge repository for course materials such as lecture notes. Once such materials were placed on the Web it could be called e-learning and since the term was synonymous with distance learning, traditional means of teaching such as lectures and tutorials ceased to be required. Accountants rubbed their hands in glee until questions were raised concerning the pedagogical value of such education. This practice has became known as shovelware. Shovelware refers to "any content shoveled from one communication medium to another with little regard for the appearance, ease of use, or capabilities of the second medium" (Fraser 1999). There has rightly been a strong reaction to shovelware. Fraser argues "You may have shifted the nature of student access by moving to the Web, but access is not insight". There is substantial evidence that the students don't want it (Hara and Kling 2000), (Oliver and Omari 2001) and (Sheard et al 2000). There is also significant concern about the consequent commercialisation of higher education (Noble 1998).

FIGURE 1
PROPORTION OF DELIVERY BY ELECTRONIC MEANS

FIGURE 2
SPECTRUM OF E-LEARNING



In her paper 'Models of Online Courses' (1998) Robin Mason discusses how experience of using Web technology has shown course designers how learning is best encouraged and supported in the online environment. She uses the term 'Pedagogical Evolution' in this context. In consequence to this reaction there has been a scramble to adopt ideas concerning good pedagogical practice from the obvious source of knowledge; experts in distance education and those with experience in the development of CBL. In Britain as in other countries this has meant recourse to our specialist distance learning provider, The Open University. The fruits of this experience are now being applied to e-learning and may typically include the following ideas:

1. Since effective learning involves active learning, the pedagogical quality of e-learning materials can be simply measured by the quality of interaction involved.

2. Development of effective e-learning materials is extremely expensive and is best left to experts. One Figure oft quoted whose source is unclear is that 200 hours of development time are necessary for one hour of delivered e-learning material. The Open University once estimated that the development of a new course cost £1 million (Scott 2001).

3. As a result of 1 & 2 above, substantial planning, analysis and design is necessary before e-learning materials can be developed. By implication therefore a sequential lifecycle model is the most appropriate to the development of e-learning. (eg see Phil Race model used in 'course design for On-line learning' 1 day workshop at University of Salford 3/11/00 Figure 7. Also see Dick and Carey(1990)).

4. Off the shelf tools do not provide the level of complexity or customisability required and are therefore not suitable for the development of e-learning.

This pedagogical correctness is examined in the following sections.

THE PROPORTION OF INTERACTION

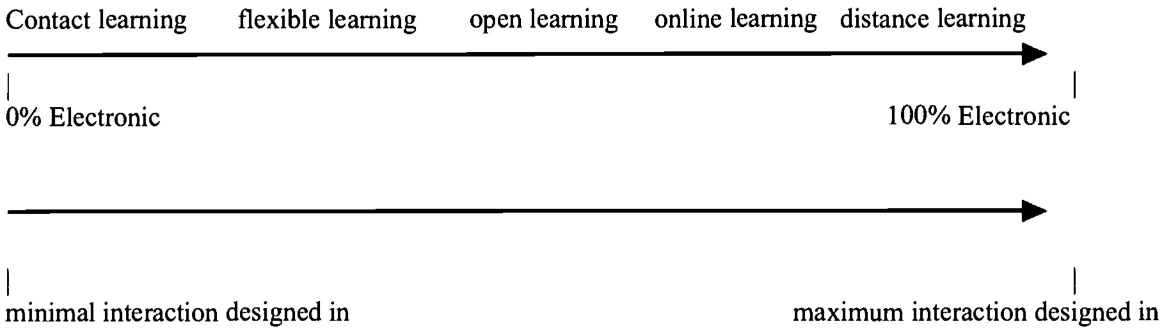
It is widely agreed that the level of engagement with and participation by students is a key metric in the quality assessment of higher education eg (QAA 2000 p. 41) and (SCOTT 2000). Designing interaction is rightly regarded as a vital part of the experience of higher education. It follows therefore that the greater the proportion of the learning objectives that are expected to be achieved by electronic means the greater the proportion of interaction that has to be designed into the e-learning materials. It can be argued that the converse is also true (see Figure 3).

ELECTRONIC LEARNING BY SPECIALISTS

It has been argued above that e-learning is not necessarily the same as distance learning. It follows that in some situations, where the delivery of courses whose delivery is in great part (eg >90%) electronic, the development work may best be left to specialist distance institutions. In the majority of situations the bulk of e-learning is lower on the spectrum and the main pedagogical issues may not be those involved in distance learning.

Distance learning clearly offers substantial advantages to the learner, for example in the area of accessibility, and therefore has a substantial market. One could argue that courses whose learning and teaching which is mainly required to be conducted by distance should be left to the specialist distance learning institutions. They have the necessary infrastructure such as departments for course design, reprographics, copyright, telephone helpline, on line libraries etc. The Web offers new

FIGURE 3



possibilities in terms of the media used in the delivery of such services.

However, in general what the materials of the dedicated distance learning institution gain in quality of production, they lose in flexibility. When a course involves investment of 200 hours of labour per hour of delivered material, substantial and restrictive version control procedures are necessary. Furthermore, changing distance learning materials is a significant problem when students may be enrolled on a course for many years. In fast changing academic areas, such as Information Systems, this creates a substantial and intrinsic problem for distance learning.

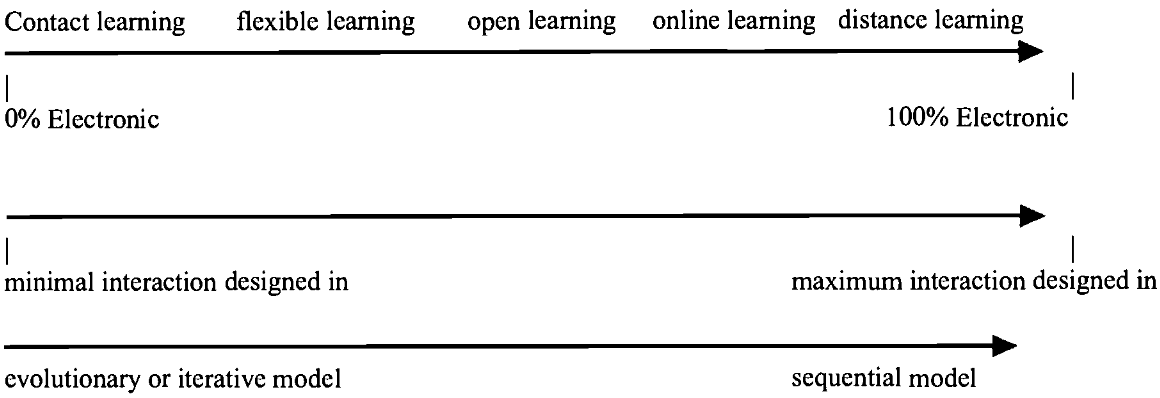
In this way institutions whose foundations are built upon contact teaching may usefully adopt an evolutionary life cycle approach for the development of e-learning materials.

LIFECYCLE MODEL TO BE USED

The debate concerning development lifecycles, established in the literature of software engineering eg (McConnell 1996), has been adopted into more general Project Management texts such as the Project Management Body of Knowledge (Project Management Institute 2000). There is significant debate concerning this issue in the context of web development - see (Scharl 2000) and (MacCormack 2001). One can juxtapose the sequential model of development known as the Waterfall model (Royce 1970) with the iterative model of development known as the Spiral model (Boehm 1988) and 1996). The evolutionary model put forward by (Scharl 2000) could be described as a close cousin of the spiral model. In the Waterfall model each stage of development follows each other sequentially until the final product is tested and released to the market. In the Spiral model, there is a substantial degree of user involvement and the product passes through a number of iterations before final release. In true evolutionary development there may be a number of planned releases, each one building upon the previous release. This is practised by a number of e-commerce organisations such as Expedia (ref. Computer). There has been much debate on the respective merits of different life cycle models (McConnell 1996), (Redmill 1997). In truth each is suited to different situations. Whilst the sequential model is the only practicable one for a major one off project such as a space mission to Mars which must be right first time, an Evolutionary or Spiral model may be much better suited to the development of a web site used for promotional purposes or for the purposes of supporting materials for a course that is primarily contact based.

In this context one could argue that the life cycle model to be adopted depends upon the proportion of the learning objectives that are to be achieved by distance. Whilst the sequential model is most suitable for a course that is designed to be delivered mainly by distance, the spiral model or evolutionary model is better suited to a course that is primarily contact based and is using electronic materials for support purposes. This is of course an important issue since the emphasis in the Waterfall model on getting the analysis and design right at first may actually obstruct the introduction of valuable support materials, where the adoption of a 'Just do it' philosophy may be more appropriate see Figure 4.

FIGURE 4



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BRINGING ENTERPRISE AND E-BUSINESS CONCEPTS TO THE CLASSROOM: THE CASE OF 240CO

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ABSTRACT

Introduction to Information Systems is a required second year course for all students completing an undergraduate degree in business or a business minor at the Sprott School of Business, Carleton University. This paper highlights recent curriculum innovations that have occurred in the course to incorporate concepts pertaining to enterprise systems, enterprise integration, process, and the transformation to e-business. The concepts are introduced in lecture and are then brought to life through collaborative learning activities as the students become a company (240co) and work in groups to simulate the concepts they have learned. At a second year level, students have not yet encountered all of the functional areas of a business nor have they seen the interplay among the functions. Through the simulated company experience, students come to appreciate what all the business functions are, and they experience some of the challenges a firm goes through on the road to becoming an integrated, e-business enterprise.

INTRODUCTION

Today concepts like e-commerce, e-business, intranets, and enterprise integration which only a few short years ago were scarcely found in IS curriculum, are working their way into the basic introductory information system textbooks reflecting what has been happening with IS faculty as they revamp and revise their classes to incorporate the new concepts. These concepts are not about IT along but include the need to understand business processes and the interaction among business functions. Consider for example learning how Marketing, Accounting, Production, and Operations interact and how they use technology in order to fulfill a customer's order.

The paradigm of enterprise integration and e-business suggests a move away from functional, silo based approaches when teaching these concepts (Selen, 2001; Shtub, 2001.) The reality is however, that the silos themselves are not disappearing even in organizations that claim to be process-oriented, fully integrated, and e-enabled. The implication for the students is that they must then be able to weave together the functional orientation of the firm with an overlay of integration through process, information flows, and information technology. This is consistent with research on skills for IS professionals which found that business knowledge, including an appreciation of business functions, and the ability to interpret business problems and develop appropriate technical solutions represent required critical skills (Noll and Wilkins, 2002).

One of the modes of bringing the concepts of enterprise integration and e-business to the classroom has been through the introduction of enterprise systems also referred to as enterprise resource planning systems (ERP). Through programs like the SAP University

Alliance, universities world-wide are creating an environment in which students can use an e-enabled enterprise system like SAP R/3 to learn some of the concepts. A number of papers have been written that give examples of innovative ways of using enterprise systems in the classroom. Shtub (2001) for example presents a methodology for teaching processes along with a special training aid called the Operations Trainer that "simulates the entire order fulfillment process from customer orders to the purchasing of raw material. Four interconnected functional areas are presented." (p. 569). The focus is on the traditional management of operations in a functional organization with process and advanced information systems being emphasized. Another example is an industry-oriented initiative developed in Australia (Stewart and Rosemann, 2001). Working with an industry partner, business and information technology graduate students develop an ERP-related reference process model of an actual business. "This project allows students to understand common business functions and appreciate a process view of organizations" (p.240).

The Sprott School of Business at Carleton University is also embarking on introducing enterprise integration and e-business concepts into the classroom. The School uses a broad based definition of e-business—one that emphasizes that e-business is as much about business process and management practice as it is about technology. The definition includes the notion of an integrated enterprise, linked with its customers and suppliers, and with the ability to manage processes and information flows through the use of enterprise systems and Internet-based technology.

Important in the School's approach to e-business is recognition of the need to think cross-functionally. Integration cannot take place if the perspective remains one of functional silos. This is not to say that the standard functions of business such as Marketing, HR, Production, etc. will disappear. Rather, from a curriculum standpoint, the goal is to have the students appreciate both the functional perspective and the interdependence and interaction which takes place across functions in order to complete the core business processes of an organization.

At the undergraduate level, this goal has been particularly challenging given the limited knowledge the students have of the various business functions. By the time a student graduates they are expected to have some depth of knowledge in a particular function such as Accounting or Information Systems and it is expected that they will have touched all of the business functions through their required courses. Students in first and second year however, have had an introduction to only a few of the traditional business functions. It is these same students that are being introduced to the concepts of enterprise integration and e-business and that represent the audience for the curriculum innovation that is the focus of this paper.

COURSE BACKGROUND

Introduction to Information Systems is a required second year course for all students completing an undergraduate degree in business or a business minor. The course runs for one semester of 13 weeks. Approximately 600 students a year take the course in sections varying in size from 60-70 students each. This undergraduate business program core course serves as a strong building block for upper-level courses in all functional areas of the business school.

As an introductory course, the range of topics covered is very broad. The goal is not depth in a particular IS topic, but rather breadth across a range of IS related topics that reflect the use of information systems technology in business. Topics include but are not limited to: enterprise and functional systems; networks and telecommunications; databases and data enhanced decision-making; e-commerce and Internet technologies; business processes; and systems development and management. Hands on components include the development of simple, individual websites and as well as collaborative, group-based websites and an Access database that forms the backend for role-based access to data through an intranet.

CURRICULUM INNOVATION – 240CO

While the concepts such as enterprise systems, process, and e-business have been covered in this intro course for a number of years, there was a desire to create some mechanism to bring these concepts to life for the students. Telling the students that it is difficult to share data across the organization carries little significance. The goal of the curriculum innovation was to bring a business and all its complexity to the classroom so that, through a simulation, the students could at least in part experience some of the dynamics of a business as it tried to transform itself into an integrated e-business enterprise.

In the first class meeting, students are introduced to 240co and are welcomed as employees in the company. All sections of the course run as their own company, though the basic company is the same for each section. The organization chart is shared with the students along with background on the history of the company and the products it manufactures. At this beginning stage, the firm does not do e-commerce, nor do they have an enterprise system. The instructor (Executive Suite) is the most senior person in the organization. Below the instructor are two levels of hierarchy—a senior management group and a series of functional area groups. In week two, the students are randomly assigned to one of the groups. In total 14 groups are created representing the following: Senior Management, Sales, Marketing, Customer Service, HR, Training, Finance, Accounting, Research and Development, Manufacturing, Engineering, Purchasing, Information Systems, and Shipping, Receiving and Warehousing. The potential for overlap in the definition of these functional areas is purposeful as one of the first exercises the students do when they get into their functional area group is to define the roles and responsibilities of the function. As students report out on how they have defined their function, overlaps in responsibilities are highlighted and the students are asked to reflect on what types of problems and benefits they think that might mean for the company.

Table 1 outlines the series of activities that are covered over the course of the semester. The order of the list of activities reflects the order in which they are covered during the semester. Each activity is described briefly along with the outputs expected from that activity. The activity may take place directly and entirely within the time allotted in a weekly class or it may require the students to follow-up outside of class. Each section meets once a week for 3 hours. In most weekly sessions the first half of the class is spent covering the concepts in the textbook for that particular week. The second half of the session involves what is fondly referred to as a "group hug". During the group hug, students work in their groups on the activity at hand. The activity may require them to interface with other groups. It may require them to interface with the senior management group. The groups may or may not do a brief report out in that same week of what they have worked on in their group.

The most intricate of the simulation activities is the database exercise. The exercise is designed to highlight the difficulties of sharing data between functional areas in a large organization. In this assignment, each functional area group is required to request a meaningful set of data from three other arbitrarily designated 'partner' groups. The requesting group asks a data question of their partner group (the Sales group, for example, might ask the Shipping, Receiving and Warehousing (SRW) group to report on current warehouse inventory levels of various products). The recipient group then creates a fictional set of data to answer the question. The recipient group must also write a set of queries in Access in order to answer the question in a meaningful way. These queries are then added to the Access database in a query table. The final step is that the recipient group needs to specify viewing permissions in another table. So if Sales requested data from SRW, then Sales, in creating the table, must give access to themselves, to the SRW group, to the Senior Management Group and to the Executive Suite.

Once the databases are received, the instructor imports all the data from the individual databases using a set of routines that rely on the specific format of the student databases. The result is a master database that serves as the backend to an intranet site, and allows role-based access to the data that each group has been allowed to see. So an individual student logs into the 240co 'intranet' website using their student number. The website has embedded logic that allows it to determine which area group a student is a member of, and then goes about creating an environment for the student, driven by their group membership. In the specific student's environment they see only the data they are allowed to see, based on the permissions that were set as part of the database assignment. So the Sales Group would only be able to see the data that has been explicitly exposed to them through the permission table created as part of the assignment.

TABLE 1
THE SERIES OF ACTIVITIES USED TO SIMULATE A FIRM TRANSFORMING ITSELF TO AN INTEGRATED E-BUSINESS ENTERPRISE

240co Simulation Activities C/A*	Description/Objective	Outputs	Evaluation Y/N
Creation of Organization C	Provide context of organization.	Put students into functional area groups including a senior management group.	N
Function's Work System Definition C+A	Each functional area group is asked to define the roles and responsibilities for their respective groups. The definitions are to include a description of the basic data that the group would create, who their customers are ,what technology they would use, and what their main functional processes are.	Students get started in class and then in the next week are asked to make a brief (5 minute) presentation on the definitions they have derived for their function.	No – but written feedback provided
Employee Web Sites A	Creating a website that reflects student and student's role as an employee in 240Co.	2 –3 page website created by each student.	Yes – Individual assessment
New Corporate Strategy C	The Executive Suite (instructor) lets the students know that the company is going "e". The firm is now going to develop e-commerce capabilities, redesign processes, and install an enterprise system.	Brief (2-3 minute) in-class presentation from each functional area group of what impact they perceive the recent announcement will have on their function.	No
Identifying and Sharing Business Data C	Each functional area group identifies the business data they would own. They also identify which functional area groups would most likely request data from them and which functional area groups they would most likely request data from. In all instances examples of the data are to be supplied.	Brief (2-3 minute) presentation from each functional area group of which other functional groups they would likely go to for data to run their operations effectively and which groups would likely come to them for data. All functional groups are listed on the board. As the groups report out, arrows are drawn between the groups to represent the sharing of data. The result is a messy spaghetti chart.	No – but debrief with whole class.
Functional Area Group Web Sites A+C	Focus on creating an intranet and contrasting desire to be unique at individual and functional area group levels and yet look for consistency at a corporate level.	Functional Area Group Web sites linked into an intranet. Websites to include a mission statement of function along with main roles and products or services of function. Presentation of websites by respective functional groups.	Yes
Data Exchange / Intranet Development A+C	Using Access students create data tables and queries on data that they create that relates to their function.	Students create a set of internal tables (for their function) as well as external tables that are based on requests for data from 3 other functional area groups.	Yes
Future Directions A+C	Each function area group is asked to reflect back on the semester and identify which of the technologies that have been discussed in class would help to move the e-agenda forward for their specific function and the company as a whole.	Five minute prepared presentation from each functional area group.	Yes

* Context of Activity C = Classroom, A = Assignment

CHALLENGES AND LIMITATIONS

The main challenge of making 240Co possible each semester is the administrative requirement of running the course. The administration includes both the face-to-face activities with the students along with the backend systems functionality associated with the course website. On the student front, managing the groups and processing the assignments can require considerable instructor attention. Well-trained teaching assistants to run the labs for the hands-on components are also a must. The teaching assistants have contributed considerably to the creation of documents, available through the course website, that serve as aids for each of the assignments.

On the technology front, the success of the Access assignment relies heavily on a custom-built website using Active Server Pages to embed processing logic in the website. The student interface, which is evolving as the course matures, allows for news items, assignment information, course information, lab materials and other associated documents to be disseminated in a one-stop shopping format. In addition, student marks and group information is hidden behind a username/password protected front-end that also serves to provide the logic to the intranet site for the Access assignment. This importance of the website backend cannot be underestimated. Not only is it an efficient vehicle to provide course-specific materials and secure information to students, it also serves to illustrate many of the concepts taught in the course.

The course is currently designed for sections of approximately 70 students. This may not be large enough to satisfy class sizes in other institutions. The simulation could be expanded to accommodate greater numbers of students through the addition of more functional areas groups. The current number of area groups is 14. A maximum of 16 area groups is suggested with no more than 6 students per group bringing the possible section size to 96. Beyond this size, the quick report outs and coordination across groups would become unruly.

FUTURE DIRECTIONS

The simulation of 240co serves to demonstrate many of the concepts behind enterprise systems including business processes, shared data stores, etc. A hands-on component using an enterprise system is a logical next step. Beginning in the fall of 2002, the use of SAP's R/3 enterprise system will be incorporated into the course curriculum. Each functional area group will enter transactions into the system that are logical for their function. The students will then be required to track which functional area groups have been impacted by the transactions. The eventual use of mysap.com will provide new opportunities to highlight additional e-business concepts. The goal is that the 240co simulation will bring each of the organizational functions to life for the students and the interfacing with the enterprise system will serve to reinforce the interaction and interdependence among the functions in order to accomplish core business processes.

Assessment of learning outcomes is anecdotal at this point. Attendance has been a problem in this course in the past. The new format has resulted in near full attendance at all sessions. The level of activity in the classroom suggests that students are grasping the complex concepts. They get down to business in their group hugs and are very serious about the discussion. As part of their functional area group websites the students must create a mission statement and a definition of the roles of their function. They take this exercise very much to heart and are quite proud to share with their classmates the contribution they believe their function is making to the success of 240co. The students often take initiative within their functional role to suggest some new options for 240co. These suggestions are beyond any of the requirements of the assignments and demonstrate the ownership that the students feel toward 240co. More formal assessment of this curriculum innovation is required and will be a focus in the coming semester.

CONCLUSIONS

The management concepts behind e-business and enterprise systems are as important as the technologies associated with the concepts. Through the use of the 240co simulation, second year students get to know all the functions better and they begin to see how the silos operate and how they need to interrelate with each other. At the same time they also experience how technology can help and hinder the flow of information necessary in an integrated environment.

The simulation can be used on its own or as an intermediate step to bringing R/3 into the classroom. Installing SAP's R/3 enterprise system into a university setting is not a trivial exercise. As a consequence, an additional goal of this course innovation was to develop a way to have students learn about enterprise integration and e-business without dependence on having an established R/3 environment.

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NAVIGATING THROUGH THE MAZE OF CURRICULUM MODELS AND ACCREDITATION IN UNDERGRADUATE INFORMATION-SYSTEMS EDUCATION

Panel

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Information systems (IS) education can be taught across many types of schools and departments including Management, Engineering, and Liberal Arts. Yet, regardless of type, IS curriculum models play a key role in the revision and modernization of university curricula and textbooks to support them. Many factors influence what students are ultimately taught, including curriculum models, accreditation requirements, student-body characteristics, instructor, instructional materials, and requirements of the business community. It is generally agreed that IS curricula need frequent updating to remain effective.

IS curriculum models not only enable academic communities to maintain programs that are consistent both with the needs of the business community and the body of IS knowledge, but also provide for administrative awareness regarding course offerings and resources needed for a viable program, including computing hardware, software, and laboratory. Those who hire students graduating from programs following a curriculum model have a better understanding and appreciation for each student's knowledge base.

There are several published curriculum models for undergraduate IS education in a four year degree program. The IS'97 Model Curriculum and its on going revision, IS'2002 Model Curriculum [http://www .is2000.org/], are independent of academic unit and corresponding department. The IS'97 Model Curriculum, developed jointly by the Association for Computing Machinery (ACM), the Association for Information Systems (AIS), and the Association of Information Technology Professionals (AITP) (formerly

DPMA), was reviewed by over a thousand individuals from industry and academia. The IRMA Curriculum Model was developed by a joint task force of the Information Resource Management Association (IRMA) and the Data Administration Management Association (DAMA) and was adopted at the 2000 IRMA International Conference in Anchorage, Alaska Model. The IRMA Curriculum [http://www.irma-international.org/] is a generic framework for an international curriculum on information resources management in schools of management and is designed to be customized to accommodate institutional requirements. Information Systems-Centric Curriculum (ISCC'99), funded by the National Science Foundation, contains guidelines for educating the next generation of information systems specialists and has been developed jointly by academicians and practitioners from industry [http://www.iscc.unomaha.edu/]. The ISCC'99 curriculum is intended to prepare information specialists for the development and use of large information systems.

There are primarily two processes of accreditation that impact information systems curriculum. Schools and departments of management are concerned with achieving and maintaining AACSB [http://www.aacsb.edu] accreditation. Second, is the new information systems accreditation conducted by the Computing Accreditation Commission (CAC) of the Accreditation Board for Engineering and Technology (ABET) [http://cis.bentley.edu/isa/pages/accreditation.html]. The latter accreditation is geared towards the approximately 50% of IS programs located outside of management and business schools. Accreditation is used to differentiate programs and is highlighted in program and institutional marketing endeavors.

The objective of this panel is to explore the impact of curriculum models and accreditation on IS undergraduate curriculum and degree programs. IS educators from Schools of Management, Engineering, and Interdisciplinary Programs will present their current and planned approaches to the IS curriculum. It is hoped that the paths taken by these educators will help others navigate through the maze of curriculum development.

TEACHING CASE STUDIES: A COLLABORATIVE APPROACH

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ABSTRACT

Many of the Association to Advance Collegiate Schools of Business (AACSB) accredited schools require undergraduates MIS majors to take a course in the management of information technology. Over half of these schools utilize case studies in the teaching of this course. We believe that case studies are an important vehicle for teaching crucial IT management issues, particularly in providing students with a real-world example of organizational issues, and that case studies are best taught in an active, collaborative environment. Based upon our understanding of collaborative learning and collaborative teaching, we propose a procedure for enhancing the effectiveness of this active learning methodology, and discuss how this methodology has been implemented.

COLLABORATIVE LEARNING

Collaborative learning is defined as a learning process emphasizing group or cooperative efforts among faculty and students, stressing active participation and interaction on the part of both students and instructors (Brufee, 1984). Collaborative learning has long been stressed as an effective teaching methodology by theorists (Vygotsky, 1978). A review of the literature of peer/collaborative learning can be found in McKeachie (1999).

The importance of collaborative learning extends to the business environment, particularly in the use of teams to accomplish business tasks. The effectiveness of using teams to accomplish information systems tasks in the business environment is well recognized (El-Shinnawy and Vinze, 1998; Janz, 1999). Surveys of employers indicate that teamwork skills are among the most important when evaluating IS graduates for entry-level positions. Employers have rated teamwork skills as more important than systems analysis and design, database, or programming skills (Van Slyke, Kittner and Cheney, 1998).

Collaborative learning is recognized as an effective teaching methodology in MIS programs in the United States. Through collaborative learning, students learn to take advantage of each team member's expertise and to experience first-hand the problems of coordinating a team effort (Goyal, 1995/1996). Studies have shown that collaborative learning leads to a higher degree of satisfaction with the learning process, to a greater motivation to learn, and to better performance (Flynn, 1992).

Aram and Noble (1999) argue that the traditional lecture approach does not adequately prepare students to understand and cope with the levels of ambiguity and uncertainty they will inevitably face when assuming entry level positions. Collaborative learning can be utilized in a number of class settings, and it is particularly appropriate for system development projects. Collaborative learning can also be effectively used for research projects and simulations. However, it is our intention to focus on how teachers can utilize techniques of collaborative learning in the teaching of case studies in the Management of IT course.

COLLABORATIVE TEACHING

Instructors in a collaborative teaching environment can also realize some of the same advantages enjoyed in a collaborative learning environment. In particular, instructors can benefit from synergistic effects promoted by team dynamics. In addition, collaborative teaching can lead to a quicker development of best teaching practices.

Brabston, et al. (1999) proposed three models for collaborative team teaching:

1. The interactive model. Two or more instructors in front of the class at any one time.

2. The rotational model. Each member of the teaching team teaches in only that part of the course related to his or her area of expertise.

3. The participant-observer model. Each team member alternately takes the lead in teaching. The other team member primarily observes but also actively participates when appropriate.

Buffington and Harper (2001) have presented a fourth model for informal collaborative team teaching.

CASE STUDIES

Case studies are an important tool for teaching MIS concepts (Tracy and Waldfogel, 1997). Romm and Pliskin (2000) cite a study by Lee, Trauth and Farwell (1995) showing four major clusters of knowledge/skills required of MIS personnel in the upcoming decades:

1. Technical Specialties Knowledge/Skills: including operating systems, programming languages, database management systems, networks, telecommunications, etc.

2. Technology Management Knowledge/Skills: including issues such as where and how to deploy information technologies effectively for meeting strategic business objectives.

3. Business Functional Knowledge/Skills: including how to re-engineer business processes before the adoption of a new information system to produce maximum benefit from the system.

4. Interpersonal and Management Knowledge/Skills: which relate to the "boundary-spanning" role of IS personnel. This role requires IS professionals to master interpersonal skills such as selling, negotiating, leading, and counseling.

Romm and Pliskin (2000) note that of these four skills, three of them—technology management, business knowledge, and interpersonal skills—are not the traditional "hard skills" associated with an IS education, but rather can be classified as "soft' skills because they emphasize an understanding and ability to work with people rather than machines. Romm and Wong (1997) persuasively argue that the best way of teaching these soft skills is through the use of case studies.

Case studies are routinely used in a number of MIS courses. In a content analysis of 34 electronic commerce course syllabi, Sendall (1999) found that 44 percent of e-commerce classes were incorporating case studies as part of the curriculum.

Our focus is on the IT management course at the undergraduate level. We believe that this course is critically important to the MIS major, and we share the surprise of O'Hara and Stephens (1999), who found that this course is not universally required at AACSB-accredited schools. In their study, O'Hara and Stephens content analyzed 39 undergraduate syllabi of the IT management course. They found that the most common assessment method of students in this course were exams, quizzes, case study analyses, research papers or topic studies, computer-based projects, reports, and assignments. Of the 39 courses, only 51 percent utilized case studies. Further, case analyses accounted for only 16 percent of the grade, on average.

TEACHING CASE STUDIES THROUGH COLLABORATIVE LEARNING

Case studies can be taught with many different methodologies. Romm and Mahler (1991) describe five methodologies:

1. **Individual processing**. Students prepare for cases as individuals.

2. **Chronological group discussion**. Each case is presented via a team (and instructor) with the team intact throughout the interactive discussion.

3. **Simultaneous group discussion**. Each case is first discussed in sub-units, which later recombine as one large group.

4. **Chronological group dramatization**. Cases are dramatized with the all students serving either as actors or audience.

5. **Simultaneous group dramatization**. Students first break into sub-units which later recombine for case dramatization.

Each of these methodologies has its virtues, and each involves a certain amount of active learning. Annette Jones (2000) summarizes the argument for active learning:

> Active learning is based on the assumption that learning is by nature an active undertaking, and that different people learn in different ways (Meyers & Jones, 1993); it presumes that students learn best by doing. Active learning provides opportunities for students to talk and listen, read, write and reflect on course content through problem-solving exercises, small group discussions, simulations, case studies and other activities. Biggs (1999) also suggests that active engagement in the learning process encourages the less academic student to employ high-level engagement techniques such as theorization, reflection, application, which are more naturally adopted by the more academic student even if the teaching method is more passive.

We believe that one of the greatest strengths of teaching cases is the flexibility which they provide the instructor. A teaching case allows an instructor to choose the level of depth for discussion of a topic, as well as which topics, theories, and practices are discussed. While many teachers have developed their own pedagogical methods for teaching cases, there is no generally accepted prescription for one "right" way to teach cases.

As we continue to sharpen our teaching skills, several questions occur to those of us that teach cases in class. These questions generally center on inquiry as to whether our approach is the most appropriate. Generally, the purpose of case instruction is to provide a real-world example of the issues that organizations must face. Such exposure allows students the opportunity to identify issues and problems faced by a firm, to see vague, conflicting and often ill-structured business scenarios, to evaluate decisions made by the principles, to relate theory and concepts to a specific instance, and/or to make recommendations about what should be done based upon the student's own knowledge of the subject matter. As such, it is always our hope that the material will "come alive" for the students, generating high interest because of the fact that the issues are real and the companies are struggling to deal with them.

Teachers have often assigned cases to small groups and then have these students present their analysis to the class. We term this approach the "traditional case approach." However, some teachers who have been teaching cases for a while have developed his or her own particular method for conducting discussion of a case in class. We next sketch out the two methodologies we have most recently followed.

CASE STUDIES IN THE IT MANAGEMENT COURSE AT OUR UNIVERSITY

Each of the two authors of this study teaches the IT Management course. For the past four years, Instructor "B" teaches the course in the fall semester, and Instructor "A" in the spring. Both of us are proponents of active, collaborative learning in the teaching of cases. Both of us are interested in improving the effectiveness of our teaching. We have in the past informally discussed the teaching of cases in our respective classes, and have determined that a more formal approach to improving our teaching is in order.

As a result of our informal discussions we have developed a case study evaluation instrument. It was administered for the first time in spring 2001, and was subsequently administered at the end of the fall 2001 and spring 2002 semesters. Below, we describe the case teaching methodologies employed by each instructor in his respective section.

The Spring 2001 IT Management Class—Instructor "A"

Inspired by a workshop hosted by Larry K. Michaelsen (see Michaelsen, 1997-1998) prior to the beginning of the semester and disappointed by the negative feedback I received from my spring 2000 class, I made several sweeping changes to my case study methodology. In spring 2001, I divided my class of 22 students into seven teams. I consciously used principles of demographic diversity as advocated by Trimmer, Van Slyke and Cheney [1999] in comprising the teams. I also ensured that there would be at least one "high-performing" student on each team. The teams endured throughout the semester. Although Michaelsen strongly advocates giving students all the class time they need to operate in groups, I purposefully composed teams whose members shared some free time at some point during the week. Further, I encouraged teams to conduct e-meetings to discuss case questions and to prepare the final report.

Five case studies were assigned at the beginning of the semester, with case discussion to begin on the fifth week of the semester. The cases came from Turban (1999). Text questions for each of the five cases were supplemented with my own questions.

On each case studies day, the period began with all students taking a short multiple-choice quiz on the details of the case. As advocated by Michaelsen in his workshop, students then immediately grouped together in their teams to discuss the quiz and to retake it, this time as a group quiz. The quizzes served to motivate students to read the case carefully.

I then led the discussion of the case questions in a question-answer format. Students frequently enlivened discussion with vigorous debate, as opposing points of view were enthusiastically presented. Invariably, discussion would fill the remainder of the class period, and the following class period was dedicated to tying up the loose ends of the case.

One week after the case discussion concluded, each team submitted a written analysis of the case. At the end of the semester, all students rated the relative contributions of their teammates. Students were forced to give at least one teammate more points than the rest, a practice advocated by Michaelsen. Altogether, the case work (quizzes and reports) was worth 25 percent of the course grade. Forcing students to allocate points unevenly led to several students having their course grade elevated or demoted a level.

The Fall 2001 IT Management Class—Instructor "B"

I assign a short, end-of chapter case at least one week in advance. I ask the students to read the case and answer the questions included in the text after the case. The students' written (wordprocessed) answers are turned in to me *after* the case is discussed in class. I make it very clear that their work is not graded in terms or "right" or "wrong"; instead, I simply look at each paper to determine whether a thoughtful and justifiable response has been formulated. Once the cases have been turned in, I grade each student's work by assigning a check mark (✓) or minus (-) indicating whether I have deemed their work to be sufficient. Insufficient answers are relatively rare. Those receiving a check mark are given credit for all of the points for the assignment, while those who receive a minus receive no credit.

The written answers to the case questions serve as reference for the students as we discuss the case in class. Because of the availability of some written guidance, many of the students seem more at ease when they are called upon to contribute to the discussion. Also, I have noticed that students seem to be more prone to add to the discussion voluntarily when they have a well-formulated response in writing at their disposal.

I purposefully don't read the questions accompanying the case before the class discussion. Instead, I work up my own set of questions. My reasoning for this approach is that if I read the questions prepared for the case, I may actually constrain my own thoughts about the issues. I prefer to lead the discussion on what I feel is most important to emphasize. Only after I have exhausted my own list of questions for the class will I ask for responses to the given case questions if, in fact, we have not already covered the question in our discussion.

When I have a classroom that allows for rearranging the student seating, I ask the students to move their chairs into a circle. I also sit in the circle. This arrangement seems to improve the informality of the setting and is very conducive to group discussion.

Student comments from previous years of teaching cases through this approach, both formally through instructor evaluation reports and informally through discussion with individuals, have been very positive about the value of teaching cases in my classes. The anecdotal evidence for the success of the approach is strong but indirect.

The Spring 2002 IT Management Class—Instructor "A"

Buoyed by the success of the spring 2001 approach, I made only one important format change for the new semester. Because the most negative reaction to the approach in 2001 was to the requirement that forced students to rate at least one member's contributions higher than the others, the requirement was dropped. Personally, I had serious reservations about the forcing requirement. In spring 2002, students did not evaluate teammates' contributions, but were free to drop noncontributing member's names from the written reports.

Another small change is that the case work dropped from 25 percent of the course grade to 23 percent. The only other apparent difference between the two semesters was the increase in class size—from 22 to 31. The number of teams increased from seven to ten.

Instrument Development and Administration

We developed a 12-item questionnaire administered in the spring semester in a collaborative fashion. The instrument itself (see Appendix A) is designed primarily as an exploratory tool to assess the effectiveness of our approach to teaching case studies. We believe a basic value of the case approach is in the teaching of soft skills (Romm & Pliskin, 2000), which led to the development of questions two and six. We also believe that the case approach is an excellent vehicle for teaching the Bloom's (1965) higher levels of learning, hence questions five, seven, eleven, and twelve. Because many of the changes in approach were inspired by Michaelsen (1997-1998), we developed questions four, eight, and nine. Question three was developed to assess students' perceptions of cases as agents of active learning, as suggested by Horgan (1999). Both instructors felt that cases were an important tool for teaching key issues, resulting in question one. Finally, we wanted to learn whether students preferred our new approach to the more traditional case approach, which accounts for question ten. The instrument concludes with two open-ended questions to explore issues not sampled by the first twelve questions.

Students anonymously evaluated the case studies at the end of each semester. A five-point Likert scale was used to evaluate the first twelve questionnaire items. A total of 22 students participated in the spring 2001 survey; 20, in fall 2001; and 26 in spring 2002. Because of the differences in teaching styles between the two instructors, some items were not applicable to Instructor "B's" class, specifically items 4, 6, 8, and 9. The results of this survey from each semester are shown in the tables below. Questions have been sorted from their original arrangement, to an order showing statements with which students most strongly agreed first.

Results

The results of the spring 2001 survey (Table 1) indicate a widespread satisfaction with the approach to case studies. Our perception is that students like this case methodology much more than they did in the spring 2000 class. Students seem to be particularly satisfied with cases as tools for making abstract MIS principles concrete. Not surprisingly, the question which received the least support concerned the forcing of uneven ratings—which led to some students receiving lower grades for the course than they otherwise would have. However, only two of the twenty-two students either disagreed or strongly disagreed with question nine.

Even the response to question ten was gratifying. This question, which ranked tenth in order of agreement, asked students to compare the spring 2001 approach with the traditional approach. Although three students rated the question neutral, not one of the twenty-two either disagreed or strongly disagreed with the statement.

In addition to the twelve questions above, students were also asked to respond to these two open ended questions:

1. What is the one thing you liked best about our approach to cases this semester?

2. If you could change one thing about our approach to cases this semester, what would it be? How would you change it?

As might be expected, a number of students rephrased one or more of the twelve statements to indicate the greatest strength. As proponents of active learning, we are pleased to note that six students indicated that active class discussions were the greatest strength of this approach to case studies.

Even responses to the "greatest weakness" question tended to be positive. In fact, five students indicated that there was no weakness with the 2001 methodology. Typical responses to this question included:

- More than five cases should be used (2)
- More in-class time should be allocated to cases (2)
- Class should be 75-minutes rather than 50 minutes

Complaints tended to be about the cases themselves rather than to the methodology:

TABLE 1
RESULTS OF CASE STUDIES QUESTIONNAIRE

Question Number	Question	Mean
7.	The cases provide students with a good means of applying information systems principles to real world situations.	1.36
1.	The cases brought out important points about managing information systems, such as the role of IS in a global economy, the potential of e-commerce, the role of IT in strategic planning, IT ethics, etc.	1.41
11.	The cases provide students with a good opportunity to synthesize; that is, identifying potential solutions to a case problem and choosing the most appropriate solution.	1.45
12.	The cases provide students with a good opportunity to exercise evaluation skills, i.e., appraising the extent to which particulars are accurate, effective, economic, or satisfying.	1.45
4.	Having both an individual quiz and a group quiz is a good idea.	1.55
2.	The cases are a good way of teaching "soft skills"; for example, interpersonal skills and management skills.	1.64
3.	Cases increase the likelihood of student participation in class discussion.	1.64
6.	Because much of the case work involved team work, the cases served as a good vehicle for applying principles of team management.	1.68
5.	Writing the case report aided in understanding the case principles.	1.73
10.	I prefer the approach to cases used this semester to the traditional case approach, i.e., when student teams are assigned the responsibility of presenting a particular case.	1.73
8.	Requiring students to assess relative contributions of teammates is a good way to motivate individual efforts.	1.77
9.	Requiring students to rate at least one teammate's contribution as better than average is a good idea.	2.41

TABLE 2
RESULTS OF CASE STUDIES QUESTIONNAIRE—FALL 2001

Question Number	Question	Mean
3.	Cases increase the likelihood of student participation in class discussion.	1.65
7.	The cases provide students with a good means of applying information systems principles to real world situations.	1.75
1.	The cases brought out important points about managing information systems, such as the role of IS in a global economy, the potential of e-commerce, the role of IT in strategic planning, IT ethics, etc.	1.85
5.	Writing the case report aided in understanding the case principles.	1.85
11.	The cases provide students with a good opportunity to synthesize; that is, identifying potential solutions to a case problem and choosing the most appropriate solution.	1.85
12.	The cases provide students with a good opportunity to exercise evaluation skills, i.e., appraising the extent to which particulars are accurate, effective, economic, or satisfying.	2.00
10.	I prefer the approach to cases used this semester to the traditional case approach, i.e., when student teams are assigned the responsibility of presenting a particular case.	2.10
2.	The cases are a good way of teaching "soft skills"; for example, interpersonal skills and management skills.	2.15
6.	Because much of the casework involved teamwork, the cases served as a good vehicle for applying principles of team management.	N/A
4.	Having both an individual quiz and a group quiz is a good idea.	N/A
8.	Requiring students to assess relative contributions of teammates is a good way to motivate individual efforts.	N/A
9.	Requiring students to rate at least one teammate's contribution as better than average is a good idea.	N/A

- Cases should be more current (2)
- Cases should be more detailed

The open-ended responses tended to be similar to those of the Spring 2001 class responses. The responses to "What is the one thing you liked best about our approach to cases this semester?" included the dynamics of increased class discussion and the "real world" application of principles and theory. We note that these responses correlate to the two highest-scoring items in the questionnaire.

There was very little response to the second open-ended question, "If you could change one thing about our approach to cases this semester, what would it be? How would you change it?" Most students chose not to respond to this question or simply replied "Nothing." One student stated that there should be more cases. Another student stated that additional in-class time was needed to adequately discuss the cases.

A comparison between the spring 2001 and spring 2002 survey reveals that student attitudes are generally the same—students have a favorable reaction to this approach to using case studies. The responses to the open ended questions again were mostly favorable. Nine of the twenty-six students indicated that what they liked best about the approach was the class discussion. Another five indicated that the "group work" was the one thing they liked best.

There were no noticeable or consistent patterns to the responses to the question 14—what would you change. Indeed, five students omitted a response to this question. Three students indicated that the written reports were redundant, given the considerable in-class discussion. This conclusion could be attributed more to students' desire to lighten their work load than to actual increase in effectiveness. Two students suggested that we have more than five cases, and two suggested having fewer than five cases. Two students suggested more detailed cases and two suggested spreading the cases more evenly throughout the semester.

However, there are three differences between tables one and three that are worthy of note. Question 10 receives about the same level of favorable support in both semesters. However, the question moves from tenth position to fifth position in it rank order. Question number twelve shows the greatest change in mean

TABLE 3
RESULTS OF CASE STUDIES QUESTIONNAIRE—SPRING 2002

Question Number	Question	Mean
1.	The cases brought out important points about managing information systems, such as the role of IS in a global economy, the potential of e-commerce, the role of IT in strategic planning, IT ethics, etc.	1.73
7.	The cases provide students with a good means of applying information systems principles to real world situations.	1.81
11.	The cases provide students with a good opportunity to synthesize; that is, identifying potential solutions to a case problem and choosing the most appropriate solution.	1.96
4.	Having both an individual quiz and a group quiz is a good idea.	2.00
10.	I prefer the approach to cases used this semester to the traditional case approach, i.e., when student teams are assigned the responsibility of presenting a particular case.	2.00
6.	Because much of the case work involved team work, the cases served as a good vehicle for applying principles of team management.	2.08
3.	Cases increase the likelihood of student participation in class discussion.	2.12
2.	The cases are a good way of teaching "soft skills"; for example, interpersonal skills and management skills.	2.15
8.	Requiring students to assess relative contributions of team mates is a good way to motivate individual efforts.	2.15
12.	The cases provide students with a good opportunity to exercise evaluation skills, i.e., appraising the extent to which particulars are accurate, effective, economic, or satisfying.	2.15
5.	Writing the case report aided in understanding the case principles.	2.19
9.	Requiring students to rate at least one teammate's contribution as better than average would be a good idea.	2.89

(0.70), moving from third to tenth. In all other cases, rank order is virtually identical.

The most striking difference between tables one and three is the uniform decline in favorability. In all cases, the level of satisfaction declined an average of 0.45, nearly half a point, ranging from a decline of 0.27 to 0.70. There are at least three factors which can account for this decline.

The first factor is that many of the students in the spring 2002 class, sixteen of the thirty-one, were also in my decision support systems class in fall 2001. I received the second lowest evaluations in my 17-year teaching career in this class. I believe that there was some carry-over from this relatively negative experience in fall 2001 to the spring 2002 class.

A second factor is the increase in class size from 22 to 31, a forty-one percent increase. As Mostert and Sudzine have shown, larger class sizes have a negative effect on case discussions. The size of the classroom did not change, and the ten groups were not able to meet without rubbing elbows with other members of the group.

I believe the most important factor, however, has to do with investment. In spring 2001, I was full of enthusiasm and energy with the new approach. I spent an entire class period early on in the semester describing how the new and innovative approaches we were taking to cases. Students eagerly provided input to fine-tuning the new approach. In spring 2002, however, I merely announced how we were approaching cases. Students did not feel they had the same investment in the approach as the previous semester.

LESSONS LEARNED

While Brabston, et al. (1999) proposed the three models for collaborative team teaching as described earlier in this paper, we would like to propose a fourth, less radical model. We suggest a more formal approach to procedures that good instructors are already doing informally. We propose that when two or more instructors are assigned responsibility for the teaching of a particular class using case studies as a teaching tool, that these instructors routinely perform the following steps:

1. Compile a list of generally agreed upon desired outcomes from teaching the cases.
2. Construct a questionnaire designed to evaluate the processes used to achieve the outcomes.
3. Administer the questionnaire at the conclusion of each semester.
4. Meet to discuss questionnaire results; identify methodologies that best meet desired outcomes.
5. Incorporate appropriate methodologies in future classes.

We believe that, while no "one-size-fits-all" when it comes to teaching methodologies, this process can only result in more effective teaching. A structured approach to evaluating methodologies from multiple instructors teaching a common course, as we have begun to do, should lead to a fine-tuning of individual teaching performance.

The case study format presents an excellent opportunity for instructors to collaborate in the determination of which methods and desired outcomes are most appropriate for a course. Based on the results of the spring 2002 questionnaire, Instructor "A" plans to reinstitute the policy of having students evaluate team members' performances, but not to force one member to be rated above the others. Additionally, Instructor "A" plans to enthusiastically sell students on this case approach at the beginning of the semester.

We give here one more example of our dynamic, collaborative methodology. Question three was ranked highest in terms of respondent agreement in the class taught by Instructor "B." The same question ranked seventh in both classes taught by Instructor "A." A possible reason for this difference may be that Instructor B's teaching style is less likely to promote discussion in class. If this is the case, Instructor B's students may have welcomed the opportunity to participate more broadly in discussion when the case studies were being taught, thus recognizing this important value of case teaching methodology.

In this paper, we have presented a combination of anecdotal and empirical evidence of the benefits instructors (and, ultimately our students) can derive from the above model. We believe this process can only result in more effective teaching. We believe that there is no one-size-fits-all teaching methodology, but we do believe a structured approach to evaluating our methodologies, as we have begun to do, should lead to a fine-tuning of individual teaching performance.

Particularly given the AACSB's emphasis on assessment (Williams and Price, 2000), we believe that our model of collaborative teaching should serve as an excellent springboard for improving instruction. The responses to questionnaire items are valuable, but the discussion they provoke is invaluable. We do not believe it is enough to simply divide students into groups to discuss case studies. The devil is in the details.

For example, if many students indicate that "lively discussion" is a great strength of one instructor's approach, the positive response is not necessarily due to the content of the questions. Discussion of this item may reveal that lively student participation is a product of the instructor's serving more as a facilitator than as a leader. Discussion of these and other questions lead to synergistic improvements. Good teaching is certainly as much art as science, but it is an art enhanced by our collaborative procedure.

LIMITATIONS

The results of this questionnaire must be interpreted with caution. The instrument used in this study was constructed with elements which seemed relevant at the time. We plan to revise the instrument by grounding it more firmly in the literature and by following with validation tests. Another limitation is that apparent student satisfaction with the 2001 methodology does not ensure that the methodology was more effective. There could have been contaminating factors—the students may have found that pioneering a new methodology was a positive experience. Or the instructor may have done a more effective job for all aspects of the course—pulling the case study results up by the bootstraps, as it were. Nevertheless, the evidence does point to our collaborative case approach being an effective way of teaching cases.

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APPENDIX A

Case Questionnaire Name: ____________________________

Use the scan tron to answer the first twelve questions below. Do not put your name on the scan tron. You must write your name above in order to receive the ten points extra credit.

A: strongly agree B: agree C: neutral D. disagree E. strongly disagree

1. The cases brought out important points about managing information systems, such as the role of IS in a global economy, the potential of e-commerce, the role of IT in strategic planning, IT ethics, etc.
2. The cases are a good way of teaching "soft skills"; for example, interpersonal skills and management skills.
3. Cases increase the likelihood of student participation in class discussion.
4. Having both an individual quiz and a group quiz is a good idea.
5. Writing the case report aided in understanding the case principles.
6. Because much of the case work involved team work, the cases served as a good vehicle for applying principles of team management.
7. The cases provide students with a good means of applying information systems principles to real world situations.
8. Requiring students to assess relative contributions of teammates is a good way to motivate individual efforts.
9. Requiring students to rate at least one teammate's contribution as better than average is a good idea. [Note: questions was reworded as "Requiring students to rate at least one teammate's contribution as better than average would be a good idea" in the spring 2002 survey.]
10. I prefer the approach to cases used this semester to the traditional case approach, i.e., when student teams are assigned the responsibility of presenting a particular case.
11. The cases provide students with a good opportunity to synthesize; that is, identifying potential solutions to a case problem and choosing the most appropriate solution.
12. The cases provide students with a good opportunity to exercise evaluation skills, i.e., appraising the extent to which particulars are accurate, effective, economic, or satisfying.
13. What is the one thing you liked best about our approach to cases this semester?
14. If you could change one thing about our approach to cases this semester, what would it be? How would you change it?

INCORPORATING ON-LINE TESTING INTO FACE-TO-FACE TRADITIONAL INFORMATION SYSTEMS COURSES

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ABSTRACT

One of the critical components in the curriculum is evaluation of the student's knowledge or the amount they learned in the course. Over time, the assessment process has not changed significantly; it is only recently that university instructors are turning to technology for assistance in this labor-intensive task. There are disadvantages and advantages for both instructors and students of on-line testing. Much of the discussion surrounding alternative testing implementation centers on various learning styles. One question is "why do we continue to assess students in traditions set long ago?" Some other questions are raised: Does the on-line testing improve student learning and achievement? Can/should instructors tailor tests to student's preferences for learning? How does the creation of on-line exams affect the instructor's work-load? This research looks at two traditional face-to-face Information Systems Courses which incorporated on-line testing into their curriculum and begins to provide some answers to these questions.

INTRODUCTION

"On-line education can be defined as teaching and learning activities enabled by electronic media" (Romm and Taylor, 2000). Electronic media or "technology is not simply an add-on service as computers or audiovisual..." (Tsichritzis 1999, 93). Emerging technologies are an integral part of the university curriculum—not only are they, themselves, studied, but also the manner they support the delivery of many facets of the curriculum. One of the critical components in the curriculum is evaluation of the student's knowledge or the amount they learned in the course. Over time, the assessment process has not changed significantly (Natal, 1998); it is only recently that university instructors are turning to technology for assistance in this labor-intensive task.

There is a growing emphasis on accountability of faculty and an increased importance on ensuring student success, where success is being defined as student learning. AACSB reviewers are evaluating business curriculum with a strong interest in outcomes assessment—measures of student learning. The questions being asked are- are the students learning what the university thinks they are learning and can it be measured? How is improvement in student learning measured? Is the testing environment secure? The answers to these questions are being confounded by the proliferation of distance education or on-line courses using the Internet as a means of delivery.

For a course that is taught fully on-line or distance, it is expected that the testing component is also accomplished at a distance or on-line. However, on-line testing or assessment may be an appropriate venue for courses taught in a face-to-face environment. It may relieve part of the repetitious, time-consuming activities involved with creating exams, grading exams, and calculating the exam scores and final grades. More time might be spent in the actual teaching of the course content and less on administering exams. This research looks at incorporating on-line testing into a traditional lecture-based course.

BACKGROUND

Most of the on-line testing literature involves training or use of computer-based instruction (CBI)/computer-based training (CBT) (Woit and Mason, 2000; Tunc and Armstead (2001); Kaczmarczyk 2001) and the usage is either in the corporate workplace or the elementary/high school skills-based context. Recently, with the new emphasis on technology, increased band-width and the dominance of the Internet, university professors are incorporating some of this technology into their courses. On-line testing is easy to track and document (Roberts 2000; Tunc and Armstead 2001; Woit and Mason 2000) and can be used to establish baselines for future assessment. Feedback mechanisms can be incorporated into the on-line testing (Gibson, Tesone, Blackwell 2001) and different learning styles of the students can be accommodated. Therefore, this mode and process of testing or assessment may be more effective and efficient for both faculty and students.

Dottie Natal (1998, 7-9) of Imagen Multimedia Corporation presented the advantages and disadvantages for both instructors and students of on-line testing at the Technology Education Conference in Santa Clara. Advantages or benefits for students are:

- "Any time, any place" testing
- Support for ESL (English is a second language) students
- Support for students with disabilities
- Valuable class time not used for exams
- Depending upon the type of exam—immediate feedback may be available
- Access to tools they are comfortable with

Drawbacks for student include:

- Procrastination - last minute test taking
- Availability of computers
- Lack of computer skills
- Inability to use their standard test-taking skills (answering the hardest first, sure answers first....)

Some benefits for the instructor are:

- Decreased record-keeping time
- Reusable test questions
- Easier reading than hand-written
- Increased teaching time
- Better test design—for different learners
- More frequent assessments
- Better statistical feedback

Drawbacks for instructors are:

- Security problems
- Unexpected results with regard to writing standards
- Debugging problems with feedback or test administration
- Hardware problems

Other research has provided additional instructor enhancements to include immediate assessment, therefore, enabling the instructor to review areas particularly challenging for individual students based upon on-line testing scores. This in turn provides class time for discussion of more difficult topics, instead of administering quizzes and exams (Woit and Mason 2000; Tunc and Armstead 2001; Kaczmarczyk 2001).

On-line testing has been identified with distance education courses. These are courses in which students enrolled do not attend class, do not accomplish the related tasks within a set time frame and can be at any location. Many of these students have computers at home, or have access at the workplace and have mastered the software. Why not use this mode of assessment for students enrolled in traditional face-to-face university courses?

Universities provide access to computer labs throughout campus and in the dormitories. Some universities require computer ownership for admission. Universities are providing wireless connections to email and the Internet enabling laptops to be used anywhere on campus. In one scenario, on-line testing might be administered in a controlled setting, with-in one of the computer labs.

One university experimented with installing a fully-outfitted computer lab for quiz taking. A proctor was hired to monitor testing activities. Students reserved a computer for completing the required quiz (Tunc and Armstead 2001). However, there is always the danger of the system being unable to accommodate users accessing the system at exactly the same time; each system has its own saturation point which must be taken into account.

Another scenario might have all students taking the test at the same time, but from any location they choose. This strategy not only raises overloading-the-system issue, but also monitoring the students while they are taking the test. Are they using books, documents, the Internet? Does the instructor care as long as the student is learning while they are completing the exam? Who is really taking the test? Will the technology create new methods of cheating?

A third scenario is any time, any place, without restraints. This probably eliminates the system-overload issue, but not the other issues. Which delivery mode is optimal depends upon the preferences of the faculty and students and the university's level of technology and support for that technology.

LEARNING STYLES

Much of the discussion surrounding alternative testing implementation centers around recent readings of various learning styles and their impact on testing and test results. Considerable research exists in tacit and explicit learning that will not be repeated here. Nevertheless, profound research conducted by Howard Gardner, author of *Frames of Mind* (1983), which led to further research, and issuing of *Multiple Intelligences* (1993) identified educators' oversight of various forms of intelligence that exists.

Dr. Gardner's work identifies more than one form of intelligence. Referred to as multiple intelligences, seven varieties of intelligence are identified by Dr. Gardner and his team of researchers. During the more than thirty years of work, psychologists working with all levels of education found that intelligence manifests itself in intrapersonal, interpersonal, spatial, linguistic, logical-mathematical, bodily-kinesthetic, and musical intelligence. It is stated that all individuals may possess more than one of the intelligences, and some, typically those who are mentally challenged, posses possibly just one of the identified intelligences. These multiple intelligences provide for a variety of perspectives on how information is learned. However, educators may fail to test more than one of these intelligences.

Currently, assessment of learning is conducted towards the logical-mathematical intelligence as specified in *Multiple Intelligences* (1993). This assessment style is derives from Binet-Spearman formulation of evaluation. In the Binet-Spearman model, "the individual is tested in isolation" (Gardner 1983, 52). This approach is used when a student sits at a desk during a designated time period (that may not be the original class meeting time or regular class meeting room) and regurgitates data pertinent to the course. As Gardner states "the mind is a multifaceted, multi-component instrument, which cannot in any legitimate way be captured in a single paper and pencil-style instrument" (1993, 70) and further that "members of Mensa are expert in nothing—except in taking tests of intelligence" (1993, 53). These claims appear to be supported by very successful students who may not do well on exams; they were not the best test takes.

The question that begs to be answered is 'why do we continue to assess students in traditions set long ago?' There is a greater understanding of learning styles which is not extended to the ability to adequately assess student grasp of information.

ON-LINE TESTING IMPLEMENTED

On-line testing was implemented in two different traditional fact-to-face courses. In one course, Business Data Communications, weekly quizzes forced students to read the text, become well prepared for class discussion and stay up-to-date with the course materials. In the other course, Management Information Systems Technology (MIST), an on-line test was used for the midterm with one section, while the other section took the exam in class. Students in both MIST sections were given the option for an on-line final exam or an in-class final exam.

Both instructors used an on-line, Internet-based course management system. The system is used throughout the university in many different types of courses. All the students in the Data Communications course had used the software in at least one previous course. It was new for some students in the MIST course. The software provides automatic grading of certain types of questions and automatic posting of grades. Faculty can design the exam in any format. The easiest design may be true/false and multiple choice, but essay questions are accommodated. Immediate feedback on an individual answer is not a feature of the software; after the test is completed the student receives feedback on the entire exam, the software generates a comparison page of student answers and correct answers.

The data communications course is an elective in the Information Systems field, the students are Juniors or Seniors, and all of the students have reasonable, if not excellent computer skills and should all be familiar with the on-line course management program used for quizzes. In this course, valuable face-to-face in-class time was not spent on the weekly quizzes. The professor prepared only true/false and multiple choice questions based on the text material. The exam preparation time is equivalent to that for an on-line exam consisting of the same types of questions. The real time savings is in the auto-grading feature of the software. Exams were posted each week and the students had the entire week to complete the exam. The students had one hour to complete the exam; the software keeps track of the length of time spent on-line in the testing area. During class, following each exam, time was spent discussing/arguing about the exam questions, thereby reinforcing important concepts. Since extra points were earned if their arguments were successful, this strategy was a sure way to get students to participate in class discussions and stay current with the reading material. The students provided feedback on their experience.

- The quizzes were a good learning tool and should be expanded
- The quizzes forced me to stay current with the readings
- The quizzes formed me to focus on the materials and class—usually I do not read the book before studying for mid-terms
- I learned more because of the weekly quizzes

One student commented that because the quizzes were administered on-line there was no reason to attend class.

The MIST course is an introductory core Information Systems course and most of the students are Sophomores. Many of the students have used the on-line course management system before entering the course, some have not. However, all requirements and assignments for the course are available only on the on-line system and by the mid-term, each student should have experience with the system. The same instructor taught two sections of the MIST course; one section completed the mid-term during class time and the other section used the on-line system. The on-line students were on a limited time schedule, similar to those in the classroom. There is a built-in utility in the on-line system that releases the test materials at a certain time and then makes it unavailable after an elapsed period, however, the students were in the location of their choosing. Therefore, both sets of student had the same amount of time for completing the exam. The tests consisted of fifty multiple choice questions and nineteen short answer questions. The exam covered all materials up to the time of assessment. Both sets of students were advised to use textbooks, lecture notes, class papers and classmates in formulating their response. Surprisingly, exam results were slightly higher for the in-class test takers than for the on-line test takers (Table 1).

TABLE 1
GRADE FREQUENCIES

	In-class: N = 29	**On-line: N = 31**
Mean	97.7	95.8
Median:	98.4	96
Mode:	98.4	98
Std Dev.	1.6	2.36
Min/Max	93.6/100	88/98

There were 31 on-line test takers in one section of the undergraduate course and twenty-nine test takers in the in-class test-takers. Both sections were given the same test-taking directions. In-class test takers were asked to leave the room if they wanted to discuss the exam with classmates. Both exam periods were limited to the university requirements of 1 hour and fifty minutes.

Both sections had the option to take the exam as either in-class, on-line, or a mix. Interestingly, students in one section chose to take the exam in-class, and the second section chose the on-line presentation. In neither section had students participated in an on-line testing experience.

Data are limited to test scores. Demographic data on students was not collected in either testing environment. Nor was the amount of time taken for completion of the exam registered. While demographic and completion time data is available for the on-line students, these data were not collected for students completing the exam in-class.

Comments from students taking the on-line test were overwhelmingly positive. Only two mishaps occurred. Both were satisfied by reinitiating the exam on-line for one student and providing a paper copy for the second student. The student opting to complete the exam on-line was able to answer all questions in the remaining allotted time period. Since the questions were answered once already, the student had no trouble retaking the exam. The second student experienced no difficulties in completing the written exam.

When final exam time arrived, both sections were again given the option to take the exam in-class, on-line, or a mix. The original in-class section opted for a mix of in-class and on-line with a majority taking the exam in-class. About one-third of students opted to complete the exam on-line. The original on-line class resoundingly opted for completing the final exam on-line. Part of this motivation may be a result of the exam scheduled on the very last exam date. This date may have interfered with summer plans. Taking the exam on-line allowed students to be at any location comfortable to the student.

DISCUSSION

On-line testing may add another level of complexity to the test-taking process. Either the instructor or the students may perceive on-line testing as another obstacle to conquer; in the students' mind it might be another deterrent to a good course grade. The level of technical skills of the instructor and their confidence in that skill are important factors in determining whether an attempt is made to incorporate any technology into the curriculum. The technical skill level and confidence of the student are also important factors.

Does the on-line testing improve student learning and achievement? There was no statistically significant difference in the means for on-line exams and in-class exams. Additionally, the means for the on-line exam were lower than the means for the in-class exam. Therefore, in this study, there is no improvement in student learning and achievement when an on-line exam was administered.

Can/should instructors tailor tests to student's preferences for learning? Can/should instructors offer several versions of the test and let the students select their preference—before they see the questions? This may give the students more control over their outcomes. This issue requires further study and research.

Another consideration of students in determining whether to take the test in-class or on-line may be the accessibility of the instructor to answer questions. In both instances, students were assured of instructor availability for questions arising during the exam. In the instance of the mixed test takers (some in-class, some on-line) the instructor carried a cell phone set to vibrate. In the instance of all on-line test takers, the instructor remained in the office during the entire testing period thereby providing access through email or telephone.

How does this affect the instructor's workload? "Faculty may wish to practice on the actual systems the students will be using" (Loeding and Wynn 1999, 181). A dry run enables the faculty to anticipate problems with the system, the software or the exam itself. Faculty administering on-line testing may have to be more flexible than those in a traditional classroom situation. Technical difficulties may negatively influence course evaluations at the end of the semester and can impact the perception of the entire course. In the two instances where the on-line exam failed, the instructor was flexible in allowing the students to retake the test in the on-line environment or to take the exam in a classroom environment. Although the task of grading may be eliminated for certain types of exams, this flexibility and additional access may increase the faculty's workload.

The concern about students copying or cheating is always present. Who is taking the exam and with whom are they taking it? The concept of cheating has long been a concern where there is no one monitoring the exam. Dr. Jerry Harvey (1988) claims that there is 'no such thing as cheating.' What Dr. Harvey referred to is the realization that learning occurs in various forms inside and outside the classroom. Dr. Harvey believes that collaboration is instrumental in the leaning process; it facilitates and enhances learning. He recognizes this need to accommodate various learning styles as an extension of future requirements in the chapter "Encouraging Future Managers to Cheat" in *The Abilene Paradox* (1988). In this chapter, Dr. Harvey acknowledges that once students graduate they will not work alone but with teams of people. He identifies areas of benefit in allowing students to work together in completing assessments as "providing a model of how work really gets done" (Harvey 1988, 124) and to do otherwise "thwarts the expression of synergy" (Harvey 1988, 125). By providing those skills for which the student is best able to provide for the success of the team, the concept of conducting on-line testing may support positive interaction and building of relationships towards conclusion of a task.

If Dr. Harvey's claims are accepted, cheating is one less item of concern. Furthermore, as documented by Kaczmarczyk (2001) cheating as a phenomena during on-line exams has not been sufficiently documented.

Therefore, instances of cheating in distance or non-monitored test taking may not be an issue. In the MIST exam scenario, the instructor encouraged both classes to use class notes, lecture slides, and each other for formulating responses to questions. The reality is probably time constraints inhibited much if any conversation.

Thunderstorms and power outages can adversely affect transmission of the test. Technical problems may make it impossible for a student to complete the exam in a timely fashion. If the exam is in a controlled computer laboratory setting, the system may not be able to handle 20 to 30 attempts to access it at the same time. If the exam is truly an "anyplace" exam, bandwidth may influence the assessment outcomes. Students must be very knowledgeable of the computer system they are choosing.

On-line testing should only be one component of the evaluation of the student (Gibson, Tesone, Blackwell 2001). Other activities used to asses learning outcomes might be assignments, participation credit, projects, papers or case studies.

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DETERMINANTS OF GROUP PERFORMANCE IN INFORMATION SYSTEMS PROJECT TEAMS: AN EMPIRICAL STUDY

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ABSTRACT

Most information system development projects are conducted by a group of people including systems analysts, designers, programmers, etc. This paper examines the effects of group efficacy and team building on group cohesion and the impact of the later on group performance in systems development projects. A survey was conducted among 4th-year MIS undergraduate students working at real-life system development projects for four months. One hundred and eighty five students forming 35 groups participated in this study. The research model draws on small group research theory, which asserts the importance of the determinants of group performance to both researchers and practitioners. The data analysis method used was Partial Least Squares (PLS).

INTRODUCTION

Group research indicates that understanding the determinants of group performance is a key for modeling of team effectiveness. Group work becomes a norm in most projects and a growing number of organizations are latching on to anything that makes groups perform better. As an example, organizations are looking for products such as groupware software and web portals that allow for online collaborative work to help them think faster and get products to market sooner and with less expense. In addition, information systems development projects often involve systems analysts working in groups either face-to-face or through an electronic collaborative setting. Hence, organizations need to have an in-depth sense of what makes groups perform better regardless of the medium of communication used. The goal of this study is to identify what determine group performance in IS development projects.

THEORETICAL BACKGROUND

Group Cohesion

Group cohesion conceptualization and measurement goes back to Festinger (1950) who defined it as

> the total field of forces which act on members to remain in the group. These forces may depend on the attractiveness or unattractiveness of either the prestige of the group, members of the group, or the activities in which the group engages (p. 274).

While the importance of this construct has been identified as a key in effective work groups (Cohen and Bailey, 1997), its conceptualization and measurement has been centered on one factor structure construct (Mullen and Copper, 1994), namely interpersonal attraction to the group. Recently, Cota et al., (1995) have called for defining group cohesion as a multidimensional construct based on the Group Environment Questionnaire (GEQ) developed for sport teams by Widmeyer et al., (1985). The authors suggested that group cohesion have four dimensions; (1) Group Integration-Task, which is an individual team member's perception about the similarity and closeness within the team about accomplishing the task, (2) Group Integration-Social, which reflects individual team member's perception about closeness and bonding regarding the team's social activities, (3) Individual Attraction to Group-Task, which describes individual team member's feeling about personal involvement in the group task, (4) Individual Attraction to Group-Social, which reflects individual team members' feelings about personal involvement in the social interaction of the group.

The most important shift in the literature was separating task and social cohesion when defining group cohesion. Carless and De Paola (2000) tested the construct as 1) a single-factor model, defining cohesion with highly interrelated perceptions about the group; 2) a two-factor model, based on Widmeyer et al., (1985) which distinguishes between individual attraction to the group and group integration; 3) a two-factor model, based on task and social cohesion, and 4) a four-factor model distinguishing group integration-task, group integration-social, individual attraction to group-task and individual attraction to group-social. The authors found evidence that group cohesion construct is multidimensional and includes task cohesion (the extent of motivation towards achieving the organization's goals and objectives (Widmeyer et al., 1985, p. 17), social cohesion (motivation to develop and maintain social relationships within the group) and finally individual attraction to the group. The present study adopts this conceptualization.

Group Efficacy

Group efficacy has been defined as the group's collective estimate of its ability to perform a task (Gibson, 1999). Indeed, group efficacy has been investigated as to outcomes such as problem solving (Cervone and Peake, 1986), learning and achievement (Campbell and Hackett, 1986) and traning effectiveness (Earley, 1994). Moreover, Bandura (1997) identified four sources of group efficacy: (1) group's past performance accomplishment, (2) the so-called "vicarious experiences" by looking at successful performance by someone who is similar to oneself, (3) verbal persuasion, that is, others' expression of faith in one's capabilities and, (4) emotional and psychological arousal towards the task and the group.

Furthermore, group efficacy-group performance relationship has been examined and a strong link was found in several studies (Silver and Bufiano, 1996; Gibson et al., 2000). While the relationship between group efficacy and group performance is quite robust, researchers do not agree about the operationalization and measurement of group efficacy construct. Gibson et al., (2000) compared three methods of measuring group efficacy: (1) group potency, which refers to a belief in a group about its general effectiveness across multiple tasks, (2) an aggregation of group members' estimates, and (3) group discussion which is based on a consensus among group members about the performance of the group. These methods were used to assess group efficacy regarding several group performance characteristics. The authors found that discussion method predicted group outcomes better than the other two.

Group potency is not relevant for the present research since there is only one task group members have to perform. Also, group discussion may not be appropriate as a single response is obtained through free format discussion within the group. Some members may influence others to reach consensus. In the current study, we selected a method where members of the group assign an estimate of the group's ability to perform a specific task without being biased by their peers. These estimates are then aggregated taking into account the variance within groups. Within-group interrater reliability will be calculated for group efficacy sclae using James, Demaree, and Wolf's (1984) interrater reliability index, so aggregation of data is justified.

Team Building

Team building refers to

> enlisting the participation of a group in planning and implementing change which will be more effective than simply imposing change on the group from outside (Salas et al., 1999).

An extensive literature review was conducted on team building and its application to sport teams (Hardy and Crace, 1997). The results show that team building leads to an increase in team performance. On the other hand, Smither et al., (1996) stated that research findings on the effectiveness of team building provide a mix results that make drawing firm conclusions difficult. The reasons behind these findings can be attributed to the non-empirical, narrative nature of most of these studies and, the ambiguity of what team building is.

Indeed, team-building conceptualization dates back to Beer (1976) who attempted to formalize this construct. Salas et al., (1999) built on this work and identified four components of team building as 1) goal setting (group members set objectives at the beginning of the task), 2) interpersonal relations (group members develop trust in one another and confidence in the group), 3) problem solving (group members become involved in finding solutions to the problems encountered), and 4) role clarification (increased communication among group members regarding their roles within the group). This comprehensive framework for team building construct was adopted in this study.

Group Performance

Group performance has been conceptualized in terms of objective and subjective outcomes. Objective assessment includes countable measures such as group productivity, where as subjective measures include the subjective rating of the performance of the group. Hackman (1990) identified three dimensions of group performance construct. First, task effectiveness, which refers to the degree to which, the group output meets the standards of the organization. Second, system viability which refers to the degree to which the process of carrying out the work enhances the capability of members to work together interdependently in the future. Finally, professional growth, which refers to the degree to which the group experience, contributes to the growth and personal well being of team members.

To date and in the best of our knowledge only one study (Chang and Bordia, 2001) has tested this measure of group performance empirically. The authors argued that Hackman's (1990) measure of group performance is the most comprehensive one for understanding and capturing group performance. The importance of assessing this construct is critical since it is the dependent variable in most group-related studies.

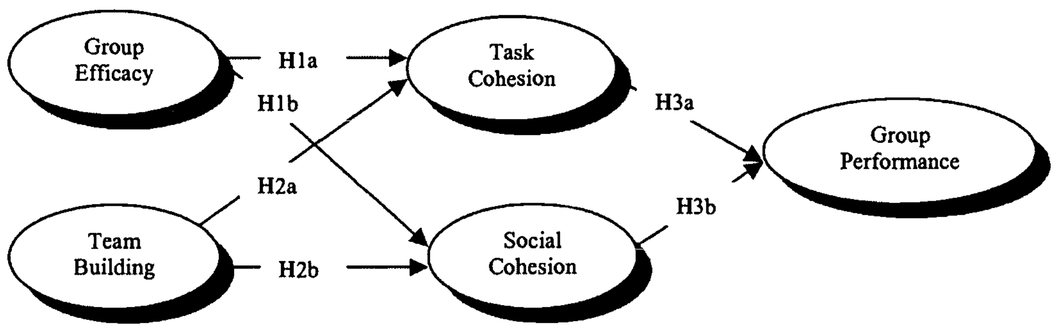
RESEARCH MODEL AND HYPOTHESES

As can be seen in Table 1 (for space purpose, we show here only a subset of the literature), what has been done in prior research reflects studies that have tested links between one independent variable (oftentimes one dimension of a multidimensional construct) and a dependent variable (i.e., group performance). Moreover, clear construct conceptualization and an assessment of the reliability and validity of each construct, that is, the measurement model as well as the structural model was lacking in most studies (Carless and DePaola, 2000). Furthermore, a comprehensive research model, as shown in Figure. 1, which examine the three main determinants of group performance, has been called for in several studies (Cohen and Bailey, 1997). It was the objective of the study presented here to develop and test such model.

TABLE 1
SOME EMPIRICAL RESEARCH

Author (s)	Group Cohesion	Group Efficacy	Team Building	Group Performance
Gibson et al., (2000)		X		X
Salas et al., (1999)			X	X
Carless and DePaola (2000)	X			X
Chang and Bordia (2001)	X			X
Pescosolido (2001)		X		X

FIGURE 1
RESEARCH MODEL



Group Efficacy

Group collective sense of capability may be an important determinant of its effectiveness. Group efficacy-group performance relationship has been a subject of interest and a strong link was found in several studies (Earley, 1994; Peterson et al., 1996; Silver and Bufiano, 1996; Gibson et al., 2000). Group members, who have a good estimate of the group's ability to perform a specific task, will have higher group cohesion and consequently perform better. Hence,

H1a: Group efficacy is positively related to task cohesion.

H1b: Group efficacy is positively related to social cohesion.

Team Building

Research shows that team building leads to an increase in team performance (Woodman and Sherwood, 1980; Hardy and Crace, 1997; Shandler and Egan, 1996). Enlisting the participation of a group in planning and implementing change will be more effective than simply imposing change on the group from outside. Accordingly, we hypothesized that team building leads to group cohesion and consequently perform better. Hence,

H2a: Team building is positively related to task cohesion.

H2b: Team building is positively related to social cohesion.

Group Cohesion

Group cohesion and its impact on group performance has been a subject of interest in several models of effective teams (Cohen and Bailey, 1997). The importance of this construct has been identified as a key in effective work groups (Evans and Dion, 1991; Mullen and Copper, 1994; Cohen and Bailey, 1997). Accordingly, we expect that IS project team members that show a high level of cohesiveness will have a higher performance. Thus, we hypothesized:

H3: Task cohesion is positively related to group performance.

H4: Social cohesion is positively related to group performance.

METHOD

Sample of Respondents

One hundred and eighty five MIS undergraduate students from a 4th-year systems analysis and design course participated in this study on a voluntary basis. Thirty-five groups of 4 to 6 students were formed randomly at the beginning of the semester to conduct real system development projects at different companies in a mid-east Canadian metropolitan city. The group project lasted 4 months. Participants were informed that all data will be kept anonymous and that the research is intended to have a better understanding of group dynamics and their effect on group performance.

Questionnaire Items

The constructs are measured and operationalized with specific items contained in the survey instrument. The first step in developing instruments with desirable psychometric properties is to specify the domain of the construct and be as exact as possible in defining the conceptual content of the construct. An examination of the literature was conducted; mainly group research and IS literature showed a deep understanding of these theoretical concepts. The second step, suggested by Churchill, of instrument development involves verifying that the dimensions identified in the previous step are an accurate representation of the constructs and generating items to capture the specified construct domain.

Measures used by Chang and Bordia (2001) to assess task cohesion and social cohesion were each measured by four-item scales. Group efficacy was measured by a scale of one question (Pescosolido, 2001) "What is the highest grade level that you feel 100% sure that you are capable of achieving as a group?" Team building was measured by four item scale assessing goal setting, interpersonal relations, problem solving and, role clarification (Salas et al., 1999). Group performance was measured by a three subjective item scale (Hackman, 1990).

Analytical Procedures

Hair et al. (1998) have underlined the importance of screening data prior to any analysis. The investigation of issues related to missing data, outliers and assumptions of multivariate analysis followed the authors' guidelines. Screening the 185 usable questionnaires for missing data shows a negligible number was missing. Twelve questionnaires were drop from further analysis because they were half completed. A mean substitution was used as one acceptable means of generating replacement values for all the missing data (Hair et al. 1998). Furthermore, outliers, which are unusual observations that may not be representative of the population under study, were examined. Outliers can be the result of some data entry error or extraordinary events and have the potential to seriously distort statistical tests. The research data were analyzed to look for univariate and multivariate outliers. Since most of the variables under study were measured on a seven-point scale, none of the observations appear extreme and therefore all the data were kept for analysis. Furthermore, data normality was checked (PLS does not require data normality). These tests involve assessing the normality of data distributions. Data normality was tested using skewness and Kurtosis tests in addition to Kolmogorov-Smirnov normality test. The results of this examination led us to believe that the assumption of data normality is accepted.

Assessment of the Measurement Model

Assessment of the research model was performed using self-report survey data and Löhmoller's partial least-squares (PLS) approach to multiple indicator structural equation analysis. The largest construct in this study has 4 items, which makes a required sample by PLS of 20 observations (4 * 5). Although it is based on ordinary least-squares regression, PLS is chosen over regression because it allows: 1) modeling multiple dependent and independent variables; 2) incorporates unobservable constructs, and 3) empirically estimates the contribution of multiple construct measures. In addition, PLS relaxes data normality constraints and it is suitable for this study since the research model is at the early stage of development.

PLS analysis involves two steps: (1) assessment of the measurement model, including the reliability and discriminant validity of the measures, and (2) assessment of the structural model. For the assessment of the measurement model, individual item loadings and internal consistency reliabilities are examined as a test of reliability. For discriminant validity, items should load higher on their own construct than on other constructs in the model, and the average variance shared between the constructs and their measures should be greater than the variances shared between the constructs themselves. The structural model and hypotheses are tested by examining the path coefficients. In addition, the explained variance in the dependent constructs is assessed as an indication of model fit.

Reliability Assessment

PLS estimates parameters for both the links between measures and constructs (i.e., loadings) and the links between different constructs (i.e., path coefficients) at the same time. The adequacy of the measurement model can be assessed by looking at: (1) individual item reliabilities, (2) the convergent validity of the measures associated with individual constructs, and (3) discriminant validity. Individual item reliability is assessed by examining the loadings of the items with their respective construct. A rule of thumb employed by many researchers (Rivard and Huff, 1988) is to accept items higher than 0.707, which implies that there is more shared variance between the construct and its measure than error variance.

The second criterion used is the Cronbach's alpha which reflects the consistency of the measure and the homogeneity of the items in the scale. In the majority of cases, the alphas equalled or exceeded 0.7, the benchmark Nunnally established for instruments used in exploratory research (Nunnally, 1978).

The third indicator assessed is the Rho coefficient provided by PLS. This internal consistency is assessed in a PLS model using a measure developed by Fornell and Larcker (1981). It is not influenced by the number of items in the scale as opposed to alpha; it is; however, influenced by the relative loadings of the items. It is based on the ratio of construct variance to the sum of construct and error variance. A value greater than .50 indicates that the construct variance is accounts for at least 50 % of the measurement variance.

Finally, a measure called the Average Variance Extracted (AVE) determines the average variance shared between a construct and its measures and the variance shared between the constructs, which are the squared correlations between the constructs. AVE is obtained by the sum of loadings squared, divided by the number of items in the construct, whereas the variance shared between two constructs corresponds to the square of the coefficient of correlation between the latter. The AVE should be higher than 50 % (Rivard et al., 1993).

TABLE 2
RELIABILITY ASSESSMENT

Variables	# of items	Alpha	Rho	AVE
Team Building	4	0.74	0.88	0.66
Self-Efficacy	1	—	—	—
Task Cohesion	4	0.90	0.90	0.78
Social Cohesion	4	0.84	0.87	0.62
Group Performance	3	0.81	0.95	0.86

Convergent and Discriminant Validity Assessment

Convergent validity can be assessed by the degree of "agreement" among items measuring the construct. To evaluate discriminant validity, Fornell and Larcker (1981) suggested a comparison between the average extracted variance of each factor and the variance shared between the constructs (the squared correlations between the constructs).

A PLS run was conducted to compute the covariance matrices of all measures used o evaluate the loadings of the different measures on their constructs. Table 3 reflects the loadings of items on their own constructs. It is expected that the loadings of all variables within the same construct should be high on this construct, indicating high convergent validity, and low on the other ones, displaying high discriminant validity. The first

TABLE 3
PLS LOADINGS: CONVERGENT AND DISCRIMINANT VALIDITY

	Loadings				
Variables	**Task Cohesion**	**Social Cohesion**	**Self-Efficacy**	**Team Building**	**Group Performance**
TSK1	**0.85**				
TSK2	**0.91**				
TSK3	**0.87**				
TSK4	**0.71**				
SOC1		**0.78**			
SOC2		**0.80**			
SOC3		**0.85**			
SOC4		**0.71**			
EFF			**1.00**		
TM1				**0.84**	
TM2				**0.86**	
TM3				**0.75**	
TM4				**0.79**	
PRF1					**0.90**
PRF2					**0.94**
PRF3					**0.94**

characteristic indicates that they share a lot of variance with their construct and the latter that they are independent from the other constructs. Table 4 reflects AVE (average variance extracted) values. Squared correlations (off-diagonal) are reported where the on-diagonal are the AVE squared root. The number on the diagonal should be higher than the elements off diagonal.

These loadings show a clear discriminant and convergent validity for all constructs. Items that did show an imperfect loading structure were deleted, that is, they did not show (1) higher loadings on their respective variables displaying convergent validity and (2) lower loadings on the other variables displaying discriminant validity. Items of the two dimensions of Asset Specificity construct (supplier investments and human resources) were aggregated by averaging, for each dimension, the weight of each item and its associated value. Then, PLS run was performed and items that did not load high on their constructs were deleted. The reasons for these findings are not entirely clear. One possible explanation is that the validity of this measure cannot be truly established on the basis of a single study. Validation of measures is an ongoing process, which requires the assessment of measurement properties over a variety of studies in similar and different contexts.

TABLE 4
VARIANCE SHARED BETWEEN CONSTRUCTS

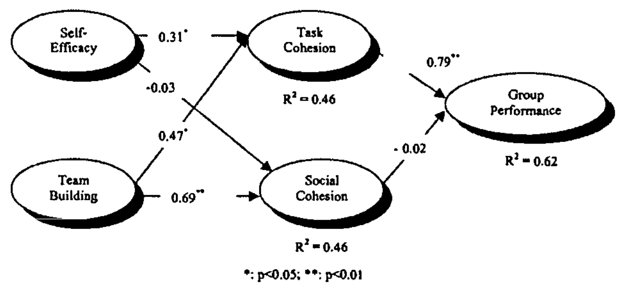
Variables	Variance				
Taks Cohesion	**0.88**				
Social Cohesion	0.07	**0.79**			
Team Building	0.37	0.46	**0.81**		
Group Performance	0.62	0.03	0.24	**0.93**	
Self-Efficacy	0.28	0.08	0.20	0.27	**1.00**

The numbers on-diagonal are the square root of the average variance extracted (AVE). These values should be higher than that off-diagonal. The largest correlation off-diagonal is 0.62. The lowest AVE squared root (on-diagonal) is 0.93. Hence, the smallest on-diagonal value is larger than largest off-diagonal values displaying the expected pattern. Hence, from the results of this second PLS runs, discriminant and convergent validity of the measures appeared to be satisfactory. The measures can be used to further assess the model and verify the hypotheses.

Assessment of the Structural Model

The structural model shown in Figure 2 provides the hypothesized relationships. The model's constructs are conceptualized with reflective items since these items reflect their respective construct by covarying simultaneously. Each hypothesis was tested using PLS Graph (Chin, 1995) by looking at the path coefficients. The estimated path effects are given along with their degree of significance. A bootstrapping procedure was used to assess the level of significance of the paths computed by PLS. T-values were computed from a series of PLS evaluations made against several partitions of the data set. The results of the PLS run with the overall sample (n = 35 groups) are shown in Figure 2.

FIGURE 2
MODEL PARAMETERS
FOR THE RESEARCH MODEL



As can be seen in Figure 2, the correlations between the constructs suggested that there were a priori grounds for expecting significant effects between them except the ones between group efficacy and social cohesion and the correlation between social cohesion and group performance.

Self-efficacy shows a positive effect on task cohesion with a path coefficient of 0.31 ($p < 0.05$) but not on social cohesion. Team building shows, as expected, a positive effect on task cohesion with a path coefficient of 0.47 ($p < 0.05$) and a significant effect on social cohesion with a path coefficient of 0.69 ($p < 0.01$). Task cohesion shows a strong effect on group performance with a path coefficient of 0.79 ($p < 0.01$). Surprisingly social cohesion had no effect on group performance. The percentage of the variance explained (R^2) of group performance was 62 %.

DISCUSSION AND CONCLUSIONS

The primary objective of this research was to examine the antecedents and consequences of group cohesion, that is, task cohesion and social cohesion. To that end, the developed model was empirically tested using data collected during a survey study. The results of the empirical analysis provide a number of interesting insights and suggest several conclusions.

The findings of this study provide support for the group research theory perspective on the determinants of group performance. First, group efficacy was found to play an important role as an antecedent of task cohesion but not social cohesion. Task cohesion is increased when group members collectively believe that they will perform better on specific task. Group members were united in trying to reach their goals as a group and were committed to the task. However, group efficacy did not have much effect on social cohesion. One possible interpretation of this result is that even though group members believed that they were capable of achieving highest performance, they did not develop social ties outside of group work. These are very interesting findings. Groups with high degree of self-efficacy will develop cohesion around the task in hand and not a social one.

As advocated by prior research, the analysis also sheds light on the positive effect of team building on both task and social cohesion. As expected, there was a significant positive effect. Group members who set objectives to achieve the group's goals, share information regarding their respective roles within the group, and were involved in the identification of major problems in the group and implement solutions for those problems developed both task and social cohesion. The argument posits that the ever-present team building ingredients will induce group members to a higher degree of cohesiveness.

Finally, and in accordance with group research literature, there was a significant positive impact of task cohesion on group performance but no effect of social cohesion on group performance. These results may imply that in the presence of higher degree of task cohesion, group will have higher performance. On the other hand, groups that may spend time partying together and socializing did not show any significant correlation with group performance. Indeed, these results provide insightful information as of the predictors of group performance and the role of group efficacy and team building on task cohesion.

IMPLICATIONS FOR RESEARCH AND PRACTICE

There are several potentially important implications for IS researchers and practitioners. The findings of the study demonstrate the value of the contributions of the antecedents and consequences of group cohesion, more particularly, task cohesion. This study represents an initial step in a theory-based empirical test of group performance and its antecedents. In developing and testing the research model and lays the foundation for future research concerning this important issue of group performance IS investigators interested in this issue will have instruments to capture its determinants.

For practitioners, this study has some important implications. The results of the survey received a substantial support for the theoretical foundation upon which this research is built on. The interplay of the relationships of different constructs is also of interest to practitioners who assess group performance. Certainly, it is hoped that firms will be able to enhance their understanding of what makes group perform better by employing the instrument.

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TRIALS AND TRIBULATIONS IN THE DESIGN AND DELIVERY OF AN INNOVATIVE BUSINESS COURSE IN ENTERPRISE RESOURCE PLANNING IN AUSTRALIA

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ABSTRACT

A significant number of businesses world-wide have implemented enterprise resource planning systems in order to achieve improvements in transaction processing efficiency, process integration and productivity and lead a significant paradigm shift in managing business operations. However, with too much focus on specialism, traditional curricula of business education did not make any provision for the holistic approach integrating the different aspects of business operations. Recognizing the importance of process centering, enterprise-wide computing solutions available in the market, and increasing role of information in managing business operations, a postgraduate business course in enterprise resource planning using SAP R/3 system as a teaching and learning aid at the University of Western Sydney, Australia was designed and implemented in 1998. This paper briefly reviews the program after four years of program delivery, and expounds the background to this program, its unique design features, delivery processes, and assessment systems from the educational effectiveness perspective. This paper reports on the work-in-progress of an evaluative research study of the innovative program that incorporates SAP R/3 system. Based on the feedback from students and preliminary analysis of the data collected the program appeared to have succeeded in transforming the students into business specialists with strong process, software and project management skills. However, complexity of the software, limitations of academic skills and knowledge, lack of quality curriculum materials, reliability of the system, support facilities, varying student mix, difficulty in obtaining the industry support, and effectiveness of the curriculum are observed to be problematic.

INTRODUCTION

Taking into consideration the latest developments in enterprise wide computing and increasing role of information in managing operations, and the need to design appropriate professional courses to meet the requirements of industry, a post graduate business program in enterprise resource planning was designed and implemented at the University of Western Sydney, Australia. This paper describes the background of the innovative design of this masters program and reports on the evaluation of the program after four years of running. Based on the information collected through a survey of students and lecturers, and the principles of curriculum design, delivery and evaluation in higher education context, this paper evaluates the program and recommends changes for future.

BACKGROUND AND CONTEXT

The environment in which business operates today is changing very rapidly. E-business initiatives, increasing competition, cross-functional integration, integration of inter-enterprise processes in the value chain, increasing strategic importance of information technology are forcing business organizations to change their management systems and processes rapidly and frequently (Handfield & Nichols 1999) in line with the dynamic changes in supply, demand and customer expectations. Role of information and computer-based information system in business and their significance is increasing as new technologies and new processes are evolving. From traditional payroll and bookkeeping functions, computerized systems are now penetrating complex managerial areas.

Move Towards Integration and Processes

Many organisations such as General Electric, Toyota, IBM, Ford, Microsoft and others are shifting the focus of management development away from specialization and towards integration of the different disciplines and functional departments (Malekzadeh 1998). This way they believe, will be able to provide increasingly demanding customers with a better and more flexible service. In this context, business organisations are using information technologies as enabler of change, and integrated enterprise-wide computing information systems to support today's complex and effective decision making (Davenport 1998). Enterprise systems are integrated systems that provide seamless integration of all the information flowing through a business organisation from accounting, human resources, supply chain and customer information. Usage of ERP software is changing the face of information technology in business organisations and is blurring the lines between information technology and users. Increasingly, the managers are required to become information intelligent, with the ability to learn new information technology applications and design and redesign systems.

Business Education in Universities

As the organizations adapt in response to changing environmental conditions, there should be a corresponding change and adaptation in universities. The strength of business education at present lies in specialist or technical areas such as marketing, finance, accounting, human resource management, or operations. All these fields evolved over a period of time into narrow areas of study. These functionally specialized schools within university structures reflect the needs of the large, highly bureaucratized organizations that have dominated this century. Not surprisingly, universities are generally criticized of producing narrowly trained individuals who hold a compartmentalized orientation of the way business is conducted (Morris 1997).

Reports after reports revealed that business graduates do not have the ability to integrate and cross-functional/ interdisciplinary perspective (AC Nielsen 1998, Barker et al. 1998, Karpin 1995). For example, Karpin pointed out that the universities in Australia though successful in providing functional skills, have precluded the development of integrative skills critical in business environment. The report argues that over-emphasis on functional skills such as accounting and marketing act as a barrier to building better teamwork skills and integrated approach to business management (Karpin 1995). Though adopting cross-functional integration as a teaching approach and creating an information orientation were recommended in a classic review of higher education by Porter and McKibbin in 1988, the evidence of such change is sketchy.

The integrative business processes that span across various functions are not embedded in the present curriculum designs and generally left entirely to either the individual student or to a learned faculty member to tie them together basing on his/her experience. Though debates are on about an alternate business education curriculum integrating the common core with a process oriented approach, the forums for discussion and exchange of ideas concerning these redesign efforts are limited (Stover et al. 1997).The exponential growth in business management knowledge and the increasing technical content of even the most elemental business course has not given chance for the additional integrative elements of the course.

Graduates and employers are realizing the importance of integrative capability at the workplace and are forced to spend considerable amount of resources in retraining business graduates and impart integrative process-oriented skills. Thus it triggers an unlearning phenomenon within the fresh graduate to become acceptable employee and start learning. This learning process becomes harder and harder as the graduate is not equipped with the skills to learn, reflect and learn continuously on his/her own. Thus the educational system that was designed based on the old management paradigms relevant to a manufacturing-based economy, and in a time of industrial revolution, has now become irrelevant and obsolete.

Potential Role of ERP Systems in Business Management Education

In universities, too much of focus to integrate IT into the business curriculum has been on either the acquisition of IT skills or usage of IT to support the teaching process (Mutch 1996). While accepting that these are necessary developments, more attention is needed in imparting the meaning of information and its critical role in operations management. Enterprise resource planning (ERP) systems provide an excellent opportunity for introducing business process orientation and help in developing a cross-functional curriculum that imparts integrative skills and offer real-world exposure to students (Watson & Schneider 1999). By integrating enterprise resource planning systems into the curriculum, it is possible to overcome some of the problems associated with the lack of integration and process-orientation in business management education, to some extent.

For example, its process-oriented approach to the business, seamless integration of data that interfaces several functions, ability to use mathematical models, focus on information and systems view of decision making, and the ability to demonstrate the affect of integrated data in business will highlight the challenges ahead and prepares them better than an education that is focused on functional specialisation. Importantly ERP system's ability as a powerful computing tool to demonstrate the cross-functional integration and the influence of business process approach and reengineering in managing operations play a powerful role in preparing managers for the 21st century.

RATIONALE AND APPROACH TO CURRICULUM DESIGN

There are different approaches of incorporating ERP systems into the business curriculum and depend upon the field or discipline initiating this move (whether information systems, computer science or business management), and the specific focus (particular software training or business process perspectives or as an aid to teaching business/information concepts). The employers embracing enterprise systems are dependent upon vendor-specific product specialists who are information technology specialists and lack theoretical foundations in business management and process-centered approach to managing business (Elam et al. 1999). In the absence of process focused specialists, a functional specialist generally handles the reengineering and configuration of the processes within functional framework and tries to integrate them with other functions. Similarly, information technology specialists translate the 'reengineered' processes by the functional specialists into an automation framework. This approach may result in gap between the process and technology and may lack the balance between business and technology. The enterprise solutions thus developed may become complicated, time-consuming and expensive exercise for the business (Bingi et al. 1999; and Booth et al. 2001). In addition, absence of process-centered approach in the implementation negates the very objective of using enterprise-wide resource planning solutions.

Balance Between Scholarship and Vocational Training—A Dichotomy

Integrating a large ERP software product into business course raises a traditional dichotomy in an ideal university curriculum. Resolving the question of balance between scholarship and vocational training is imperative to meet the changing market needs of universities and their customers—industry and students. Contrary to the traditional 'push' model in designing and developing courses, a realistic 'market pull' models are increasingly becoming popular in Australia. These new and revised curriculums are, through most subjects, increasingly, are reflecting a vocational emphasis embedded within a suitable theoretical or academic framework.

Despite its prevalence, demand for graduates and success of formal academic business and management education, serious questions have been asked about their relevance to a modern industrial economy. Some of these educationalists, who prefer a classical approach to university education, doubt the value of application or vocation in business education (Cannon 1996). More subjects with a practical orientation would be recognized as a valid pathways to further and higher education, thus elevating the status of the more vocationally oriented subjects. In fact, a report by Cunningham et al. (1998) recommended universities to develop strategies to capture the profitable professional graduate market, which is vocational to some extent, as a component of life long learning. The educational needs of working professionals, expanding international student markets, and budgetary pressures on universities to earn fees, have encouraged several universities to start full-fee paying post graduate programs that will impart employable skills to the students. Several specialized business courses were designed and successfully marketed by the universities. Some of them are in quality management, marketing management, logistics management, operations management, human resource management, industrial relations, occupational health and safety, finance and banking, professional accounting, public sector management, and technology management.

In line with the growth of enterprise resource planning software solutions and related information technologies, demand for highly skilled professionals is rapidly rising. The software manufacturers have their own training and certification programs to deliver product-specific application, configuration and implementation skills to enterprise IT professionals and consultants. Working in conjunction with operational staff in the customer organization, the "vendor-certified" software product experts undertake the complex task of implementing enterprise solutions in accordance with the respective vendors' recommended practices.

By implementing enterprise systems, organisations are embarking on a new way of life that involves continuous changes. Changes such as adaptation of system to changes in the structure, installation of new releases of software, training new users of the system, training old users on new functions and capabilities and changing the system or software from time to time based on the managerial advice, will continue forever after implementing enterprise systems (Davenport 2000). Organisations must be prepared to change on an ongoing basis and employ resources and strategies to manage those changes. Though there are a large number of consultants who have acquired the product specific technical skills, they generally do not possess adequate theoretical grounding in business operations required for the day-to-day operations and maintenance. The high cost of these consultants and their narrow focus on one or two software modules in an ERP system, create problems for ongoing running and maintenance of the enterprise systems after their implementation. This program is expected to fill this gap to some extent, by providing graduates with business knowledge from process centred perspective as well as software skills. This initiative is expected to support larger enterprises to manage change in a cost-effective way, and a large number of medium and smaller organizations to affordably implement and maintain integrated ERP solutions in their operations.

SAP and other ERP Software Solutions—The Choice

Several enterprise resource planning software products such as SAP R/3, BAAN, PeopleSoft, and JD Edwards have emerged in the marketplace. These software products have a complex client-server architecture, are powerful and user friendly, web-enabled and incorporates several decision support capabilities now, and cover a broad spectrum of enterprise functions. In the 1990s, as a part of their strategic moves of expanding the adoption of ERP software, several software vendors developed university alliance programs and started encouraging universities to incorporate the software into their curriculum. SAP, People soft and JD Edwards are leadings in this initiative. Though started in Europe initially, and then to USA, these initiatives moved into the Asia and Australasian region in mid 1990s. In its university alliance program, SAP provides universities with a complete version of its R/3 system software and a training database, along with associated documentation, technical support and faculty training free of cost (Watson & Schneider 1999). Universities on their part will invest in the hardware and integrate SAP R/3 in their curriculum.

Because SAP was the most popular ERP software with about 40% market share in 1996, and the prohibitive cost of other competitor products from JD Edwards and PeopleSoft, and lack of a viable university support programs at that time from other competitors, SAP was chosen by the University of Western Sydney in the year 1997. When the author made first contact with the SAP Australia in 1996, only two universities, the Queensland University of Technology (QUT), Brisbane, and, the Victorian University of Technology (VUT), Melbourne had just started some courses on ABAP programming and SAP. These courses were offered from the Faculties of information technology and from the schools of information systems. Considering the limited investments required for hardware and free availability of software from SAP and not from any other ERP vendor, the University of Western Sydney Nepean, has started designing the curriculum incorporating SAP R/3 in their business operations courses in its then successful masters program in operations management.

A new professional master of business course in enterprise resource planning was designed to develop lateral depth to students across all elements of business operations. Some of the objectives associated with an ERP system initiative in universities include exposing students to the real-world from the classroom, developing cross-functional curriculum, enriching specific curriculum, exploring new research opportunities and creating a competitive advantage (Watson 1998). In addition, incorporating ERP software into curriculum is likely to enhance the credibility of business schools in the eyes of industry that generally criticizes academia of ignorance of the developments in the industry.

The main objective of this program was to equip students with the knowledge of the business processes, and skills for redesign, configuration and implementation of these business processes with the help of SAP R/3 software. In order to fill the skill gap and to deliver broad-based expertise in emerging ERP solutions discipline, the proposed academic program envisages in its curriculum the following. It includes business operations theory from process management perspective, a holistic view to business management, focus on strategic as well as day-to-day operational issues, a complete understanding of the enterprise environment, ability to redesign processes employing basic reengineering principles, ability to implement and use an ERP software in a business organization, awareness of the technology behind the software and skills to manage change.

In 1997, no academic program in Australian universities provides knowledge and expertise to students in maintaining and assisting the ERP system implementation, and in providing support to users, from business perspective with an underpinning theoretical framework. There were, however, some successful programs in information systems area incorporating ABAP (programming language), process modeling and other business perspectives by the computer science faculties/schools using SAP R/3 system as a base (Watson 1999; Hawking 1999). Though ERP concepts can be taught without having access to a SAP R/3 software system or any other software, hands-on exposure for students strengthens students' learning experience and provides real-world exposure. Importantly, students will be able to develop ERP software skills that are highly valued by business.

FEATURES OF THE PROGRAM

This program aims to bridge the gap between traditional business and information technology courses offered by universities and the real world requirements of business in practical application of skills. The objective of this program was to equip students with necessary skills in optimizing and planning business processes and the usage of software, with knowledge of technology, reengineering and management of change issues underpinning the course. Graduates of this course are expected to be able to assist in implementing and configuring the ERP software to suit specific requirements of business and assist in the reengineering of business processes for improvement. After the implementation of the enterprise systems, these graduates are expected to maintain and upgrade the system. These graduates are not expected to be technical (information technology) personnel who have the capability to design and administer the system; their expertise, rather, will be confined to the implementation, configuration, running and maintenance of the system in several application areas. Each subject included in the course will not only teach the relevant conceptual frameworks and tools, but also develop abilities to extend knowledge through research and independent investigation.

The Masters degree requires completion of 12 subjects. Graduate Diploma requires 8 subjects and the Graduate Certificate requires 4 subjects. The Graduate Diploma and Graduate Certificate are nested within the Masters degree. The proposed program structure has three tiers. The design process adapted an 'interactive model' of course design, which involves specification of learning outcomes, sequencing of content, selection of learning strategies and methods, and selection of assessment procedures that are common in any design processes (Cunningham 1997). The program structure envisages three tiers of knowledge with some flexibility for students to acquire additional theoretical inputs from IT or business subjects. The first level provides foundation knowledge, the second tier imparts knowledge and practical skills about business processes and management systems, and the third tier focuses on strategic technology, enterprise performance management and implementation issues.

Foundations

In the first tier of the program structure, three subjects that provide foundation knowledge to the course are included. They cover issues such as basic IT concepts, enterprise computing concepts, process concepts and logistics/supply chain operations knowledge.

1. Enterprise computing concepts—enterprise-wide computing concepts, enterprise application integration concepts, integration of processes and information systems, client/server technology and security, communications, messaging and workflow concepts.

2. Commercial IT Environments—to provide basic concepts of systems analysis & design, database concepts, and data communications & network concepts.

3. Logistics and supply chain management or operations management—overview of logistics and supply chain management concepts, processes and costs, transportation, inventory, production, warehousing, supply chain integration, and information technologies in supply chain management.

Process Management

In the second tier, subjects related to the various business processes are included. They include both primary business processes and enabling processes. This level provides knowledge and skills concurrently on several process-focused modules emphasizing on the interface with other modules/processes.

1. Customer order management processes and systems—includes concepts of customer order management and customer service; incorporates Sales & distribution and Customer service modules of ERP software.

2. Production Management processes and systems—imparts concepts and basic knowledge of production planning and control processes and systems for repetitive or batch manufacturing system; and incorporates production planning/management modules of ERP software.

3. Materials and quality management processes and systems—imparts knowledge of procurement processes and incorporates MM module of the ERP software.

4. Financial planning and control processes and systems—imparts basic financial planning and control process concepts and knowledge; and incorporates ERP software skills in Financials and costing modules.

5. Human resource management processes and systems—imparts basic knowledge of human resource management processes, and incorporates human resource module of the ERP software.

Strategic and Management Issues

Third tier of the structure incorporates strategic and management issues in relation to the technology and system management, programming languages, enterprise performance measurement and management, and an action learning project. This action learning project is an industry-based project that involves redesigning process or processes, and/or implementing parts of ERP systems in business organizations. Integration of business technology with the reengineered business processes at the enterprise level forms the core in this tier.

1. Managing Integrated Business Technology—incorporates ABAP programming, reporting and analysis, and system administration issues in ERP context.

2. Enterprise Reengineering and Management of change—Reengineering of processes and implementation of SAP with the help of ASAP methodology, and general concepts of change management and project management; and integration of the technology and various other subjects in the course that emphasize on particular aspects or processes.

3. Enterprise Resource planning project—action learning project involving application of concepts, models and skills to the actual live project in industry; with cooperation and involvement of industry partners of the program.

4. Value Based management systems—new cutting edge developments such as SCM (Supply chain management), CRM (Customer relationship management), PLM (Product Life cycle management), SEM (Strategic enterprise performance management) are expected to be taught in this subject. In addition, students are exposed to the latest cutting edge software products in this area and their integration with ERP software.

Individual Choices

Students are given an option of picking up two electives from any school within the University. The curriculum designed in this program is flexible and can meet the needs of a broad spectrum of professionals entering this field. While the core requirements expose students to the foundation, process management, and strategic issues in designing and implementing ERP solutions, flexibility in electives allow students to tailor the program to meet individual career goals, depending upon their background and experience or lack of it.

Entry Requirements

The proposed program is open for people from any undergraduate discipline. Applicants with an extensive industry experience, but no undergraduate degree of graduate diploma are also eligible to apply. Applicants are required to demonstrate their aptitude and interest in the field of study though a written submission and a letter of support from their employer or some academic references. This multidisciplinary entry to the program strongly reflects the process-oriented approach in any business and the overarching presence of business operations in any area of work. The multidisciplinary nature of entry is also expected to facilitate cross-fertilization between various disciplines and exchange of information and knowledge between students, and better understanding of process approach to business management, efficiently facilitated by academics.

Teaching and Learning Strategies

Delivery mode is an essential part of a teaching and learning. Literature cites that the mode of instruction should be selected according to the age and educational background of the participants, preferred learning styles of participants, available resources for course development and delivery, and whether the course is predominantly skill-oriented or knowledge based (Donovan et al. 1999; Holland 1995; Cunningham 1998). Though there are three modes, viz., classroom based, self-paced, and computer based, no exclusive strategy is effective. Hence, a mixed strategy was proposed for the delivery of the program. In addition to the classroom lectures interspersed with case studies, practical work and assignments using software, tutorials and guest lectures from industry were proposed.

Assessment is an integral part of learning. In many academic institutions, assessment is viewed as a way to measure the learning that has taken place during the semester, as a way to apportion grades that differentiates between students, but not as a way that enables students to demonstrate their understanding. Despite the necessity to award grades at a university, the assessment in this program is approached primarily as a means of giving feedback to students on their learning and getting feedback from students on teaching. Considering this objective, appropriate assessment methods were selected, designed, and implemented considering the principles of validity, reliability, feasibility and flexibility. In addition to these, transparency of processes and criteria, simplicity in procedures and tasks, and maintaining relevance to the changing subject content are the other important principles that are taken into consideration in the assessment process. As a general guideline, each subject will have three to four assessment tasks that comprises of examinations, computer-based practical examinations and tutorials, assignments that require theoretical knowledge and practical software skills, research papers on specific topics, and field project stressing on application and implementation at a workplace.

EVALUATION OF THE PROGRAM—AN APPROACH

Evaluation in Higher Education Context

Evaluation in the higher education context, is the process of delineating, obtaining and providing descriptive and judgmental information about the worth and merit of a program's goals, design, implementation and impacts in order to improve the program and promote understanding of the process (NRC 1999). This is carried out with a view to improve the course for future cohorts of students. Depending upon the reason for doing evaluation, the type of data required and the sources from which data is collected is different. Some of the sources are the subject outline documents, information from subject coordinators, former and current students, and professional evaluators. This information about the course is gathered from the students with the help of structured questionnaires and/or interviews that seek information about their reactions to curriculum design, course content, course delivery, and their use of course materials, suitability of teaching methods employed, suitability of assessment procedures and methods used, and other supporting facilities for learning. Methods for gathering data include subjective judgments, student achievements and surveys of student opinion.

Most evaluations in several universities depend heavily on information obtained from students currently enrolled, for evaluating the courses and improving teaching programs. While emphasising that there is no single fixed approach to evaluation, literature provides several approaches to evaluation—goal oriented evaluation, decision oriented evaluation, goal free evaluation, illuminative evaluation, and transactional evaluation (Wagner, 1994). As summarised by Wagner (1994), Parker's approach to evaluation focuses on the performance of the participant on the job, his/her satisfaction, and the knowledge gained by them, whereas Bell system emphasises on several outcomes in terms of the participants' reactions, the knowledge gained or demonstrated competence, and the value of training in relation to its cost. Similarly, the CIRO approach deals with the contextual issues in evaluation and participants' reactions for essentially improving the program. Kirkpatrick approach concentrates on the reactions of participants, the measurement of learning, behaviour and the results of training in terms of several organisational performance indicators. Each approach has its advantages and limitations, and hence the lecturer could use a combination of approaches to suit his or her specific needs and focus in the evaluation.

Objectives of This ERP Program Evaluation

The main objectives of this evaluation are to bring about improvements in the curriculum and delivery and to judge the success or failure of this innovative post graduate business course in enterprise resource planning with SAP R/3 system. With these objectives, it is decided to evaluate the following aspects of the course—curriculum design, delivery and teaching performance, assessment, university resources, SAP R/3 system facility, projects, placement and other support facilities. There are no separate evaluations of particular subjects, instead, graduate students are asked to evaluate the entire program and provide feedback.

Sampling and Data Collection

Unlike other evaluations, the study focused on the graduate students who had completed the course and left the university. For the sake of definition, graduate student is defined as one who had completed at least Graduate Certificate program and left the university at the time of survey. The cohort of students comprises of international students from countries such as India, Pakistan, Thailand, Indonesia, Taiwan, China, Hong Kong, Sri Lanka, Jordon and Scandinavian countries. Statistics indicate that about 104 students completed this course with graduate certificate or graduate diploma or a Masters degree, in the past four years. The program is offered mostly in the evening and on weekends to accommodate for the part-time students who comprise about 50% of the students in the course.

The type of instruments employed for data collection in this evaluation is questionnaires. Though literature suggests different other methods such as case studies, supervisor ratings, logs, and interviews, a questionnaire survey is employed to collect data. This approach is considered to be appropriate and relevant here, in view of its low cost, confidentiality and relatively easier way to administer and understand, and avoidance of fear and embarrassment for students (Burns, 1999). Since the questionnaire is administered on all the students, there are no sampling problems. However, there are certain limitations for this method—viz., possibility of misrepresentation of the questions by the respondents, incomplete and inaccurate information, ambiguity or vagueness in the questions designed, non-flexibility in providing free expression of opinions and finally the motivation of the respondents to answer questions (Gay and Diehl, 1992). However, whatever form, the importance of student feedback is immense in making improvements in the program design and delivery, particularly in the university's push towards more customer focused educational programs.

ANALYSIS AND TENTATIVE FINDINGS

Demographics

An analysis of the demographic data reveals that about 50% of the students are international students coming from various countries such as China, India, Indonesia, Jordan, Norway, Pakistan, Sri Lanka, Taiwan, and Thailand. While all the local students have some experience in either information technology or business functions or in both, only about 50% of international students have some experience before enrolling in this course. Summary of the respondents' demographics are given in Table 1.

Overall Perception of the Course

On a scale of 1 to 5 (1= very poor, 2 = poor; 3= good, 4= very good and 5=excellent), the respondents are asked to assess the course with reference to various dimensions, as well as the knowledge and skills gained by them in various areas. Analysis reveals that students on the whole, have perceived the curriculum design as good, while other dimensions such as resources and support, teaching performance are considered inadequate. The overall evaluation of the program with reference to various dimensions is given in Table 1.

Differences Between Local and International Students

An analysis of their responses and t-tests revealed that there are significant differences between the international students and local students. This

TABLE 1
SUMMARY OF THE RESPONDENTS' DEMOGRAPHICS

Characteristics of respondents	Local students	International students	Overall
Proportion of respondents	48% (50)	52% (54)	100%
Response rate	50% (25)	30% (16)	39%
Students with 'some experience'	100% (25)	38% (6)	76%
Students with 'No experience'	0% (0)	62% (10)	24%
Students 'With IT experience'	68% (17)	19% (3)	49%
Students 'With Functional experience'	60% (15)	19% (3)	44%
Students with both 'IT and Functional experience'	28% (7)	0%	17%
Students with undergraduate degree	74% (20)	100% (16)	88%
Students with exposure to ERP software	24% (6)	7% (2)	20%
Students working in an organization that has implemented or intend to implement SAP software	36% (9)	0% (0)	22%

classification is made without any prejudice, and keeping in view of the equity issues. The purpose here is to delineate the differences in terms of learners' needs and perceptions - both international and local and try to improve the program to consider both aspects. Results show that international students are relatively less satisfied with the course than the local students. The differences are particularly significant with reference to curriculum design, course delivery and the overall program. A review of the comments and the informal discussions revealed that the international students are more concerned about the curriculum design and resources & support issues while local students are concerned about the knowledge and skills of academic staff and course materials. A summary of the differences are presented in Table 2.

Further analysis, however, reveals that the satisfaction level of graduates is significantly different for different aspects. From the above, it can be seen that the satisfaction level of students in terms of resources and support and the course delivery are not good enough, when compared to the curriculum design. However, the comments made by the students and rating of other factors reveal some of the weaknesses in the curriculum design and delivery as well as the resources and support provided to the students. A brief review of the issues raised by the students is given below.

Curriculum Design and Sequencing of Subjects

Curriculum design is considered the strength of this course. Confirming this notion, respondents rated it to be good and reinforced the university's belief about the program. Certain elements of the design, however, are far from satisfactory and needs considerable improvement, according to the study. For example, respondents commented that the discussion of theoretical framework for each subject, knowledge of other ERP software (other than SAP R/3), basic concepts of data communications, database and systems analysis, and, knowledge of technology, configuration and administration of the system, are not adequately covered in the course.

However, respondents rated coverage of SAP R/3 modules, integrative nature of the course, and concepts of business processes and hands-on component of SAP R/3 system as good. There are, however, significant differences between the international students and local students. For example on the issue of covering concepts of business processes, international students are far less satisfied than the local students. The lack of functional experience of the majority of international students may be a factor contributing to this perception. It is difficult to cover the basic process knowledge as well as software skills in a particular unit exhaustively, given the constraints of time (36 hours of tuition) and limitation of the academic staff's competence on the software. Students are provided basic introductory knowledge of the appropriate business processes and software skills in the course and are required to develop on their own and/or by taking other electives that impart deeper knowledge and skills on process concepts and management.

On design of assessment tasks, there are significant differences between international and local students. For example, international students feel that oral presentation and written research paper have significant

TABLE 2
OVERALL PERCEPTIONS OF STUDENTS—LOCAL VS. INTERNATIONAL STUDENTS

Perception of Students	Local Students	International Students	Significance	Overall Rating
Curriculum design	4.03	2.92	0.000	3.59
Course delivery	3.51	3.24	0.015	3.40
Resources & Support	2.71	2.10	0.719	2.47
Teaching performance	3.01	3.16	0.325	3.07
Course materials	2.78	2.88	0.101	2.82
Overall program	3.30	2.93	0.002	3.15

proportion of weightage which could disadvantage them in view of their non-English speaking background. Another issue raised by them, is the field project. Field project generally requires students to obtain access to an organization and involves collecting information and interviewing managers. International students found it extremely difficult to gain access for carrying out such projects and generally felt disadvantaged.

Course Delivery

Course delivery is a challenging issue, especially, when a complex software such as SAP R/3 system need to be taught along with the theoretical concepts of the processes. In addition, it also depends upon various aspects of teaching such as knowledge of academic staff (both process and software), structure and sequence of the topics, design of and feedback on specific assessment tasks, communications, tutorial sessions and help on the system, availability of help and guidance, and quality of course materials. The overall perception of this course is significantly low.

The difference between international and local students is not significant on the overall dimension. However, issues such as knowledge of academic staff, quality of course materials, structure of the lectures, and concern for learning needs, international students are significantly less satisfied than the local students. On issues such as availability of individual help, actual delivery of lectures, help during tutorials and access to academic staff, there are no differences and generally the respondents are more than 'satisfied'. There are, however, some dissatisfaction expressed about the specific lecturers on the issues such as feedback on assessment tasks, structure of the lecture & topics, and general lack of concern for the learning needs of students. In addition, the knowledge and skills of academic staff is viewed as just 'inadequate' by the students and generally reflects the limitations of the delivery of such courses. It is observed in qualitative comments that the academic staff is not fully equipped to impart knowledge of SAP configuration.

Support and Facilities

Support and facilities are the major issues for all the respondents. Generally, respondents expressed complete dissatisfaction on the support and facilities provided by the university in running such IT-based and relatively new course. It appears that the administrators have failed to provide adequate support to the program and neutralized the positive perceptions of the curriculum design and delivery.

Availability of the SAP R/3 system for practice and teaching, its speed and reliability are critical factors for the success of this program. Study reveals that the university has generally failed to provide such reliable service and availability of system to the students during the class as well as after the class for practice. Some of the reasons cited for such failure include lack of proper support from the university information technology services division, reluctance of ITS to take the responsibility of maintaining the SAP R/3 system, dependence on the QUT's SAP Application hosting centre, limited system access to academics granted by the Application hosting centre (Queensland University of Technology) for fixing system problems and lack of advanced skills by the academic staff to fix some configuration problems, and inadequacy of the SAP IDES system for teaching purposes. While some of these problems are internal and can be resolved by the course administrators, others are beyond their control. For example, alternative options to own and maintain SAP R/3 system within the university, though feasible and resolve most of the problems, is an expensive solution and university is not prepared to commit such huge amount of resources for running a complex system such as SAP.

Availability of text books and adequacy of course materials provided in the course are another issue. Course materials/manuals prepared from the SAP R/3 training manuals are distributed to the students. As expected, these materials are not comprehensive, do not include discussion of concepts and explanation of the terminology in detail, and do not provide enough information for students to learn on their own. Though the manuals are not intended to be self-study materials, and are to be accompanied with appropriate explanations in the class, students generally felt inadequate with these materials. They complain that there is insufficient material to study in order to gain a deeper understanding. Moreover, these manuals are edited versions of SAP training manuals and are not suitable for university teaching. It is important to address these issues and develop appropriate course materials suitable for teaching and learning at the university level. This condition is expected to improve with the availability of online materials from this year onwards.

Since it is relatively a new course, not many reference books are available in the library. Thought it has improved lately, students are still dissatisfied with the non-availability of sufficient copies in the library. Secondly, most of the books prescribed in this course as additional reading materials are professional reference books and are quite expensive for students to buy. With a new SAP R/3 version coming every year, students are reluctant to invest on such expensive books which could become obsolete in a year's time. General unavailability of the resources in the university library compounded this problem.

Knowledge and Skills

Students are asked to rate their own skills and knowledge gained during the course and their response is summarized below. The difference between the local and international students is again significant on ABAP programming, application modules and business processes. The overall perception however is generally low as shown below. Students reported to have gained sufficient knowledge of business processes and application modules. However, it appears that the students could not gain adequate skills and knowledge in systems administration, software configuration, implementation, ABAP programming and reengineering in the course.

It is important to note that this is a business course designed with an emphasis on business processes and cross-functional integration rather than pure technical skills typically offered in computer science or information technology courses. Therefore, it is expected that they will be less competent in technical areas. International students also felt relatively less competent on business process skills, ABAP programming and application module software skills than the international students, according to the study. It may be generally attributed to the lack of functional or business experience of a majority of international students. It is difficult to gain competence in business processes with no prior knowledge or experience of business environment. The generally low overall rating for students' knowledge may be attributed to the factors such as teaching competence, complexity of the software and lack of appropriate course materials.

TABLE 3
OVERALL PERCEPTIONS OF STUDENTS—LOCAL VS. INTERNATIONAL STUDENTS

Skills and Knowledge Gained in the Course	Local Students	International Students	Significance	Overall Perception
Application modules (SD, PP, MM, FI/CO, HR etc.)	14.76	17.49	0.000	3.16
ABAP programming	3.10	2.15	0.000	2.71
Business processes	17.08	15.25	0.001	3.27
System administration	2.24	2.29	0.258	2.26
Implementation & configuration	2.78	2.80	0.078	2.79
Process reengineering	2.91	2.75	0.024	2.84

Competence of Academic Staff

One of the fundamental requirements for the continuous delivery of the program is the software competence of academic staff. Though the training is provided free of cost by SAP, not many academics are interested to undergo software training. Therefore, the depth and range of academic expertise available for teaching in this program is limited. The need to continuously update their software knowledge with every change in the version through training and practice is placing enormous demands on academics' time and the interest is waning. The complexity of the software, lack of practical experience of the academics in the configuration and implementation of the software and the limited expertise of academics, is contributing to the poor rating of the teaching performance and general overall impression of the program.

Though an attempt is made, experience by this university suggests that it is difficult to successfully integrate a complex and dynamic software like SAP R/3 into university curriculum and impart comprehensive software skills, process knowledge and cross-functional skills to students. By joining the University SAP application hosting centre as a member, software access has improved considerably and reduced the administrative workload for the academics.

LIMITATIONS OF THE STUDY

The emphasis throughout the evaluation process has been on the learner and how satisfied he/she is with the program in terms of its design, and delivery. Though this approach adopted may not be the best, but, given the circumstances, this approach traditionally serves better in obtaining feedback from the students. However, needless to say that the value of their feedback significantly depends upon the questions asked. In order to ensure that right questions have been asked, several instruments used in the past by the Universities, literature on curriculum design and a focus group discussion with the students are used to develop these questionnaires.

Some of the weaknesses inherent in a questionnaire survey are applicable to this evaluation also. However, an attempt is made to overcome some of the weaknesses by discussing issues with the students informally, and by asking their general opinions on the aspects which are done well, and aspects which needs improvement. In addition, before the administering of the questionnaire, students are asked to indicate their opinions and perceptions on the overall program, without being hindered by the structured questions. In fact, students responded well with this request, and given many other comments on the program, and suggestions for improvements. All these qualitative remarks are incorporated in the analysis while interpreting the data.

CONCLUSIONS

Universities must move from a position that emphasizes improved teaching to one that emphasizes improved learning by helping students to enhance their abilities to engage the learning challenges in their environment. Though we teach the importance of cross-functional teams, responsiveness to customer needs, and continuous real-time feedback for fine-tuning organizational performance in our courses, we do not demonstrate by example. Students often see narrowly functional teaching, a large bureaucracy that does not change curricula for years or design new ones to suit changing industry/business needs, and one end-of-course evaluation process that appear to have little relevance to their lives. This course being an innovative full-fee paying course with increasing demand and incorporates complex software such as SAP R/3 system, it is important to evaluate the course design and delivery and improve. Like any other business enterprise, universities/educational institutions also face timely, perishable opportunities for delivering the requisite skills to our students. If we fail to learn these new technologies and use them effectively in teaching and learning, we will keep ourselves as well as our students in the past, while the rest of the world moves on. This small attempt by the University to design business curricula with process orientation and use SAP R/3 system as a teaching and learning tool can be continued with the help of this feedback. This could become a crucial ingredient in developing future policies on course designs and delivery at the higher education institutions. It is expected that this process is continuous and improvements will be made on consistent and continuous basis.

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INTEGRATING STRATEGIC MANAGEMENT WITH INFORMATION SYSTEMS CORE CONTENT

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Core information systems (IS) courses in undergraduate business curriculums assume varying forms and cover varying topics (O'Hara and Stephens 1999). Despite differences in content and pedagogies, many implementations of core IS courses make use of traditional texts, most of which include chapters on hardware, software, networks, etc. Detailed coverage of technology topics—especially when detached from the context of other business disciplines—can alienate non-IS students in particular and can contribute to perceptions of irrelevance. In that respect, it has been argued that a survey of information technologies can be inappropriate for a varied population of graduate business students (Novitzki 1997). Similar arguments have been made at a more general level, with academics as well as practitioners ultimately calling for an integrated business core curriculum as one solution that would serve "to demonstrate the interrelatedness of various business functions and how they work together in the firm" (Pharr 2000, p. 20).

This discussion considers one undergraduate business curriculum that integrated an IS core course with a strategic management core course, thus framing the IS topics within the context of business strategy. The integration took place when all of the core courses in the junior level business curriculum were redesigned into an Integrated Core Experience (ICE). During the redesign, it was recognized that the IS course would be better positioned if moved from the second semester to the first where it could provide an introduction to business systems. It also was recognized that the strategic management course—traditionally taken in the senior year of study—could provide a complementary perspective to this introduction. As a result, "Strategy and Systems" became the lead course of the integrated business core. Perhaps more importantly, the course was implemented and delivered in a successful manner. The course description follows.

> "Strategy and Systems" introduces a model of the strategic management process and examines the organization and its environment as a system. The concepts of strategy and systems are a critical foundation for the Integrated Core Experience. Specific topics include: the transformation of business, systems thinking and process management, industry transformation and process modeling, organizational analysis and the role of the general manager, strategic thinking and information systems, environmental analysis, core capabilities and core rigidities, the strategic management model, writing for results, the value chain, organizational architecture, information technology architecture, and strategic and systems change.

A review of relevant literature is used here to examine factors that underlie the success of such an integration of courses. In this case, a successful implementation might be attributed not to the instruction nor to cross-functional expertise, but rather to the particular courses that were integrated and the dynamics of the particular program and school within which they were integrated.

COURSE CONTENT

"Strategy and Systems" covered much of the same material that was covered originally by the IS course, but the content now was framed by a strategic perspective delivered in a team-teaching environment.

The main topics on business transformation, value chain, organizational structures, competitive advantage, etc. were organized within a framework of strategy themes and were introduced primarily by the management faculty with the assistance of articles and/or business school case studies. The IS faculty followed with coverage of relevant technology concepts such as process modeling, enterprise software, network computing, and emerging technologies, which were mapped to the strategy themes. This team-teaching environment was very synergistic and it aided in the smooth execution of the course as described in the following paragraphs.

Complementary Topics

Strategic Management and Information Systems are complementary in several ways. From the strategic management perspective, it has been argued that a technology management course should directly follow an introductory management course in providing a foundation for the rest of the business curriculum (Thompson, Purdy, and Fandt 1997). From the information systems perspective, the most covered topic in undergraduate IS core courses is "Information Systems in Organizations" (O'Hara and Stephens 1999). As noted, the IS topics in "Strategy and Systems" were organized relative to their role in supporting the strategic management of the firm. In addition to providing a more explicit managerial context, the broader thematic grouping of multiple IS topics provided for a cohesiveness and flow to the delivery of the frequently detailed IS topics. Furthermore, with management students preferring more general coverage of IS topics and IS students preferring more detailed coverage (Lee and Townsend 1999), the preferences of both groups of students could be accommodated by an intermixing of these approaches.

Common Material

Arguments have been made that the delivery of integrated content comes with a greater need for cross-functional expertise (Pharr 2000). However, the method of delivery in "Strategy and Systems" did not rely upon cross-functional expertise. Instead, the course content was geared towards a common set of readings that provided for common points of discussion for both strategy and IS. The classes were three hours in duration so that many of them could be split into two segments—the first for strategy and the second for systems. In essence, many of the sessions became separate classes taught back-to-back, ultimately providing different perspectives on the same topic using the same readings. The delivery arrangement enabled the IS faculty to focus on their technical expertise as the management faculty presented the strategic content. Such a delivery arrangement also can lead to a desirable efficiency with integrated curriculums in general—the elimination of redundancies (Pharr 2000). In fact, the integration within "Strategy and Systems" resulted in time reductions for both sides such that the integrated curriculum was able to reallocate the distribution of course hours.

PROGRAM DYNAMICS

Content-related dynamics were enhanced by various success factors that can be attributed to the environment within which the Integrated Core Experience was implemented. To begin with, the existing core curriculum had been "blocked" for several years such that students started the business program each year en masse with groups of students being assigned to a common set of core classes. In addition, the business school dean's office had instituted policies that fostered stacked course loads and release time. These and other factors contributed to the success of the integration with respect to both scheduling and incentives.

Time Commitment

With respect to the students, lLonger blocks of time are necessary for integrated classes, thus making it difficult for part-time students to participate (Pharr 2000). However, all of the business students in the ICE program were full-time students. In addition, previous years' students had been blocked into common sets of core classes. In fact, the previous blocked faculty had engaged in loose coordination between the courses. The blocks also prevented the faculty from having to offer multiple versions of a class to accommodate staggered sets of students during a transition phase. With respect to the faculty, large amounts of time are required for organizing and integrating the course content (Schaller, Cavarkapa, and Onge 2000). Such time commitment can be contrary to faculty incentive structures (Pharr 2000). In the case of the ICE program, senior faculty—mostly full professors—initially designed the integrated curriculum and then piloted it on one block of students, thus breaking ground for the rest of the faculty—including untenured professors—for the full-scale redesign and implementation.

Supportive Administration

The administration is a key factor in the success of an integrated curriculum effort (Pharr 2000). In fact, one of the faculty members who piloted the ICE program was the dean of the business school, thus helping to make the integration a top-down effort. Perhaps more importantly, the business school administration had instituted scheduling policies that fostered a modular curriculum structure. As such, core courses gave way to core modules that created concentrated periods of teaching time (sometimes twelve or more hours per week in a traditionally six-hour per semester load) offset by down time that could be dedicated to other scholarly activities. Ultimately, the administration provided both flexibility and incentives for the integration effort.

CONSIDERATIONS

Although several factors combined to help make the integrated "Strategy and Systems" course a success, some factors may need to be reexamined.

Grading

Due to the readings-intensive format of the course, participation was weighted at 30% of the final grade. This compares with an average for IS core courses of around 10% (O'Hara and Stephens 1999). The implications of this weighting need to be investigated. In fact, the implications of the weight on the integrated final exam revealed possible problems. At 25% of twelve credits all riding on one exam for the entire integrated core, the stress on the students became apparent. With respect to grading, some have argued that an integrated grade provides motivation for students to do well across all of the subjects (Schaller, Cavarkapa, and Onge 2000). However, the ICE program resulted in a blending of grades such that most students ended up with an average grade and very few earned A's.

Systems Development Topic

More than half of undergraduate IS core courses utilize a project (O'Hara and Stephens 1999). Moreover, it has been argued that a systems analysis project can be an effective tool in the IS core course (Harder 1999). However, given the integrated nature of the course content, it is unlikely that "Strategy and Systems" will be able to incorporate such a project. In addition, systems development, the second-most covered topic in IS core courses (O'Hara and Stephens 1999), was not covered in "Strategy and Systems."

Although "Strategy and Systems" was smoothly executed, it has yet to be determined if the integrated IS content is more effective than the previous version of the IS course. Anecdotally, the feel of the integrated course seemed positive, and student evaluations of the IS instructor were more favorable with respect to the integrated course as compared to previous versions of the IS course. Further examination of "Strategy and Systems" is necessary.

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RESEARCH IN PROGRESS:

A WIN-WIN PROPOSITION FOR TELECOMMUTER CENTERS: A SUCCESSFUL ACADEMIC AND CORPORATE PARTNERSHIP FOR RURAL TELECOMMUTING IN NEW ENGLAND

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ABSTRACT

A grant funded by the Center for Entrepreneurship and Information Technology Grant (CEnIT) at Louisiana Tech University led to the exploration of successful rural telecommuting within an established investment firm which employs over four hundred telecommuters in New England. A successful program for almost a decade, the firm places telecommuter centers in academic environments. Not only do these centers host the network and provide equipment, technical, and managerial support for telecommuters, they employ students on a part-time, flexible basis to serve as agents and to develop online learning modules from specifications. Student teleworkers are a critical success factor for the Virtual Office Environment (VOE) at the investment firm. This research-in-progress paper reports on studies conducted at three telecommuter centers and future research.

INTRODUCTION

The U.S. Labor Department reports that for the past decade, about half of full-time students work part-time. These jobs are rarely valuable lines on their resumes. For example, students in Analysis and Design classes often choose restaurant systems because restaurants are a major employer of students. Students may choose internships for more valuable short-term, career-oriented work experience. However, a well-established New England investment firm, headquartered in Boston, is providing part-time telework jobs for students in a professional environment with flexible hours. Furthermore, they are providing professional training for the students including Professional Skills Workshop, Business Etiquette/Professionalism, Communication Styles/Skills, Resume Building, and Interviewing Skills. Supervisors assign students to teams and evaluate team performance. According to the incubator site for this innovative telework application, "students process work ranging from a simple address update to million dollar cash investments. . . students are expected to adhere to high quality standards . . . management staff provides quality training and technical support to the students daily." In many ways, the four college locations resemble satellite offices staffed with full-time supervisors and part-time student employees. Many students join the firm full-time after graduation. Their work experience is a valuable technology component of their college education, and several students interviewed indicated that this work experience made them better students.

BACKGROUND

While the rationale for telecommuting would appear to be a win-win proposition, particularly after September 11th, telecommuting has grown at a much smaller pace than forecast a decade ago. Resistance to telecommuting has been strong, especially among managers. The telecommuter center should ameliorate many of the problems experienced by telecommuters and their managers. Instead of a long commute to an urban environment, an employee could drive to a satellite office or telecommuter center where support and supervision would be provided. The telecommuter center offers technical and supervisory support. However, telecommuter centers have experienced high failure rates because they are not a viable business model.

CEnIT GRANT SUMMARY: TELECOMMUTER CENTERS IN RESTORED HISTORIC PROPERTIES OF NORTH LOUISIANA

Telecommuter centers would provide a work infrastructure for local employees of organizations located outside the North Louisiana commuting area. Centers located in restored historic properties offer special tax advantages for participating organizations. Technology-related jobs would be made available to North Louisiana residents, including Tech graduates who wish to remain in Louisiana. USA Today (10/17/01, page B1) reports that "terrorism boosts demand" for telecommuting and distributed work sites, helping to eliminate central points of failure. Both the time and technology are right for an increase in telecommuting. This five-phase project addresses the CEnIT mission of "entrepreneurship development in technologically under-developed communities" and its thrust area is Technology Entrepreneurship. The project is in accord with the College of Administration and Business' Strategic Charter, in which citizens of North Louisiana are stakeholders.

CRITICAL SUCCESS FACTORS: CURRENT FINDINGS

In Maine and Vermont, these satellite offices are also telework or telecommuter centers, supporting not only student employees but over four hundred telecommuters. While teleworkers have not become as large a percentage of the workforce as forecasted a decade ago, the firm has operated a successful telework program, called the Virtual Office Environment (VOE), for a decade. The telecommuter centers located at two colleges in Maine and one in Vermont have been a key to the success of the telecommuter program. The partnership has required the continuing involvement of all stakeholders. The firm's CEO was the graduation speaker at the Vermont location. A group of student employees visited the Boston headquarters and observed agents working in different career paths. The Assistant Vice President for the Virtual Office Environment in Maine is often a guest speaker in business classes. In Vermont, the academic partner is a leader in online learning. There, the firm contracts with their experienced course designers and online course developers, and employs part-time students to work with these professionals to develop online learning modules for telecommuters. The partnership is multidimensional and has been a win-win for all stakeholders: part-time student employees, full-time telecommuter employees, employees in the corporate office, the firm, the states, and the colleges hosting satellite offices/ telecommuter centers. Top management at the firm has provided unwavering support for the Virtual Office Environment.

Part-time student employees and the hosting of the center in an academic environment have made telecommuter centers a viable business model while at the same time making work at home more successful. These centers support equipment and the network for telecommuters, provide training and technical support, are beginning to provide supervisory support for telecommuters, and act as a back-up facility should home operation be impossible. High speed, secure, dedicated telecommunications link the centers to Boston. Telecommuters link to their respective centers via ISDN or cable. Further, these centers act as a back-up facility for the headquarters, with student part-time employees again playing a vital role. When headquarters has a fire drill, for example, the firm's operations cannot be halted. Instead, tasks are routed to the telecommuter centers which will be fully staffed during such times and to telecommuters. When additional hours are needed for peak periods, students may choose to work additional hours during the weekend and the firm does not incur overtime pay. Students, on the other hand, participate in a Profit Sharing Plan and 401(K) plan.

Students working in a Virtual Office Environment learn to use virtual management tools, tools which are so effective that most have been adapted in the traditional environment at Boston headquarters. Initially, only exceptional and experienced employees were allowed to work at home. With the expansion to Maine and Vermont, new employees were telecommuting. The investment firm wanted to insure that these new agents had all the tools as agents at headquarters. Self-paced training modules developed for these teleworkers were so effective that they are now used at Boston headquarters as well. Lotus Notes supports asynchronous collaboration, but if an immediate need arises, a keystroke initiates a pop-up window which overlays the supervisor's screen and may include others as well. Anyone receiving the request for help may reply with the needed information. This Virtual Office Environment tool has also been adopted in the traditional work environment. With appropriate virtual management tools, anything done at a satellite office could be done at a satellite office at home, says the Vermont manager. Not all management is virtual, however. Relationship management remains critical. "Phone calls, e-mails only go so far when one is frustrated." The social aspect cannot be assumed; it must be managed with scheduled meetings, socials, visits to the center, one-on-one feedback.

The researcher visited three college sites, talked with students, interviewed the Assistant Vice President in Maine and Vermont, and a supervisor for Maine. Students working in the centers were also observed. Students must learn to conduct themselves as business professionals. Although students usually walk to work from their dorm or apartment, they are expected to adhere to a relaxed professional dress code. In one center, a sign at the entrance gently reminds students that tank tops are not professional dress. The firm requires a professional demeanor for student agents. One student told the researcher that working for the investment firm has made her a better student because she has become more organized, more disciplined, and more "detail oriented." The Assistant Vice President in Vermont describes his job as part guidance counselor. "We have to build the corporate mentality into students so that they work without gossip or childish behavior. They have to learn to work cooperatively. Students are assigned to one supervisor who works with them individually." Students have incentives to reduce errors: time off with pay. Their performance as individuals and as a team is tracked and evaluated. According to a brochure published by the firm, student telework benefits include the following: team environment, hands-on technology experience, extra income, investment industry exposure, technical computer skills, career opportunities, flexible work hours, profit sharing and 401K.

Future plans for research are detailed in Appendix A.

Working references are available from the author upon request.

APPENDIX A
FUTURE RESEARCH PLANS

Original Proposal	Continuation Proposal
Phase 1: Develop critical success factors for successful telecommuting centers by conducting in-depth case studies at successful centers.	Complete and reviewed by Board.
Phase 2: Identify candidate historic sites in north Louisiana using these criteria. Students and professors from the following fields would become involved in this process: Architecture, Civil Engineering, History, English, Marketing, Accounting, Computer Science, and Computer Information Systems.	Since the successful model uses an academic environment, candidate sites are limited. Recruiting participating companies has a higher priority.
Phase 3: Develop a marketing portfolio of properties, included both a paper brochure and a web site. The portfolio would include tax credit information for historic restoration, a history of the building and surrounding area, featured area attractions, and architectural rendering of the restored property as a telecommuter center. The properties would be mapped to criteria for successful centers.	Instead of a marketing portfolio of properties, the continuation proposal would deliver a multimedia resource guide to market the concept of a telework center for part-time student employees and full-time telecommuters. Completed academic research would also be published.
Market the use of restored historic properties in North Louisiana as telecommuter centers, using research on criteria for successful telecommuter centers and the portfolio of properties. Companies who currently hire Louisiana Tech graduates would be included.	State, local, and university officials would use the grant's research deliverables and the multimedia resource guide, as well as special incentives, to gain participation in telework programs. I would serve as a resource person.
Serve as an incubation center for the first three centers, working closely with the state and companies hosting Louisiana telecommuters to provide IT infrastructure needs, skilled employees, student interns, management consulting, tax accounting consulting, etc.	Participating companies would provide supervisors and a corporate infrastructure. I would continue to serve as a resource person and to conduct research on successful telework practices, possible in a Telework Research Center within CEnIT.

A METHODOLOGY FOR TEACHING OBJECT-ORIENTED DESIGN AND A PRELIMINARY EVALUATION

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ABSTRACT

The paper introduces a technique for teaching students how to create an object-oriented design. The technique has the advantage that it provides students with an (almost) automatic way of starting the design process. We also present a preliminary evaluation of the technique, based both on the students' performance on an object-oriented design project and on their perceptions of the technique, as assessed through a brief questionnaire.

INTRODUCTION

Object-oriented design techniques, in the form of say E-R diagrams (Chen, 1976) or Abstract Data Types (Liskow & Zillis, 1974), have been around for more than 25 years. However, it is only recently that object-oriented design has become so mainstream that it is included in textbooks on systems design and analysis (e.g., Hoffer et al, 2002; Whitten et al, 2001). Most textbooks give excellent introductions to the various object-oriented design techniques and notations, and outstanding explanations of object-oriented concepts, such as classes, instances, attributes, behaviors and inheritance. Unfortunately, to our knowledge, none of the textbooks provide any guidance on how to go about creating object-oriented designs. As a result, students often report being at a loss when it comes to tackling an object-oriented design project.

To help students overcome this problem, the first author developed a technique for teaching students how to create an object-oriented design based Rumbaugh et al (1991). The technique has been used in a number of courses. In this paper, we focus on two, namely a freshman level course entitled "Introduction to Information Technology," offered to students enrolled in a baccalaureate program in Information Technology (the "IT course") and taught by the first author, and a junior level course entitled "Systems Analysis and Design," offered primarily to students pursuing a BBA with a specialization in Information Systems (the "IS course,") and taught by the second author. In this paper, we briefly introduce the teaching technique, and then present a preliminary evaluation of the technique, based both on the students' performance on an object-oriented design project and on their responses to a brief questionnaire.

THE TECHNIQUE

We start by giving students a conceptual introduction to object-oriented design and give an in-depth explanation of object-oriented terminology (classes, instances, inheritance, message passing, and so on). We then teach students that creating an object-oriented design consists of four phases, namely

1. Identification of an initial set of classes;

2. Identification of the attributes and behaviors identified in Step 1;

3. Identification of any super- and subclasses;

4. Specification of the behaviors in of the classes identified in 3.

We also suggest that students start the first step of the design by simply identifying all nouns in a problem statement. They are then taught to eliminate:

1. Redundant nouns (i.e., synonyms);

2. Nouns that obviously refer to attributes and behaviors;

3. Nouns that concern the implementation of the system to be designed (e.g., such nouns as "the system," "infomation," "record," etc.);

4. Nouns that are irrelevant because they either concern classes of which the system does not have to maintain any information (e.g., the "user") or because they occur only in a section of the problem statement that state explicitly that the software under development does not have to display a particular piece of functionality.

The list of nouns left after elimination is the initial list of classes. Students are also taught not to eliminate a noun if they have any doubt as to whether to eliminate the noun in question. The rationale is that it is easier to eliminate an irrelevant class later on than to introduce a new class late in the design process.

It is important to note that the initial step in the first phase of the design process can be performed (almost) automatically as it simply involves identifying the nouns in a problem statement. This makes it easier for students to get started, and sets the technique apart from other design strategies. The first stage is, however, often tedious as it involves the creation of a long list of nouns, most of which are eventually eliminated. Many students are tempted to take shortcuts. We strongly discourage them from doing so.

Many of the nouns that were eliminated in the first stage of the design process become important in the second phase, as they were eliminated because they were attributes. We also tell students that, unlike relevant classes, attributes can often be derived from knowledge that one has about the application domain, and therefore do not necessarily appear in the problem statement. However, we suggest that students be conservative when it comes to introducing new attributes and to only introduce attributes when they are certain that they are necessary. After all, attributes can easily be introduced later on in the design process while the introduction of irrelevant attributes often leads to unnecessarily complicated design.

Students are also taught that for every attribute identified, one typically needs two behaviors, namely one to set or modify the value of the attribute and one to access the value of an attribute. They are also taught to look for verbs in the problem statement as they typically refer to something that the application has to be able to do and therefore often correspond to a behavior.

The third phase of the design process is the identification of super-classes. Students are taught to look for classes that have a significant number of attributes in common and to introduce a super-class if two or more classes share a significant number of attributes and behaviors.

The final stage in the object-oriented software design process is the specification of the behaviors of the classes and super-classes identified in stages 1 and 3. However, since we only covered this aspect of the design process only in the IT course, we will not elaborate on this aspect of the design process here.

We covered the material in three class sessions of 50 minutes. However, we also wrote extensive notes on the techniques and made those available to our students over the Internet. At this stage, it is important to report that, while class attendance in the IS class was good, class attendance in the IT class was poor. There may be a number of reasons for this. First, since the material had been made available to students beforehand, students may have been of the view that they did not need to attend class. Second, many of the students enrolled in the IT course were in fact seniors needing the credits that they would earn by taking this course to graduate. These students may not have been the most motivated of learners.

EVALUATION

As noted, students typically complain about being at a loss how to start a design project. Since our technique allows students to start the design process almost automatically, we hypothesized that it would enable students to create better designs and would therefore positively received by students. In order to test these two hypotheses, we performed two types of evaluation. First, we gave all students a design project. Second, we administered a questionnaire asking students about their opinions about the technique.

In order to evaluate the effectiveness of our teaching technique, we gave all students the design project enclosed in appendix A. Those enrolled in the freshman IT course were asked to create a full object-oriented design, including a full specification of all the behaviors that they had identified. The assignment was worth 10% of the final grade. Those enrolled in the IS course were asked to identify classes and their attributes and behaviors, and any relevant super-classes. They were not asked to specify the behaviors. Their projects consequently contributed only a nominal amount to the overall grade.

The student mistakes could roughly be divided into the following five categories, namely

1. Failure to identify the appropriate classes Customer and Vehicle;

   Example: Some students identified a class Customer Contact Information.

2. Failure to identify appropriate sub-class super-class relationships;

   Example: Some students identified Vehicle as a sub-class of Customer.

3. Failure to identify the appropriate attributes and/or behaviors and/or the association of an attribute or behavior with an inappropriate class;

   Example: Some students associated the behavior to determine whether a vehicle was fast or fuel-efficient with Customer, rather than Vehicle.

4. Failure to identify the appropriate sub-classes;

   Example: Some students did not identify Pickup, SUV etc as sub-classes of Vehicle. Instead, they included an attribute type in Vehicle to distinguish between the different sub-classes.

5. Failure to use inheritance in any way;

   Example: Some students, having identified the appropriate sub-classes, re-specified all attributes and behaviors within the sub-classes.

Obviously, the errors are not independent. For example, a student can only display error 3 if they have correctly identified the classes Customer and Vehicle. We used this observation when compiling the table below. A student would only be marked as having displayed error 2 if they had not made error 1, error 3 if they had not made errors 1 and 2, and so on. With this in mind, table 1 gives the frequency of errors made by the students.

The results indicate that many students failed to fully grasp the design methodology that we tried to convey. Only one third of the students made either no errors at all or only error 5, and hence arrived at the correct class hierarchy, while about 22% fail to identify even the basic classes Customer and Vehicle. We also note that about as many students enrolled in the IS course either made the most fundamental error, or made no error at all, while the majority of students enrolled in the IT course made the error of failing to identify the relevant sub-classes of the Vehicle class.

We also administered a student questionnaire in order to determine the students' perceptions of the techniques taught. The questionnaire, which was administered in the final class session, consisted of 15 questions, with 5 asking some demographic information (status, gender, major, number of classes taken previously in

TABLE 1
PERCENTAGE OF STUDENTS MAKING SPECIFIC ERRORS

	Total	Error 1	Error 2	Error 3	Error 4	Error 5	No Error
IT Course	66	9%	1.5%	12%	53%	12%	12%
IS Course	50	40%	8%	0%	6%	0%	46%
Total	116	22.4%	4.3%	6.9%	32.8%	6.9%	26.7%

object-oriented techniques, and knowledge of which object-oriented programming languages) and 10 asking students about

1. The difficulty of identifying classes;

2. The difficulty of identifying attributes and operations of these classes;

3. The difficulty of identifying super-classes;

4. The clarity of the Object-Oriented Design Techniques;

5. The difficulty of learning the techniques;

6. The difficulty of applying the techniques to different scenarios;

7. The difficulty of the technique compared to data modeling (ER Diagrams);

8. Its difficulty compared to process modeling (Data Flow Diagram);

9. Its difficulty compared to logic modeling (pseudo code/algorithm);

10. The overall effectiveness of the object-oriented design techniques.

The questions were answered on a five point Likert scale, with a low score indicating that the student considered the techniques to be difficult. Unlike the IS students, the IT students could not be expected to have been exposed to ER Diagrams, process and logic modeling. Students were therefore instructed to answer not applicable if they were unfamiliar with the technique in question. Such answers were obviously ignored in the analysis below. Also, we calculated, for each student, his or her overall average score. Table 2 gives the results.

First, notice that we had only 39 respondents in the IT course while 66 submitted the project, thus providing some evidence for our earlier assertion that attendance in the IT course was poor. Second, with the mid point on the scale at 3, we also notice that students enrolled in the IS course in general regard object-oriented techniques as relatively easy, while the students enrolled in the IT course are in general slightly less positive. Of particular note is the overall perception of object-oriented techniques, which is below the mid point for students enrolled in the IT course and above the mid point for the students in the IS course. The obvious hypothesis that this difference may be due to the fact that students enrolled in the IT course have not been exposed to other design techniques and therefore have nothing to compare object-oriented techniques to is not borne out by the data. The mid-point on question 10 for those students enrolled in the IT course who have answered questions 7 through 9, and therefore presumably have had some exposure to alternative design techniques, is 2.58.

We also tried to see if there was any relationship between any of the demographic factors and their opinions about object-oriented techniques. Tables 3 to 6 try to answer these questions (totals do not always add up to 87 as not all students answered the demographic questions):

None of the above differences is statistically significant. There is one perhaps counter-intuitive trend: The more exposure a student has had to object-oriented techniques and the more object-oriented programming languages he or she knows, the more difficult he or she seems to find the object-oriented software design techniques. There

TABLE 2
ANSWERS TO QUESTIONNAIRE—MEAN POINT ON LIKERT SCALE

	Total	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Overall
IT Course	39	2.61	2.90	2.77	3.10	3.15	3.23	2.94	2.92	2.94	2.57	2.91
IS Course	48	3.40	3.52	3.33	3.58	3.27	3.04	3.42	3.48	3.38	3.5	3.39
All	87	3.05	3.24	3.08	3.37	3.22	3.13	3.22	3.24	3.19	3.08	3.17

TABLE 3
OVERALL AVERAGE BY STATUS

	Total	Overall Average
Freshman	8	2.98
Sophomore	14	2.98
Junior	35	3.22
Senior	28	3.24

TABLE 4
OVERALL AVERAGE BY NUMBER OF OBJECT-ORIENTED LANGUAGES KNOWN

	Total	Overall Average
0 languages	8	3.37
1 language	47	3.29
2 languages	18	3.01
3 languages	14	2.86

TABLE 5
OVERALL AVERAGE BY PREVIOUS EXPOSURE TO OBJECT-ORIENTED TECHNIQUES

	Total	Overall Average
1 class	36	3.24
2 classes	27	3.28
3 classes or more	24	2.96

TABLE 6
OVERALL AVERAGE BY MAJOR

	Total	Overall Average
IS	43	3.23
IT	26	3.06
Other	5	3.76

are of course many reasons that one can advance for this state of affairs, including interference from previous knowledge, the fact that often object-oriented languages such as Java are taught as a "bag of tricks" without any attempt at instilling design skills in the student as well, or perhaps the fact that a student who knows a few object-oriented languages believes that there is nothing to be gained from learning anything more about object-oriented techniques. However, at the moment, we have no evidence for or against any of these hypotheses.

CONCLUSIONS AND FUTURE WORK

Object-oriented software design techniques are obviously not some fad that will fade in the near future. It is therefore crucial that educators in Computer Science, Information Systems and Information Technology develop techniques to teach object-oriented software design effectively. The technique that we developed has the advantage that it allows novices to start creating an object-oriented design (almost) automatically. Unfortunately, while many students whom we taught this material do not seem to find these techniques difficult or hard to grasp, the quality of the object-oriented designs that they created was not great.

Obviously, the study reported here is merely a preliminary investigation. There are many questions that remain unanswered. For example, is it the case that the poor performance of some students is due to the fact that they did not attend class? If so, does this mean that teaching these techniques in modes other than face-to-face is likely to lead to difficulties, especially in view of the fact that most students who did not attend class did relatively well in their other assessments, such as Web design projects and written examinations? Is it indeed the case that students who know a few object-oriented languages find object-oriented design harder than students who come to this material without any prior knowledge? If so, why? Also, is there any correlation between the quality of a design that a student produces and their perception about the difficulties of these techniques? Since our questionnaires were anonymous and the information obtained from them did not allow us to identify any students, we obviously could not address this question in this study. We hope to start providing answers to these questions in a more detailed study.

It may also be the case that part of the difficulty that students are experiencing in creating good design is due to the fact that, as yet, there are no software tools to help them create and, perhaps more importantly, visualize such designs. We hope to start building such software support in the near future and evaluate whether and how it influences both the designs that students produce and their perceptions of the difficulty of the various techniques described here. In the meantime, we will continue using and refining the teaching techniques described in this paper as we are convinced that they provide an excellent way of introducing students to object-oriented software design.

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APPENDIX A
THE DESIGN PROJECT

A friend has approached you to help him build an information system to help increase business for his web-based second hand car dealership. He wants to maintain information about vehicles for sale and potential customers. For each customer, he wants to maintain their name and contact information (home telephone number, office telephone number, mobile phone number and address). For each customer, he also wishes to record the type of vehicle they are interested in (light truck, pickups , SUV or passenger car), their preferred color, whether they prefer a fast car or the most fuel efficient vehicle in its class, and the price range that they are looking in.

All vehicles have a unique registration number, and are manufactured in a particular country in a particular year. Each car also comes in a particular color, has a particular engine capacity and a weight. The system should also record the type of transmission (manual or automatic) and whether the car is front-wheel, rear-wheel or four wheel drive. For light trucks and pickups, the system should also maintain their carrying capacity (the weight of the load that they can transport).

Your friend uses the following complicated rule of thumb to determine whether a car is fuel efficient or fast:

> He first divides the engine capacity by weight. If the car is made in Germany, he multiplies this by .3. If the car is an automatic, he divides this by 1.2. If the car is a pick-up, he then divides this by 1.1. If the final number is over 1.3, the car is deemed to be fast; otherwise it is deemed to be fuel-efficient.

He also uses a complicated formula to determine the price of the car:

> If the car is an import car (i.e., not made in the United States), he multiplies the engine capacity by 3; otherwise he multiplies it by 2.9. He then subtracts 5% for each year that the car is old if the car is a light truck, and 4% for any other type of vehicle.

Your friend would like the system to be able to automatically perform these calculations. He obviously wants to be able to update the information that he maintains about his potential customers. Eventually, he would like the system to be able to automatically find vehicles from his stock of cars that might be of interest to potential customers, but he realizes that this is difficult and does not expect the system that he asked you to design to be able to perform this task.

APPLICATION OF PBL AND APL STRATEGIES IN TEACHING OF INFORMATION SYSTEMS COURSES IN TWO COUNTRIES

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ABSTRACT

Problem-Based Learning (PBL) has been popular as a teaching and learning strategy in Medicine, Law, and business schools, but it is less common in Information Systems (IS) education. Action Project Learning (APL) strategy has also been applied in professional educations. These strategies focus on different ways to achieve positive learning outcomes. The authors adopted a combination of both PBL and APL in teaching IS in their respective institutions in the fall of 2001: one in the US and one in Hong Kong. The PBL approach uses both structured and ill-structured problem cases as stimulus for problem solving and learning. It fosters generic skills development of IS graduates. The APL approach uses real-life projects to allow students to relate theory to practice through hands-on experience. The authors combine these two strategies by first introducing PBL to help students to develop the generic skills required of an IS professional, followed by implementing APL to achieve desired learning outcomes. Appropriateness of subject as perceived by the students, skills development, learning effectiveness and teamwork, as well as a comparison between these two approaches and the traditional approach, were all evaluated through a questionnaire survey at the end of the semester. This paper recommends a balanced mix of PBL and APL to enhance quality of learning and teaching in IS courses. It reports on students' perceptions of the two approaches and their comments. We also present our strategy, together with its strengths and difficulties.

INTRODUCTION

Rapid technological development in the IS profession has made it difficult for educators to cover all relevant knowledge in the curricula, and also, it has rendered knowledge getting out-dated very quickly. Professional competence consists of three crucial components: knowledge, skills and capability, and personal development (Johnson, 1998). Students need to equip themselves with the skills to meet this challenge (Horwood et al., 2001). The authors have applied the PBL strategy to teach IS courses in the past years. The learning activities among students have improved. It has been considered that PBL combined with APL will achieve even better learning outcomes since studentsare able to relate theory to practice.

This paper reports our application of the combined PBL and APL teaching strategy to Systems Analysis and Design courses in our institutions. Problem cases and real-life projects had been selected for the students, who undertook PBL and APL through collaborative learning. They worked in teams of three to six. This approach is unique and has worked very successfully in the courses. In the following sections, we present the details of the approach we adopted, the students' perceptions of our approach, and its strengths and difficulties.

PROBLEM-BASED LEARNING STRATEGY

The amount of knowledge in IS is increasing at an accelerating rate. Students need to equip themselves with the skills of knowing how to learn, and it is important for them to become self-directed learners (Walker 2000). Problem-based learning has become, in tertiary education, an increasingly popular learning and teaching strategy that provides students with problem solving, self-directed learning and collaborative learning skills (Biggs, 1999). It is also a curriculum design that not only develops students' problem-solving skills, but also helps them to acquire other necessary knowledge and skills (Boud and Feletti, 1997). This approach to learning is more student-centered than teacher-centered because students assume greater responsibility for their own learning. Students normally work in teams to tackle ill-structured problems, through which they develop high-order thinking and problem-solving skills. The teacher takes the role of a facilitator instead of a knowledge provider as the students learn from one another, through the World Wide Web, and from other information resources.

Given a problem case, students analyze the problem situation using their prior knowledge and experience. They then formulate hypotheses and make plans to solve the problems. This requires students to search for further information in order to understand and tackle the problems. In this process, students undertake self-learning. New knowledge is shared and exchanged amongst team members in such a way that the team practices problem-solving through collaborative learning. Students report their findings through written reports and presentations. They also have an opportunity to further develop the generic skills required of an IS professional. However, in order for PBL to be successful, there is a need to establish an environment to facilitate students' learning.

ACTION PROJECT LEARNING STRATEGY

Action Project Learning allows students to learn by doing. It uses real-life projects as the starting point. Problem solving is an inherent characteristic of Action Learning as students practice problem solving through working on a project. Evidences have shown that APL improves quality of students' learning and brings lasting improvement to teaching (Kember, 2001). Students plan and control the problem solving processes and are actively involved in learning through participation.

The use of APL provides an environment for students to acquire some 'real' project work experience and also to apply theories to practical situations. A unity between theoretical exploration and practical experience has proven to be successful (Daqing et al., 2001). This requires students to integrate their knowledge and experience to solve application problems. Positive feedback on students' learning has been received (Shi et al., 2001). Given a real-life project, students need to diagnose what needs to be done, set goals covering their skills and knowledge, and then decide how the application problem can be disentangled to meet the needs of the sponsor of the project. They need to exercise various skills such as problem analysis, communication, creative thinking and technical knowledge. Normally, they also require new skills and knowledge to help them deal with practical situations. Having some hands-on experience will help them to assess their own competence so that they know their development needs and in what areas they should improve themselves. In general, students are motivated to better perform as they see their project will subsequently be adopted as a real, productive system. They work in teams through which they practice and appreciate teamwork. They also develop leadership and project management skills.

The main issue is how to find projects for students to practice? Many technology application opportunities in a university setting can be brought into a program, through which students can acquire 'hands on' experience (Kazlauskas, 2001). Real-life projects can be secured in local industries or in the university environment. e.g., book shop, canteen, student union etc. Before APL can start, a project has to be supported or offered by an organization or a department, who acts as the client. The projects should enthuse students, who undertake them to meet the needs of the client. The authors have managed to find projects for the students within their respective university campuses.

COMBINATION OF PBL AND APL STRATEGIES

The intention of combining the two learning and teaching approaches, PBL and APL, is to enhance students' learning effectiveness and also to let them better appreciate the IS courses. Although 'real' or 'authentic' cases are applied in PBL, students may perceive that they are not working on real projects as they may not be required to produce a product but are only asked to report and present their findings. In their minds, these are all paper work. In actual fact, the PBL approach builds a theoretical framework for problem-solving, in which students practice problem analysis, project planning, information search, self-study, and collaborative learning. Moreover, various PBL processes enable students to develop the generic skills required of an IS professional.

APL, on the other hand, provides students with the hands-on experience of learning by handling real-life projects. Students learn through active participation in real projects that involve external people. However, having APL alone may not be effective when students do not have the theoretical framework aforementioned. Therefore, combining the PBL and APL approaches seems to be desirable when a balance of time allocation to each of these approaches can be worked out.

Students are given real-life projects to handle. These may require them to perform fact-finding by interviewing users for more information, determine the best course of action, make a project plan, develop the system and present evaluation strategies. Students go through the APL process as follows:

- Students are given a brief description of the projects and problem situations that require investigations and solutions.

- Students bid on their choice of project, which determines their project allocation priority.

- Project allocations are to be made with different teams working on different projects.

- Students work through the projects by: interviewing the client (users) and drawing up the terms of reference of the project, determining the project requirements, designing the system, choosing an appropriate programming language and developing the system.

- Finally, students give a presentation and demonstration to the client in the presence of the whole class. They comment on their learning activities by submitting a group report.

STRENGTHS OF THE COMBINED PBL AND APL STRATEGY

The combined PBL and APL strategy provides a teaching and learning environment that allows students to:

- apply knowledge to practical situation

- experience the integration of different subject disciplines

- practice and appreciate teamwork

- develop leadership and project management skills

- develop the required generic skills required of an IT professional

- develop self-acceptance

- acquire appropriate social/interpersonal skills

- achieve academic competencies

Other features of the combined PBL and APL strategy are as follows: First, the project provides practical value to the users who sponsor it. Second, the project provides a vehicle for students to experience 'real' situations (people, building, office etc). Third, they interview the real user(s), who are accessible without the need for them to do much traveling when the project is on the campus. Fourth, students feel that they can contribute to a 'real' situation, thus they are more committed to putting in extra efforts in their work. Fifth, students tend to deepen teamwork and control the project work better to meet the expectation of the users. Sixth, the users are involved in attending their presentations and providing them with feedback; and seventh, students can better understand their strengths and weaknesses, and areas of knowledge and skill. They are able to understand the necessary skills and knowledge required by the IS profession now and in the future. They will also be more aware of their development needs and put forth a plan to cover the gap between their existing strengths and those currently required by the profession. The teaching and learning process can be more effective as people outside the teaching team are also involved. Indeed, the external feedback mechanism from the project sponsor is a valuable learning experience through which students can gauge their own performance and avoid pitfalls in the future.

DIFFICULTIES OF THE COMBINED PBL AND APL STRATEGY

There are a number of difficulties under the PBL strategy that need to be overcome. Students require a good number of skills for proper PBL, including problem analysis, information search, teamwork, communication etc. The PBL treatment is different from the traditional approach of teaching. Students need a short period of time to accustom to a new way of learning and teaching, especially if the entire curriculum does not follow the PBL approach. PBL requires good problem cases, which can cover the course objectives and address the common contemporary issues. They must be interesting and should motivate students to learn. APL relies on real-life projects, which enable students to learn by doing and learn from their own mistakes.

Many students have the concept of a 50% passing mark for a subject. However, an IS project needs to be completed with 100% satisfaction of its users. Ensuring students are able to complete a project successfully poses some challenges. The question is where to secure projects that students are capable of completing, thus bringing benefits to the sponsors. The selection of projects needs to be based on the following considerations:

- The project addresses the needs of the curriculum and is of appropriate standard.
- The project provides practical value to the user department.
- The project is both interesting and meaningful to students.
- The project is challenging and provides sufficient opportunities for students to learn.
- The project size is reasonable for the project team to work on.
- The degree of difficulty is sufficient for students to develop the various skills of the profession.
- The operation of the department may not be affected even if the project is not successful.
- The users are ready to be involved and to participate in the project development process.
- The users are willing to support the learning and teaching process.

STUDENTS' PERCEPTION OF THE PBL AND APL STRATEGY

In the Fall of 2001, both authors applied the combined PBL and APL strategy to their Systems Analysis and Design courses. It has been found that this experience is very motivating to students and instructors. The instructors were motivated because students gradually became active learners as opposed to passive listeners. The students were also motivated because they learnt the theory and could apply their knowledge to develop project, which required them to submit to their clients before the deadline. The interactions with students were higher as they raised more questions for discussion. To gauge students' perception of our approach, at the end of the semester we conducted a survey of the different learning issues as compared with traditional teaching methods. A total of 34 questions were asked that addressed different learning activities during the course. Students were asked to respond to each question according to the following scale: 1—Strongly disagree, 2—Disagree, 3—Neutral, 4—Agree, and 5—Strongly agree. The survey data, for both the PBL and APL approaches to learning and teaching, have been statistically evaluated using the Mann-Whitney Test. The average score, for the Hong Kong students and the US students, is provided for each question. The Mann-Whitney Test was used to test the mean differences between the two groups with statistical significance at the level of 5%. Those results that are marked with '*' indicate that the mean score is significantly different. When they are marked with '**', this indicates that the mean score is barely significant. The results are depicted in the following tables, and this is followed by an analysis of the responses.

ANALYSIS OF THE RESULTS

Regarding PBL, the analysis of the findings provides the following results:

Concerning the appropriateness of PBL for the subject of programming: the US students regard PBL as more appropriate. The US students give this an average score of 42.38 versus the HK students who give this an average score of 27.67. When the students are asked whether the PBL approach improves your learning style, the HK students are more likely to consider that their learning style had improved. The HK students give this

TABLE 1
PBL STRATEGY

Measurements	HK Mean Score	US Mean Score	Mann-Whitney	Z	*p* – value
Subject Appropriateness					
It is appropriate for Systems Analysis	32.88	31.71	435.0	-0.280	0.779
It is appropriate for Systems Design	30.17	37.26	351.5	-1.603	0.109
It is appropriate for Programming	27.67	42.38	244.0	-3.113	0.002*
It is appropriate for Systems Development	31.12	35.33	392.0	-0.954	0.340
Skills Development					
It develops your analytical thinking skills	33.48	30.50	409.5	-0.665	0.506
It develops your critical thinking skills	33.83	29.79	394.5	-0.912	0.362
It develops your problem-solving skills	32.09	33.33	434.0	-0.283	0.777
It enables you to practice leadership skills	30.52	36.55	366.5	-1.323	0.186
It develops project planning and control skills	31.64	34.26	414.5	-0.590	0.555
It develops life-long learning skills	31.59	34.36	412.5	-0.591	0.555
It develops the various skills for the IT profession	31.06	35.45	389.5	-0.953	0.340
You have more confidence in presentation	34.26	28.90	376.0	-1.164	0.244
You have more confidence in report writing	35.05	27.29	342.0	-1.707	0.088
You can apply knowledge to a problem situation	34.27	28.88	375.5	-1.260	0.208
Perception of Learning Effectiveness					
You like this approach to learning	34.91	27.57	348.0	-1.598	0.110
The approach improves your learning style	35.30	26.76	331.0	-1.869	0.062 **
You learn information search via the Web	34.73	27.93	355.5	-1.507	0.132
You understand the subject better	33.42	30.62	412.0	-0.604	0.546
You learn more of the subject	34.23	28.95	377.0	-1.150	0.250
You require more independent learning	35.93	25.48	304.0	-2.214	0.027 *
It motivates you to learn better	36.86	23.57	264.0	-2.802	0.005 *
It motivates you to put in more effort	34.31	28.79	373.5	-1.214	0.225
It provides a better learning environment	33.80	29.83	395.5	-0.873	0.383
You know better what you need to learn	34.29	28.83	374.5	-1.180	0.238
It develops your IT professional knowledge	36.57	24.17	276.5	-2.676	0.007 *
Teamwork					
You learn a problem solving process	33.62	30.21	403.5	-0.733	0.464
You require more teamwork	35.78	25.79	310.5	-2.180	0.029 *
You learn more from team members	35.81	23.80	266.0	-2.556	0.011 *
It requires more reading	33.74	29.95	398.0	-0.810	0.418
It raises questions for discussion	32.73	32.02	441.5	-0.149	0.881
Comparison with Traditional Approach					
It should have a quiz or test to assess you	34.74	27.90	355.0	-1.490	0.136
It is better than the traditional approach	31.01	35.55	387.5	-0.980	0.327
Workload is the same as the traditional approach	33.52	30.40	407.5	-0.677	0.499
Overall assessment is the approach is effective	32.53	32.43	450.0	-0.023	0.982

TABLE 2
APL STRATEGY

Measurement	HK Mean Score	US Mean Score	Mann-Whitney	Z	*p* – value
Subject Appropriateness					
It is appropriate for Systems Analysis	32.29	35.76	442.5	-0.764	0.445
It is appropriate for Systems Design	32.80	34.80	464.5	-0.471	0.637
It is appropriate for Programming	37.77	25.52	311.0	-2.580	0.010*
It is appropriate for Systems Development	35.93	28.96	390.0	-1.682	0.093
Skills Development					
It develops your analytical thinking skills	32.87	34.67	467.5	-0.406	0.685
It develops your critical thinking skills	30.99	38.20	386.5	-1.616	0.106
It develops your problem-solving skills	32.90	34.63	468.5	-0.388	0.698
It enables you to practice leadership skills	31.28	37.65	399.0	-1.413	0.158
It develops project planning and control skills	33.13	34.20	478.5	-0.242	0.809
It develops life-long learning skills	34.15	32.28	466.5	-0.404	0.686
It develops the various skills for the IT profession	34.79	31.09	439.0	-0.843	0.399
You have more confidence in presentation	36.71	27.50	356.5	-1.996	0.046*
You have more confidence in report writing	36.94	27.07	346.5	-2.121	0.034*
You can apply knowledge to a problem situation	35.99	28.85	387.5	-1.614	0.106
Perception of Learning Effectiveness					
You like this approach to learning	34.21	32.17	464.0	-0.445	0.656
The approach improves your learning style	34.51	31.61	451.0	-0.630	0.529
You learn information search via the Web	34.63	31.39	446.0	-0.707	0.479
You understand the subject better	34.31	30.43	416.5	-0.865	0.387
You learn more of the subject	33.90	32.76	477.5	-0.241	0.809
You require more independent learning	37.65	25.74	316.0	-2.531	0.011*
It motivates you to learn better	39.60	22.09	232.0	-3.707	0.000*
It motivates you to put in more effort	32.20	35.93	438.5	-0.826	0.409
It provides a better learning environment	31.83	36.63	422.5	-1.042	0.297
You know better what you need to learn	35.56	29.65	406.0	-1.279	0.201
It develops your IT professional knowledge	36.95	27.04	346.0	-2.110	0.035*
Teamwork					
You learn a problem solving process	36.98	27.00	345.0	-2.242	0.025*
You require more teamwork	33.71	33.11	485.5	-0.132	0.895
You learn more from team members	34.58	28.24	362.0	-1.353	0.176
It requires more reading	35.20	30.33	421.5	-1.065	0.287
It raises questions for discussion	33.20	34.07	481.5	-0.186	0.853
Comparison with Traditional Approach					
It should have a quiz or test to assess you	35.59	29.59	404.5	-1.294	0.196
It is better than the traditional approach	32.33	35.70	444.0	-0.723	0.470
Workload is the same as the traditional approach	36.69	27.54	357.5	-1.969	0.049*
Overall assessment is the approach is effective	33.94	32.67	475.5	-0.280	0.779

an average score of 35.30 versus the US students who give this an average score of 26.76.

In addition, the HK students consider that they can acquire greater benefit from PBL, in the following areas, than the US students:

- You require more independent learning
- It motivates you to learn better
- It develops your IT professional knowledge
- You require more teamwork
- You learn more from team members

Regarding APL, the analysis of the findings is presented as follows:

Concerning the appropriateness of APL for the subject of programming: the HK students regard APL as more appropriate for programming. The HK students give this an average score of 37.77 versus the US students who give this an average score of 25.52.

In addition, the HK students consider that they can acquire greater benefit from APL, in the following areas, than the US students:

- You have more confidence in presentation
- You have more confidence in report writing
- You require more independent learning
- It motivates you to learn better
- It develops your IT professional knowledge
- You learn a problem solving process
- You require more teamwork

Finally, the HK students regard the workload as much higher in APL when it is compared with the traditional approach.

Nevertheless, our observations constitute an isolated study of just two universities. More formal studies are required to draw a general conclusion. However, our study proves that students are far more professionally active under the combined PBL and APL strategy than under traditional teaching. Some areas in which they are professionally active include commitment to teamwork and taking up team-member responsibilities, creative thinking, analytical skills, communication skills, and leadership skills.

STUDENTS' COMMENTS ON PBL AND APL

Both the Hong Kong and US students made comments on the two approaches and the following are some of the comments:

PBL

- **Hong Kong students**. "Problem-based Learning provides (an) easier way to learn the subject. It helps (us) to understand the subject more clearly."
- "PBL provides more cases to think and less need to memorize."
- "Problem-based learning requires more group work, but overall this is an innovative and effective teaching method."
- **US students**. "The teamwork aspect of the PBL was a great idea because you learned to work together and have actual hands-on effect. It was something that you might be assigned in your future job."
- "The PBL helped me to learn better but for course purposes projects should be limited to possibly one or to (two) phases of a system."
- "Problem-based learning makes me feel I am applying my knowledge to solve real problems."

APL

- **Hong Kong students**. "I prefer APL but the workload is heavy and time is not sufficient to finish the project."
- "For the Action Project Learning, it requires more tutors to support the team. It will make the project more effective."
- "I think Action Project Learning is better than problem-based learning, because actual work is done in action project(s) while problem-based only requires the submission of reports."

- "Action Project sets a goal for my learning and leaves room for me to decide how much I would like to learn."
- **US students**. "Our team was very enthusiastic to do our project as a group. Without application of APL I would not have learned that much."
- "The project selection was great because I felt like I was working for that company plus when we have presentations they are more interesting."
- "I learned the material better by actually using the information I learned in my project. Therefore Action Project Learning is an excellent approach."
- "In general I found it a very effective way to learn the course material and I think it will aid in my professional IT career."

CONCLUSION

The combined PBL and APL strategy, which we have applied to our courses, proved to be successful in many ways. Based on our experiences and the students' responses, we believe that the PBL strategy has helped our students to learn the necessary knowledge and skills, and that it has improved their motivation. This has also been demonstrated in the overall outcome of the courses in both institutions. The students' average grades were higher than those on the same course when a traditional teaching method was applied. The improvements in their motivation have been demonstrated in their interaction with other students and with the instructors. We measured their other course-related activities (beyond attending classes) and found that they have learned problem analysis, planning, teamwork skills and how to do research. In addition, the APL strategy helps students to become actively involved in solving real-life problems. This task involves skills in human interaction that are not attainable in a traditional classroom-teaching method. It can only be accomplished through interactions with project sponsors and amongst teammates. The instructors have evaluated the amount of interaction by gathering data. On average, students met for one hour each week to discuss their project related issues.

Overall, the PBL and APL learning strategy yielded several other positive results that are worth noting. The rate at which students learn through educational activities (such as reading, searching and communicating) is much higher when compared to traditional teaching. This remark is echoed in the responses of the students from both schools in their survey ratings and in their written comments. We must also mention that this learning strategy requires stringent effort both on the part of the students and on the part of the instructors. However, the learning outcome is so beneficial that it is worth the extra effort. It has also been found that peer learning and the concept of a deadline drives students to work towards their goals. Combining the PBL and APL strategies requires that instructors write good problem cases and find suitable real-life projects. A balance in the use of teaching time needs to be made, for PBL and APL, to maximize the teaching and learning effectiveness.

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INFORMATION SYSTEMS DEVELOPMENT: USING CROSS-DISCIPLINARY TEAMS

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ABSTRACT

Increasingly, businesses are using cross-functional teams to support system development projects, creating a need to establish a common understanding of the systems development process. This paper describes a cross-disciplinary systems project designed to simulate the business team experience by grouping operations management students with information systems students to develop a forecasting application. Results of a pilot implementation are discussed.

INTRODUCTION

Because of the emphasis on team interaction and group processes in business, many institutions in business education have incorporated group projects into their course curricula. Typically, group projects are assigned to teams within a single course setting. This has several practical advantages, most notably that the students have a common understanding of how to complete the tasks based on the instruction they have received in the class. And, although the students may have different skill levels and varying interest in achievement, their objectives in terms of mastering the course content are aligned.

The single course setting, however, has limitations as a surrogate for the business environment, which is moving towards the use of cross-functional teams as offering many potential benefits. For example, new product development and process reengineering projects often involve individuals across operations, engineering, marketing and finance. In applying information technology to a business problem, team diversity is generally the norm, with the primary interaction occurring between the end-user as the content expert and the information systems specialist as the facilitator (Kirsch, et.al., 2001; Corritor and Gasper, 2001).

Dynamics between end-users and information systems specialists have also been evolving. Increasingly, managers recognize the strategic importance of information systems to the organization and are encouraging user participation in development projects (Hartwick and Barki, 1994; Sambamurthy and Zmud, 1996). The advent of fourth-generation programming tools and the application prototyping approach to systems development have enabled end-users to take a significantly more active role. Rather than simply articulating the business needs at the start of a project and waiting for the finished system, users are often involved throughout the development life cycle, creating logical data views, assisting in the interface design and testing data outputs. This growth in user involvement appears to indicate a need for end-users to gain more exposure to systems development projects, increasing their understanding of the process.

The purpose of the Forecasting Project is to more closely simulate the development process in a controlled environment, using student teams from across disciplines. To complete the application, undergraduate students in an Operations Management (OM) course are teamed with (IS) students. The objectives of the assignment are to:

- **Reinforce course content**. The OM students apply their knowledge of forecasting models. The IS students gain experience in applying programming techniques to mathematical formulae.

- **Experience the roles of end-user and developer**. Not only are the OM students content providers, they also are responsible for communicating the fore-casting model requirements clearly and for providing timely feedback during the testing phase. The IS students must, in turn, develop their listening skills to understand the requirements and translate them into the constraints of the development tool.

- **Develop an understanding of the relationship of application development to testing**. Because the application must provide accurate forecasts, the IS students must not simply provide a solution, but must also work with the OM students to determine its accuracy. This subtly alters the emphasis of the project by creating two distinct phases: initial development and testing.

- **Learn to manage a project process across heterogeneous teams**. Successful completion requires transfers of information and materials between students with varying backgrounds, time constraints and responsibilities. This adds considerable complexity to the project, requiring students to communicate continually to move the project towards a solution.

RESEARCH QUESTIONS

Given the relative novelty of this approach to applications development and student teams (Corritor and Gasper, 2001), the research questions are broad and exploratory. The first question is simply whether the Forecasting Project is feasible, given that it requires careful coordination across two courses? Second, does the project achieve the stated objectives? A corollary question is what interventions can the instructors use to ensure that these objectives are achieved? Finally, do students find projects of this type to be valuable?

IMPLEMENTATION METHODOLOGY

The Forecasting Project is introduced to the OM and IS students in the second half of their semester course. At this point, the OM students have mastered six forecasting models: naïve, moving average, weighted moving average, exponential smoothing, trend analysis and trend with seasonality. The IS students have covered basic programming techniques, including decision and repetition structures, using Visual Basic 6.0 as the software development tool.

A user graphical interface template has been developed to provide the IS students with a starting point, and to enable them to focus solely on the program code required to implement the various forecasting models. The input interface (Figure 1) uses controls that the IS students are already familiar with for storing data values and for obtaining additional user information that is specific to each model. A second pre-programmed form has also been developed to enable students to see the data as it appears when graphed.

The two simplest forecasting models, naïve and moving average, have been programmed into the application template to enable students to see a sample output (Figure 2) and to demonstrate common repetition algorithms for looping through control arrays. Similarly, standard output tasks, such as a graph showing the projected forecasts versus the actual data, have already been completed. The template provides the IS students with an initial prototype to show to the OM student. In this respect, the Forecasting Project simulates modification of an existing application to meet user requirements rather than creation of a new application from scratch.

Teams meet initially to exchange information, discuss the remaining forecasting models and to draft a problem statement, set of specifications and a timeline for initial development and testing. The latter serves as a contract and is a critical component of the project, as the OM students are responsible for assuring the accuracy of the final product and must actively participate in application testing. The resulting documentation is submitted to both instructors as the first deliverable.

Subsequent discussions can take place either in person or through email as the IS students deliver the initial version of the completed application to their OM counterpart. A copy of the completed application is also provided to the instructor for additional quality control.

FIGURE 1

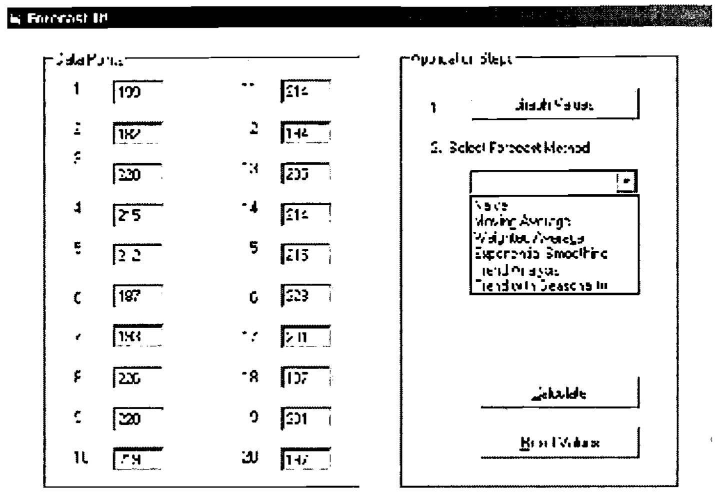
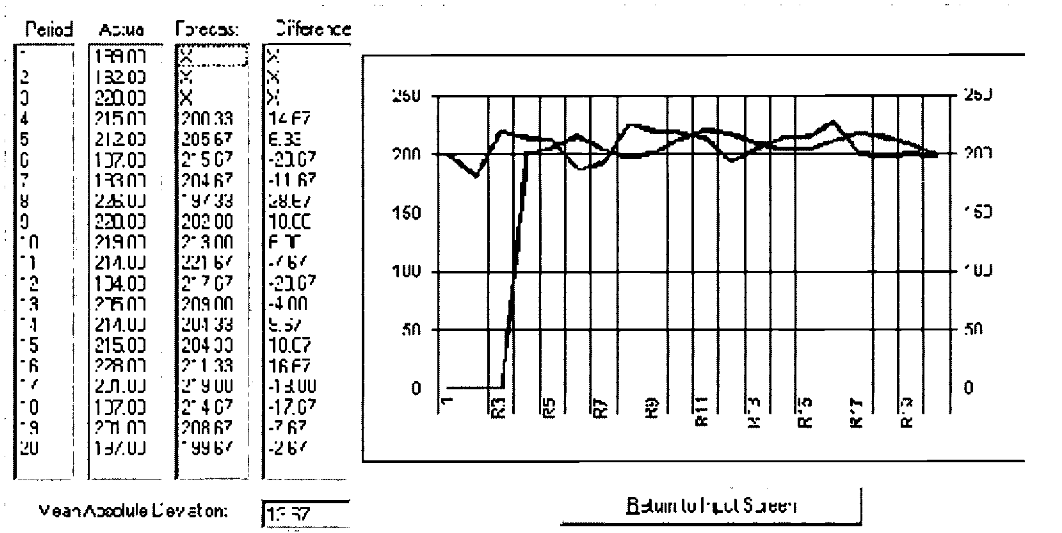


FIGURE 2
THREE MONTH WEIGHTED AVERAGE



The OM students are responsible for testing the application and determining whether the output is accurate, documenting errors and providing feedback to the IS students for correction. As constant communication with each other and with the instructors has been found to be a critical component of the success of student teams (Stephens and Myers, 2001), documentation created through this process is also sent to the instructors, who can intervene if an impasse occurs.

PILOT TEST— IMPLEMENTATION AND RESULTS

A pilot test of the Forecasting Project was conducted during the spring semester of 2002. Twenty-eight undergraduate IS students were teamed with forty-five OM students. Because of the timing of the project in relation to the spring semester break, only two forecasting models, weighted moving average and exponential smoothing, were required. In addition, although the project assignment and prototype template was presented to both IS and OM students in a joint session, the IS students worked fairly independently. The problem statement and specifications were drafted solely by the IS students. The joint testing and correction phase was also eliminated because of time constraints. Completed applications were given directly to the instructor, who graded the results and made corrections prior to returning the projects. The IS students were then responsible for delivering the corrected application to the OM students. The OM students then used the application to complete an assignment about selecting the best quantitative forecasting model.

Although some of the critical components of the exercise were missing, the pilot did result in some interesting findings. For example, the OM students learned the forecasting formulas for a single period and then applied the same formula to subsequent periods. While the IS students were able to follow the formula logic, they were initially confused by idea of forecasting over multiple periods and had some difficulty in incorporating the formula logic within a repetition structure. This clearly demonstrated some of the difficulties in translating user requirements into the logic required by the software development tool. As one IS student stated:

> I think I am having a little difficulty because I'm not at all familiar with the formulas or forecasting. My OM counterparts explained the equations well and how to use them; I was just slightly confused on what the equations would give you. I think this project is really helpful in that you realize that each side needs to clearly explain their part of the project and ask any and all questions (that you) have.

After initially meeting with their OM counterparts, the IS students spent class time developing code algorithms. This provided an opportunity for the IS instructor to reinforce basic programming concepts (e.g., using variables to store information as calculations are rolled forward in time.) Working through the algorithms in class, however, created a second problem that was not revealed until the completed applications were submitted to the IS instructor. In several of them, it was apparent that the IS students had simply followed the algorithm logic and, having obtained output, stopped without verifying the validity of their results. Typically the coding errors were subtle, pointing to the wrong data value (e.g., the current period instead of the prior) in exponential smoothing, or assigning the weights in reverse order for the weighted average forecasting model.

Because of time constraints, these errors were simply corrected by the IS instructor before they were given to the OM students. This eliminated the testing phase, and by extension, a significant opportunity for OM and IS students to work together to identify and correct errors. The result was grousing on both sides. From the perspective of the OM student, the lack of participation and project ownership resulted in perceptions that the benefits of the experience were solely accruing to the IS students:

> I thought it was interesting, but probably more from the perspective of the IS student, because I am an IS major and did **not** get to do this project from the IS side.

> The project really didn't teach me anything more than what I could have learned from studying. I understood the models, but having to collaborate with the IS student was somewhat of a hassle. Having the IS student create the application didn't teach us anything.

> It seemed the group member from the other class had to do most of the work. All we really did was explain the formulas to him.

The IS student comments revealed that they perceived themselves as doing all the work.

> It seems that we are doing twice as much work as the OM class. Not only do we have to write the program, but we have to learn their part of the project as well.

> I think meeting with the OM student was kinda pointless because all we needed was the formulas that could have been given by the professor!!

Nevertheless, the majority of the student comments were positive. The following two statements, from an OM and IS student, respectively, are particularly articulate representations:

> I thought the project was very helpful. Although I already had a strong understanding of the fore-casting models, it was beneficial to use the program and interact with others in order to find a feasible solution.

> I think it's great for "real world" experience. I am relieved that the interface and most of the code is already in place so I can focus entirely on coding just the two required models. It's interesting how each student must trust one another to achieve desired results.

Although the results are preliminary, the responses to surveys administered independently to the OM and IS students (Appendices A and B) also indicated that the students perceived the project to be beneficial. The IS students indicated moderate agreement with the statement that "The benefits of the assignment are clear to me." Likewise, the OM students showed moderate agreement with

> Overall, I believe this project was a good example of the "real world" because of the interaction required between individuals with different "expertise."

It is interesting to note, however, that while the OM students appeared to be confident in their explanations of how the forecasting models worked, their IS counterparts were not equally convinced that the OM students clearly understood the models.

DISCUSSION AND CONCLUSION

Given that this was the first implementation of the Forecast Project and the timing constrained both the interactions with OM/IS students and the testing phase, the results were encouraging. For the most part, the students enjoyed the interaction with others outside of their class although tension was initially high until students began to work with each other and realized that the project was "doable." The IS students clearly benefited by exercising their listening skills and using information, not pre-packaged by the instructor, to craft a logical solution. The benefits were not as obvious to the OM students (after all, how often do end-users readily embrace information systems change when there is already a working solution?) Nevertheless, many did recognize the value of having to explain the various models to their IS counterparts. It will be very interesting to see if increasing the joint OM/IS responsibilities in a future implementation positively affect OM student perceptions of project involvement and ownership.

With regard to project feasibility, the project appears to be feasible, at least as it was constructed for the pilot test. Requiring testing as a project phase will add another dimension and challenge to the OM/IS student dynamics. The students are not the only ones affected, however. The astute student comment regarding trust in the student teams also applies to the interaction of the instructors. Guiding students through any project process requires considerable effort, but in this case the potential difficulties are compounded by the involvement from students from other classes. Coordinating with a second instructor in another discipline requires one to enlarge his or her own perspective to encompass the objectives of both. In this respect, attempting interdisciplinary projects also creates a unique opportunity to the instructors for learning and professional growth.

If successful, the implementation of the Forecasting Project will present additional opportunities for research and further study. For example, a segmentation of the pilot test IS student data by gender indicated that female students valued the social interaction of the pilot more highly than the male students who were more inclined to work independently. Additional experience with projects like the Forecasting application may help to provide insights as to interventions that improve the process of application development for both groups.

Finally, the processes and methodologies that make this particular project successful can be adapted to simulated development projects involving other business disciplines, such as marketing, accounting and finance. Because "real world" systems development projects are requiring more group collaboration, the "soft" skills needed for effective communication are gaining in importance. A simulated development project, such as the Forecasting application benefits all participants by requiring them to be interdependent, to listen carefully, and to speak precisely to arrive at a solution. While the project benefits in terms of reinforcing programming technique are obvious, business students from other disciplines also gain from the exposure to the development process and learning how to take a more active role.

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APPENDIX A
RESULTS OF THE OM STUDENT SURVEY

Survey Question (5 point Likert-type scale)	Mean	Mode	Std. Dev.
At the beginning of the project I felt comfortable giving instructions to my IS counterpart.	4.20	5	0.91
I understood the formulas for the different forecasting models so that I could explain them to my counterpart.	4.63	5	0.77
Explaining the formulas to my IS counterpart helped me to better understand the different forecasting models.	3.98	4	1.12
Explaining the project to my IS counterpart helped me to better understand how a quantitative model is selected.	4.13	4	0.97
I found my IS counterpart easy to work with.	3.93	5	1.12
I was able to meet with my IS counterpart as needed.	3.45	3	1.15
I received updates from my IS counterpart about where s/he was with in her/his work.	3.03	3	1.39
My IS counterpart contacted me if they needed further clarification or explanation.	3.23	5	1.44
Overall, I believe this project helped me better understand forecasting.	3.85	4	0.98
Overall, I believe this project was a good example of the "real world" because of the interaction required between individuals with different "expertise."	4.03	4	0.86

APPENDIX B
RESULTS OF THE IS STUDENT SURVEY

Survey Question (7 point Likert-type scale)	Mean	Mode	Std. Dev.
I found the instructions I received from my OM counterpart to be confusing.	4.11	5	1.50
It is difficult to take the formulas as written and translate them into code statements.	4.39	5	1.89
My OM counterpart did not appear to understand how to perform the forecasting calculations.*	2.15	1	1.38
Meeting face to face to go over the forecasting instructions was very helpful.	5.22	5	1.50
I went back to my OM counterpart several times to clarify my understanding of how the formulas worked.*	3.00	1	2.06
I find it easier to take the written documentation and work through the logic on my own.	4.63	6	1.69
Writing the code took a lot of my mental effort.	4.75	5	1.69
The benefits of the assignment are clear to me.	5.54	6	1.17
I found it difficult to explain to my counterpart how the program could achieve the expected result.	4.04	5	1.56
Writing psuedocode helps me to think through the programming steps more clearly.	5.00	6	1.44

*Reverse coded

UNEARTHING HIDDEN ASSUMPTIONS REGARDING ON-LINE EDUCATION: THE USE OF MYTHS AND METAPHORS

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ABSTRACT

As on-line education becomes more pervasive and increasingly acceptable in society, there is a need to critically examine the merits and underlying assumptions driving the justification, design, and teaching of such courses. In this paper, we take a first step in this direction by uncovering several symbolisms, in the form of myths and metaphors, discernable in the discourse on online learning. Future research will involve an empirical examination regarding the validity and consequences of these myths/metaphors identified, specifically in the context of information systems education.

INTRODUCTION

According to estimates from IDC, a Framingham, Massachusetts-based market research firm, the worldwide e-learning market will grow from $2.2 billion in 2000 to $18.5 billion by 2005 (Moore, 2001). Peter Drucker, economist and futurist, caused quite a stir in the academic community when, in an interview for Forbes magazine, he stated that universities thirty years from now would be "relics ... [and] won't survive" (Lenzer and Johnson, 1997, p. 127). Money Magazine has said, "Online education may be the greatest technological advance to hit academia since the No. 2 pencil" (Clarke, 1998, p. 66) and John Chambers, the chief executive officer of Cisco Systems, has declared that "e-learning is the next major killer app"of the Internet ("The Virtual Classroom," 2000; Moore, 2001). In fact, it has become such big business, that major investors, such as Michael Milken's Knowledge Universe and Paul Allen's click2learn.com, are jumping on the bandwagon to offer courses to both college students and corporate trainees (Molenda and Harris, 2001). Media financier, Herbert Allen, Jr., is the prime backer of Global Education Network (GEN), a consortium of top-notch liberal arts colleges and ivy-league universities, including Brown, Wellesley and Williams, brought together to provide online education ("The Virtual Classroom," 2000; Weber, 2000). Additionally, some universities, such as University of Maryland and Columbia University, are forming their own for-profit subsidiaries to offer online degree programs in order to exploit their "intellectual capital," presumably without diluting the reputation of their brick-and-mortar university (Molenda and Harris, 2001). Thus, it is evident that higher education institutions, including those with outstanding "brick-and-mortar" historical reputations, as well as major investors, are charging ahead in an effort to capture a share of the online education market. This pattern is noticeable among Business Schools in general, which are increasingly leaning toward offering online programs, especially in the area of Information Systems whose courses are in high demand. But what are the driving forces behind this trend toward online education?

A number of reasons are cited in the literature. Adult students, those 25 years of age and over, currently represent nearly one-half of credit students enrolled in higher education (Kasworm, Sandmann, and Sissel, 2000), yet they have greater work and family responsibilities that prevent them from attending school full time. These students, then, may be choosing an online course because of *lifestyle issues*. Another driving force is the increasing cost of education and the lack of financial aid available for those students who would like to attend full time (Raymond III, 2000). Thus, students may be forced to choose an online course for *financial reasons*. The pervasiveness of information technology into the workplace has also created a *growing societal demand* for continuing education, requiring many workers to acquire new skills (Molenda and Harris, 2001). In this day and age most large companies are sold on the idea that *continual training and retraining* of employees will pay off big ("The Virtual Classroom," 2000). In addition, *technology in and of itself* is a major driving force. As more and more people have access to a computer and the Internet, it is easy to fall into a mindset of thinking "since it's there, we should use it." Finally, as government support for public institutions is shrinking, *nonprofits are being forced to find their niche in the marketplace and operate more like a for-profit business*. Many of these institutions are turning to online education as a way to support themselves within the marketplace (Molenda and Harris, 2000). As such, for-profit and non-profit institutions are competing for the upper hand in the headlong rush to implement new technology. Herbert Allen, Jr.'s for-profit venture, GEN, has its own conception of the driving force behind this trend and is targeting four distinct markets with its online courses: "lifelong learners" who graduated from college decades ago but want to challenge themselves; college students at smaller institutions who want to supplement their studies with courses not offered on their real-life campuses; high-school students gearing up for competitive college-admission processes; and students overseas who want access to U.S. institutions (Weber, 2000).

While online education is being touted aggressively, there are some opposing voices that seem to be muted by the sheer weight of technological and economic determinism, the basis for much of the uncritical optimism regarding on-line teaching and learning. Among those voices are 840 faculty members from the University of Washington (UW) who signed an open letter objecting to Governor Gary Locke's 1998 proposal of a distance-learning initiative that suggested traditional state-university courses could be partly replaced by online learning (Cleary, 2001). These opposing faculty argued that education should not be reduced to "the downloading of information, much less to the passive and solitary activity of staring at a screen" (Cleary, 2001). It is worth noting that the UW professors are not alone in their skepticism of online education. When Peter Lange, the Provost of Duke University, was approached by GEN he was impressed by what GEN had to offer. Yet, he expressed his reservation regarding the extent to which online education can be universally effective, and suggested that online learning be approached on a course-by-course basis. "Can a company like GEN put together a full curriculum which would substitute for what you would get if you came to Duke? The answer is clearly no," he says (Weber, 2000). William S. Reed, the vice president for finance and administration at Wellesley, declared that he is not sure if Wellesley's courses can be successfully translated into Web pages (Weber, 2000), yet Wellesley has agreed in principle to join the GEN venture. Even the U.K.'s Open University, an institute that creates and studies ways to apply new technologies to learning, has some harsh words regarding online education. "For online education to become mainstream is kind of a depressing thought, because it is such a crappy experience. The bottom line is that learning online is a soul-destroying experience. It really, really stinks. It's always second best (to face-to-face learning)", said Marc Eisenstadt, chief scientist for the Knowledge Media Institute at the U.K.'s Open University (Hamilton, 2001). Moreover, the jury is still out on the issue of online education at organizations such as the AACSB, the primary accrediting organization for business schools, which typically house Information Systems departments as well. While the St. Louis, Mo., organization "encourages innovation and experimentation in education" in its guidelines, the AACSB also cautions "simply adopting new technologies without thinking about the implications for quality assurance would raise troubling questions" (Cleary, 2001). The sentiments of those who are erring on the cautious side before jumping feet first into online education can be properly summed up by Arthur Levine, president of Teachers College at Columbia University in New York, when he said, "We still don't know if online education is any good" (Cleary, 2001).

As IS educators, the authors' own position in this debate is one of cautious optimism—while we see significant gains that can be derived from online education, we consider the *taken-for-grantedness* of the presumed merits, largely fuelled by financial and technical opportunism, as being detrimental to the long-term interests of the society to produce reflective Information Systems practitioners.

Given the hype that has accompanied this new form of learning, and the significant investment of both money and time that has gone into creating e-learning ventures, we believe that there needs to be a critical examination of the assumptions underlying the discourse on this topic, with the goal of separating hype from reality. In order to delve deeper into the question of whether online education is an appropriate supplement to, or replacement for, traditional education, following the approach of Hirschheim and Newman (1991), we explore some of the symbolisms, namely myths and metaphors, pertaining to online higher education, with the ultimate goal of investigating if and how they apply specifically to information systems education.

SYMBOLISMS—MYTHS AND METAPHORS

Symbols embody a community's views (or theories) about particular phenomena, which in turn explain behaviors exhibited by members of the community. Thus, symbolisms, such as myths and metaphors, can be used to make sense of situations that are new, problematic, ambiguous, or unsettled (Frost and Morgan, 1983). Symbolism revolves around shared meanings—patterns of beliefs, rituals and myths, which evolve through time and function as social glue, binding communities together (Smircich, 1983). In the realm of online education, where there exists for many an absence of experience to guide practice, the images and ideas embedded in the discourse reflect and simultaneously shape people's views (Schultze and Orlikowski, 2001) towards this new form of education. Thus, unlike mainstream positivist research studies, which are concerned with the empirical testability of theories in an attempt to increase predictive understanding of phenomena, the current study calls for an interpretivist approach, as we are attempting to understand phenomena through accessing the meanings that participants assign to them (Orlikowski and Baroudi, 1991). The interpretive perspective emphasizes the importance of subjective meanings and social-political, as well as symbolic, action in the processes through which humans construct and reconstruct reality (Morgan, 1983, p. 396) and asserts that the language humans use to describe social practices constitutes those practices (Orlikowski and Baroudi, 1991). According to this perspective, an examination of embedded symbolisms, or more specifically, myths and metaphors, in the language of writers/speakers on online education will enable an understanding of the common attitudes and beliefs surrounding online education, and thus a comprehension of the (socially constructed) reality regarding this phenomenon.

Myth can be defined as

> A dramatic narrative of imagined events, usually used to explain origins or transformations of something. [It also reflects] an unquestioned belief about the practical benefits or certain techniques and behaviors that is not supported by demonstrated facts (Trice and Beyer, 1984, p. 655).

Myths are often communicated through the telling of a story; nonetheless, they are not merely recountings of any particular tale, but ways of classifying and organizing reality (Polkinghorne, 1988, p. 83). Myths are devices of mind that have been used throughout time to provide explanations, reconcile contradictions, and help resolve dilemmas; however, myths have also been known to distort images and misdirect attention (Bolman and Deal, 1984). Negative traits notwithstanding, "myths are necessary to create meaning, solidarity and certainty" (Bolman and Deal, 1984) and serve the following functions: 1) myths explain, 2) myths express, 3) myths maintain solidarity and cohesion, 4) myths legitimize, 5) myths communicate unconscious wishes and conflicts, 6) myths mediate contradictions, and 7) myths provide narrative to anchor the present to the past (Cohen, 1969). An example of this is the "myth of academe," which represents the belief that faculty lead lives devoted to the selfless pursuit of knowledge in institutions carefully organized to support that pursuit (Shaw, 2000). It is important to note here that myth is not necessarily empirically invalid. Rather, it is a belief *that is assumed to be valid* in the presence of contrary evidence or in the absence of any evidence at all.

Metaphors have been described as a way of understanding and experiencing one thing in terms of another. Aristotle spoke of the value of metaphor almost 2,200 years ago: "Ordinary words convey only what we know already; it is from metaphor that we can best get hold of something fresh" (Embler, 1966, p. 12). According to Morgan (1986, p. 12), metaphors are used as "a way of thinking and a way of seeing that pervade how we understand our world generally." A metaphor has the power to shape reality and structure the thoughts of the people who are caught up in a particular metaphor and its entailments (Duncan, 1968; Graber, 1976; Lakoff and Johnson, 1980). The true effectiveness of metaphors is their almost paradoxical ability to point out dissimilarities and contrasts between two objects while simultaneously demonstrating that there are considerable similarities between the objects being compared (Weaver, 1967). Based on the work of Koch and Deetz (1980) we can make the following assumptions with regards to metaphors: 1) they are fundamental in the English language, 2) basic metaphors entail others, 3) complex networks of metaphors permeate our language, leading us to conceptualize certain things in certain ways, 4) metaphors are usually coherent and can be traced back to fundamental forms of experience, and 5) inconsistent metaphors can be explained by tracing them to different realms of experience. An example of a metaphor is the phrase "time is money", which entails the idea that time is valuable, can be spent, saved, lost, and so on. From this example, it is evident to see how metaphors can be helpful as carriers of meaning; however, they can also be dangerous fantasies "and not suited for guiding serious meaning" (Boland, 1987, p. 367).

METHODOLOGY

The following steps outline how went about unearthing the myths and metaphors embedded within the literature on online education. The first step in discovering the myths and metaphors utilized to describe online education involved the selection of articles for analysis. We used Pro-Quest Direct and ERIC to search for peer-reviewed articles that contained at least one of the following terms: online learning, online courses, online education, online instruction, web-based instruction, web-based courses, Internet courses, e-learning, computer-based instruction. Published research articles were used as the unit of analysis as they "provide a clear sampling frame, as well as the best view of what is accepted in the research community" (Watson-Manheim, Crowston, and Chudoba, 2002). Most of the articles chosen for analysis came from journals in education research, while a few came from business journals. Although the articles selected for analysis ranged in publication date from 1996-2002, a majority of the articles (14 out of 21 chosen) were published between 2000 and 2002, as this seems to be the time at which online education emerged as a hot topic. A total of twenty-one articles were chosen for review based on the fact that they contained recommendations for how to design and teach an online course, offered "lessons learned" from real-life experience in teaching an online course, or presented issues to consider when teaching an online course. The second step in our analysis was to examine each article in search of common myths and metaphors embedded in the discourse on online education. Finally, after making a comprehensive list of the myths and metaphors found in these works, they were sorted in order to determine which myths and metaphors were the most prominent throughout these articles.

ANALYSIS

Myths

Technological connectivity implies interaction. Interaction is one of the key components in any learning experience (Dewey, 1938; Vygotsky, 1978) and has become one of the most pervasive constructs in distance education. In fact, there exists the belief that online education provides an element of interaction that is absent in the traditional classroom. It has been suggested that unlike a traditional university, where students have difficulty finding time to meet with and to learn from one another, online education offers students the opportunity to interact whenever they have time (Shedletsky and Aitken, 2001). The technology used to teach online education is also said to facilitate and promote interaction through its ability to provide synchronous as well as asynchronous communication (Schrum, 1999) rendering face-to-face communication unnecessary (Liaw and Huang, 2000). The interactive component of technology is also believed to eliminate the time and space barriers between instructors and their physically distant students, thus recreating the classroom environment and allowing learners to engage in learning at their convenience with respect to place and time (Bernard, Rojo de Rubalcava, and St.Pierre, 2000). A further benefit of technology that appears in the literature is that the student can receive individual and immediate feedback and reinforcement from both instructors and peers (Raymond III, 2000).

On-line courses are more effective because they embody a student-centered learning philosophy. Distance education researchers portray the traditional classroom setting as a teacher-centered, talking-head, passive-student model which is characterized by a boring lecturer who drones on while students sit idly by trying to absorb enough information so that they can regurgitate it for a test and forget it (Markel, 1999). Online education, on the other hand, is declared to be "a more student-centered, collaborative, and egalitarian learning environment" (Weisenberg and Hutton, 1996). In this new paradigm, students become self-motivated managers of their own learning instead of passive bystanders, while instructors move from oracle, lecturer, and purveyor of knowledge to facilitator, guide, and mentor (Weisenberg and Hutton, 1996; Shedletsky and Aitken, 2001; Eastmond, 1996; Bernard, Rojo de Rubalcava, and St.Pierre, 2000; Raymond III, 2000; Murphy and Cifuentes, 2001). In essence, it is believed that the online forum breaks down the teacher-student hierarchy (Weisenberg and Hutton, 1996).

Any faculty member can teach an online course, any course can be taught online, and anyone can learn online. This myth starts with the belief that professors will be eager to participate in an online venture, and that being successful in this environment does not require any traits or skills that are different from teaching a traditional course. An additional notion is that the web is an appropriate medium for any type of course. This part of the myth views the web as a medium that enables the delivery of courses that were created within another framework (Carr-Chellman and Duchastel, 2001), and that all a professor needs to do is to make a few changes to his traditional course to prepare it for the online environment. In many cases, entire degree programs are being offered online, which inherently implies that any course can successfully be taught online. Online education is also seen as the remedy for the large masses of the population who for some reason or another cannot attend a traditional university. In fact, it has been stated that if technology continues its rapid growth, the need for student's to be physically present in the classroom will be eliminated (Charp, 2000). This bold statement makes the assumption that the online learning environment is appropriate for everyone and that there are no technological, motivational, or cognitive/ intellective skill barriers that would prohibit entry into, or successful completion of, an online course or program.

Faculty receive the same support and rewards for teaching an online course as they do for teaching a traditional course. The fate of a faculty member's success in the online education domain relies to some degree on administrative decisions, even though these decisions may be made by people who have no expertise in computer pedagogy, scholarship, or general computer operation (Shedletsky and Aitken, 2001). This myth is based on the belief that administrators are aware of the time and effort that goes into converting a traditional course into an online course and are prepared to offer the technical support that may be required when designing and teaching an online course (Markel, 1999). It also presumes that course-load policies will be adjusted in recognition of the fact that an instructor teaching an online course spends significantly more time communicating with students on an individual level (Markel, 1999), thus making faculty workload significantly higher. The myth also implies that many faculty who are embarking on an online endeavor may be under the impression that they will retain the intellectual property rights to the courses they have created. They may also believe that they will be rewarded the same for teaching an online course as they will be for teaching a traditional course when it comes to issues such as tenure and promotion (Markel, 1999).

The students and their instructor become one big happy family. The online environment is said to overcome isolation (Eastmond, 1996; Bernard, Rojo de Rubalcava, and St.Pierre, 2000), promote serendipitous encounters (Eastmond, 1996), and provide valuable intellectual exchanges profitable to all (Carr-Chellman and Duchastel, 2001). It is believed that online education transcends cultural, economic, and political systems thereby allowing us to increase our knowledge of one another and to recognize the similarities among the people of the world (Schrum, 1999; Anderson, 2001). It is also alleged that this forum provides all students with a voice, thus everyone has the same opportunity to express their opinions and beliefs and no one person can dominate the conversation (Swan, 2001).

Metaphors

Just-in-time learning. Primarily used in logistics, the concept of *just-in-time* processes originated from increasingly rapid modes of transportation and communication. The concept behind the idea was that items would arrive precisely at the time they were required for use or dispatch. Thus, in a learning context, this metaphor is used to describe the flexibility of online education. Just-in-time learning implies that the information can be communicated to students when and where they need it. In other words, students have access to the right information at the right time (Carr-Chellman and Duchastel, 2001). In the traditional classroom, most instruction content quickly becomes "inert", as it has little relevance to the life experiences of the learners (Gagne, Yekovich and Yekovich, 1993). However, it is believed that through the concept of "just-in-time" learning, which is made possible via the Internet, learners can "download" their own knowledge as per their immediate requirements. The learner-objective environment promoted by the Internet makes learning resources and instructional activities available to the learner anywhere, anytime, thus allowing them to create links and search for knowledge that can interact with their own prior experiences (Shedletsky and Aitken, 2001; Liaw and Huang, 2000; Carr-Chellman and Duchastel, 2001).

Dual-mode institution. The word dual means of, or pertaining to, two. The word mode refers to a particular type or form of something, which in this context pertains to the way in which instruction is being offered. Thus the metaphor—dual-mode institution—is used to refer to those institutions that offer traditional residential programs as well as distance education programs (Carnevale, 2000). The dual mode system is said to be characterized by an interlock of student choices exercised within a set of academic and organizational constraints (Guiton 1992). The metaphor also seems to imply that institutions can undertake the responsibility of both traditional and on-line education with equal ease and effectiveness.

Land-rush mentality. This metaphor creates the image that the race to enter into the online education domain is similar to the Oklahoma land rush of 1899, which has been called the most competitive event in history. Just as people dashed westward to stake their claim on a piece of land, both for-profit and non-profit institutions are scurrying to capture a piece of the online education market. Interestingly enough, the Okalahoma land rush meant disappointment to many, as the soil was not as rich as it had appeared and food and provisions were scarce. In fact, after months of starvation and being disillusioned, most returned to more civilized areas. Some say that the opening of the Indian lands in the Oklahoma Territory created as many problems as it solved.

Sage on the Stage/Guide on the Side. This metaphor stems from the second myth mentioned above regarding the changing role of faculty. The word sage refers to an experienced or profoundly wise person, whereas a guide is someone who assists or supervises. Thus, in a traditional education setting, the instructor is referred to as a sage and the classroom serves as his stage. However, in the online domain, the instructor acts as more of a guide, assisting students in knowledge construction from the sidelines rather than projecting knowledge from center stage. This metaphor therefore implies that on-line education requires a change in attitude/approach of the instructor in order to be effective (Coppola, Hiltz, and Rotter, 2002).

Digital Diploma Mill. Robert Reid, in his 1959 study of diploma mills for the American Council on Education, described the typical diploma mill as having no classrooms and faculty that are often untrained or nonexistent. Thus, the term "Digital Diploma Mill", which was coined by David F. Noble, a professor at York University in Toronto, refers to the automation of higher education in which most teaching is done by machine, not faculty, and in which there are no classrooms. This metaphor conjures up a picture of an institution churning out commercialized, computer-based education created by faculty members who may or may not be involved in the dissemination of the courseware over the Internet.

Corporatization. In the realm of online education, the term corporatization is used to "refer to the tendency of nonprofit organizations, such as universities, to operate more and more like businesses" (Molenda and Harris, 2001). As government budgets are shrinking, nonprofit organizations are being forced to operate more and more like a for-profit business by generating new ways of supporting themselves in the marketplace. This metaphor implies an erosion of the basic values of academia such as academic freedom, autonomy over course content and pedagogical styles (Molenda and Harris, 2001). Instead, the term "corporatization" conjures up an image of a uniform and structured production-oriented environment that places value on productivity and contribution to the bottom-line.

CONCLUSION AND FUTURE DIRECTIONS

For fear of being left behind, many universities are plunging into the online education waters without giving much thought to the pedagogical or economic costs that may follow. These institutions seem to think "everyone else is doing it, so there must be something to it"—it is a competitive necessity. What is not known is the kind of impact this computer-mediated or computer-delivered education will have on the faculty and students. This paper has explored some of the myths and metaphors that seem to be embedded in the discourse on online education, in hopes of unearthing and carefully examining some of the commonly held implicit beliefs that surround this new phenomenon. These beliefs, whether accurate or not, will be responsible for molding the perceptions of those involved in online education, which will in turn constitute educational practices for several years to come. Hence, it is critical that we question the myths and metaphors that pervade the online-education literature in an attempt to shed some light on the so-called truths that are being set forth.

The next phase of our investigation will involve the interviewing of faculty members who have designed and taught a variety of information systems courses online, and students who have taken such courses. The interview data, we are hopeful, will facilitate the discovery of additional symbolisms, and also allow a more definitive evaluation/elaboration of myths and metaphors discussed in the context of information systems education.

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DEMOGRAPHY AND IT/IS STUDENTS: IS THIS DIGITAL DIVIDE WIDENING?

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ABSTRACT

At a time when demand for employees with IT skills is booming, there is a decline not only in the number of females entering this field of study in most western countries but also in the number of females taking computer courses [Nielsen, von Hellens, Wong, 2000]. Moreover, the gap in computer access and training for minorities is not declining [Hoffman and Novak, 2002]. However, data from Australia indicate that under-representation of women and minorities is somewhat less pronounced in programs in IT or Software Engineering than in programs in Computer Science or Computer Engineering [von Hellens and Nielson, 2000]. This paper seeks to determine whether there are similar differences in the state of Georgia in the U.S.

INTRODUCTION

According to a National Science Foundation-backed report from Carnegie Mellon University, the number of vacant IT positions is increasing by 25 percent per year ["How to Get More...," 2000]. At a time when the law of supply and demand should be bringing females and minorities into high-paying IT jobs and companies want diversified personnel, the number of women and minorities in the workforce remains low [Gaudin, 1999]. In fact in Canada the number of women graduating from IT programs has fallen by more than 50 percent in the last 15 years. While women make up 52 percent of the overall population, last year less than 25 percent of the computer technology graduates in Canada were female [Clow, 2002].

Data for Australia indicates that the under representation of women and minorities is somewhat less pronounced in programs in IT or Software Engineering than in programs in Computer Science or Computer Engineering [von Hellens and Nielsen, 2001]. The aim of this research is to determine whether there are similar differences in the state of Georgia.

REVIEW OF LITERATURE

The evidence of a gender gap in those embracing technology is exhibited long before students arrive at universities. The American Association of University Women reports that boys are significantly more likely to take advanced computer classes in high school, to spend hours after school on a computer at home, and to enroll in computer camps ["Girls and Technology," 1999]. While 56 percent of students enrolled in college are females, students who select a technology based major are predominately male. Some researchers feel that technology classes are presented in such a way, beginning as early as middle school, that females are discouraged from participating. In a study of high school students, females reported computing as boring, involving logic or math skills and little contact with other people [Nielsen, et al., 2000] and were put off by the perceived heavy work load in computer classes [Clow, 2002]. In fact in a British survey cited by the Canadian Information Processing Society, it was reported that young women would rather be undertakers than work in IT [Clow, 2002]. Other research suggests that the masculine meaning that is ascribed to computing is offputting to females [Greenhill, von Hellens, Nielsen, Pringle, 1996].

The field of technology is not losing just the interest of females in middle and high schools. IT is rarely marketed to minorities. At an age when teenagers are very impressionable, minorities are almost never seen in print media advertisements. Few technology advertisements can be found in magazines aimed at the African American market, such as *Emerge*, *Essence*, *Vibe*, *The Source*, and *Black Enterprise*. The image of an IT professional is not marketed as "cool" to minorities. [Eglash, 2000].

When examining computer usage by race in the U.S., whites are significantly more likely to have a computer in their home and slightly more likely to have computer access at work. Studies show that even when adjusting for income and education, blacks and Hispanics have lower computer usage, computer access, and computer ownership. This gap is larger for high school graduates than for those without a high school degree, implying that education does not account for this gap. In recent years the percent of women owning computers has increased for whites but not for black women [Hoffman and Novak, 2002]. If minorities have limited exposure and access to computers, it is difficult for them to have the knowledge of and excitement for IT programs. Knowing what to expect in an IT degree program of study appears to be a problem that is not limited to minority populations.

In surveying first year IT students at Griffith University in Australia, researchers discovered that both male and female students found introductory IT courses to be difficult and to differ greatly from the students' expectations. This led to discouragement and disappointment [Nielsen, et al., 2000]. Most of these students also had trouble envisioning the type of career they aspired to develop upon completion of the degree program [Greenhill, et al., 1996]. This may be in part due to the fact that IT is both a new and an evolving field [Nielson, von Hellens, and Wong, 2001]. The technical knowledge necessary to support the IT industry is increasing and expanding continually, as are career opportunities [von Hellens, Nielsen, Doyle, and Greenhill, 1999].

When comparing males and females, females were more likely to be looking for security and stability in a career and rated the ability to work from home as an important factor when considering a job. Females are also more interested in jobs that are people-oriented and require communication skills [Nielson, et al., 2001]. While these skills are needed in many jobs in IT (women are typically strong in data management and project management [Clow, 2002]), poor communication about this industry provides a false set of expectations and opportunities. Males on the other hand were interested in salaries and job satisfaction [Nielsen, von Hellens, Pringle, Greenhill, 1999].

IT employers seeking additional employees considered "soft" skills such as the ability to communicate, work in groups, adaptability, and self motivation more important than technical skills for new graduates. These skills are ones with which females are more likely to feel comfortable and are skills at which females are more likely to excel. It is easier for employers to teach technical skills in an industry in which technology is evolving. Yet females do not view these soft skills as skills needed for success in IT [von Hellens, Wong, and Orr, 2000].

It is interesting to note that in a study conducted in Australia it was found that successful women in IT had consciously chosen career over family. While many IT jobs provide the ability to work from home and many women would like to be able to take advantage of this, respondents stated that in an environment that is male-dominated, taking advantage of such perks as working from home or visibly placing family before career would impair their ability to advance and would result in the women not being taken seriously [Neilsen, et al., 2001].

Another striking difference in gender appears to be in the approach to group work. Females tend to view team projects as a collaborative effort and enjoy a sense of collectivism. On the other hand males shared information only on study related information and are more competitive [Nielsen, et al., 1999]. Male students also view females students as being less technically competent (which is not supported through testing) and tend to resist including females in projects or study groups [von Hellens, et al., 1999].

Females in IT programs experienced gender-based discrimination. In a study conducted at Griffith University in 1995, Asian women complained that their opinions were not valued and were largely ignored. Non-Asian women felt they were the focus of sexual harassment via loud boasting and uninvited e-mails. This group of females also complained of unwanted positive discrimination in the form of less strenuous evaluation by faculty [Nielsen, et al., 2001].

Females employed in IT positions believe that they experience gender-based pay discrimination. Statistics show that women make roughly 75 cents for every dollar their male counterparts earn. Some argue that the pay differentiation is a function of education and not gender. In a recent international survey for Deloitte & Touche of 1500 IT professionals, 84 percent of the women surveyed believed that there was a plateau above which members of there gender could not advance. Statistics from the Department of Labor support this belief. Only 11 percent of all corporate executives are female [Alfe, 2002].

The aim of this research is to determine whether the differences in gender and ethnicity that are being observed in computer related degree programs can also seen in the public institutions of the state of Georgia. Specifically this research will examine breakdown by gender and ethnicity of baccalaureate students in IT, IS, and CS programs as a whole and by type of public institution. Public baccalaureate or above institutions of higher education in Georgia are classified as research universities, regional institutions, state universities, and state colleges (see Appendix A for a breakdown of Georgia institutions by type). Research universities have a statewide scope of influence in academic achievement, research, and public service and provide baccalaureate, masters, and doctoral degrees as well as a wide range of professional programs. Regional universities have a scope influenced by a specific region of the state as well as academic programs, research, and public service that are focused on regional need. State universities are influenced by the needs of an area of the state. State colleges are influenced by the needs identified within the local area in which they reside. By looking at programs and type of institutions, we can see if minorities and women are more likely to attend a specific type of university.

RESEARCH QUESTIONS

The goal of this research was to ascertain the breakdown by gender and ethnicity within public institutions offering baccalaureate or above degrees in Georgia, academic units within those institutions, and Information Technology and/or related programs of undergraduate students. Specifically gender and ethnicity was examined by college and degree programs that have a high level of technical content (i.e., Computer Science, Information Systems, and Information Technology).

Questions of interest were:

1. Is there a difference in gender mix between institutions, academic units within institutions, and IT-related programs within those institutions?

2. Is there a difference in the gender mix and/or ethnicity between the institutions by classification?

METHODOLOGY

The provost/academic vice presidents at each selected Georgia public institution were contacted by e-mail and letter and provided a survey instrument. A follow-up contact was made via e-mail/telephone approximately two weeks after the initial contact. The respondent was asked if he/she would be willing to share the breakdown by gender and ethnicity of students at his/her institution. Specifically this research was seeking a breakdown by schools or colleges within the university as well as a breakdown within certain majors.

To provide for consistency in data reporting, Spring 2002 was specified in the data collection instrument as the enrollment data benchmark period. Since all Uni-versity of Georgia System institutions are on the semester system such a designation was possible.

This study will serve as a pilot study. There are plans in place to follow-up this research to include institutions whose deans/directors participated in the Computer Research Association (CRA) Deans/Directors meetings and institutions affiliated with the newly formed Society for Information Technology Education (SITE). Future research will likely include discussions with focus groups composed of undergraduates who have chosen IT or an IT-related major at select Georgia institutions. Interaction with these groups may help provide information on how and why students select their field of study.

RESULTS

The state of Georgia has 20 public baccalaureate or higher degree granting institutions. Fifteen, or 75 percent, responded to this survey. One research institution, three state universities, and one state college failed to respond (see Appendix A). Two of the three state universities excluded from the results are historically black institutions. The inclusion of data from these two universities may have provided slightly different breakdowns of the student population by gender and ethnicity.

With 75 percent of the institutions reporting, data indicates that female students outnumber male students (58 percent versus 42 percent). As Table 1 illustrates, the disparity is greater at state universities and colleges than at research or regional universities.

While institutions of all types are comprised of more female than male undergraduates, this is not true of IT and IT-related degree programs. Only slightly more than 30 percent of the 873 undergraduates enrolled in IT degree programs statewide are female (see Table 2).

Overall females make up a slightly greater percent of the IS student population (36 percent versus 31 percent). When examining undergraduate IS majors at research institutions, female students are almost equal in number to male students (see Table 3).

The greatest gap in undergraduate population by gender in the programs compared in this study is the Computer Science degree program. When comparing Computer Science students by gender, less than 20 percent of these degree majors are female (see Table 4).

TABLE 1
BREAKDOWN BY GENDER FOR TOTAL UNDERGRADUATE POPULATION

	Research	Regional	Universities	Colleges	Total
Female	56%	55%	60%	66%	58%
Male	44%	45%	40%	34%	42%
Total Enrollment	27,957	17,768	41,200	3,626	90,551

TABLE 2
BREAKDOWN BY GENDER FOR INFORMATION TECHNOLOGY MAJORS

	Research	Regional	Universities	Colleges	Total
Female	0%	20%	30%	37%	31%
Male	0%	80%	70%	63%	69%
Total Enrollment	0	121	380	372	873

TABLE 3
BREAKDOWN BY GENDER FOR INFORMATION SYSTEMS MAJORS

	Research	Regional	Universities	Colleges	Total
Female	47%	31%	38%	0%	36%
Male	53%	69%	62%	0%	64%
Total Enrollment	406	297	1,231	0	1,934

TABLE 4
BREAKDOWN BY GENDER FOR COMPUTER SCIENCE MAJORS

	Research	Regional	Universities	Colleges	Total
Female	12%	19%	24%	0%	19%
Male	88%	81%	76%	0%	81%
Total Enrollment	1,719	218	2,104	0	4,041

When breaking down the undergraduate population by ethnicity, 73 percent is white, 19 percent is black, and 8 percent is of other race (see Table 5). These percentages do shift greatly when examining the different types of institutions in Georgia. Black students are a much smaller percent of the student body at research universities, "other" ethnic groups are a much higher percent. While the breakdown by ethnicity provides similar percentages at regional and state universities, 2 historically black state universities did not respond to the survey.

While statewide student population at Georgia institutions is 19 percent black, 32 percent of IT degree majors are black (see Table 6). When comparing the IT student population at the different types of institutions that have IT programs of study, the smallest percentage of black undergraduates is 25 percent at state colleges.

Breakdown by ethnicity in IS degree programs yields varying results. Overall, blacks and "other" races are over-represented when compared to the population of all undergraduates (see Table 7). However, at research institutions ethnic lines in the IS program closely follows those of the general population at these institutions.

When comparing the ethnic breakdown of students in the Computer Science degree program at institutions that offer this degree, there is once again a high concentration of blacks and "other" races (see Table 8). At research institutions, this degree program has a very high percentage of students from other ethnic backgrounds.

It is interesting to note that black women and women of "other" ethnicity are over-represented in IT, IS, and CS degree programs. While 21% of female undergraduates in Georgia are black, 33% of female CS majors, 37% of female IS majors, and 45% of female IT majors are black. Undergraduates of other ethnicity comprise 8% of the undergraduate population in the state of Georgia. Females of other ethnicity account for 15% of all undergraduate programs (see Table 9). In IT and IS degree programs, this select group of females makes up only 11% of the students, but in CS these women account for 20% of the CS majors.

The differences in the makeup of male undergraduates by ethnicity in the IT, IS, and CS degree programs and the general male undergraduate population are less pronounced (see Table 10). In IT and IS, the percent of male students who are black is higher than the overall male population while in CS the percentage is slightly lower. In IS and CS, the percent of males who are of "other" race is greater than what is seen in all undergraduates in Georgia.

TABLE 5
BREAKDOWN BY ETHNICITY FOR TOTAL UNDERGRADUATE POPULATION

	Research	Regional	Universities	Colleges	Total
Black	6%	26%	23%	36%	19%
White	83%	69%	69%	59%	73%
Other	11%	5%	7%	5%	8%
Total Enrollment	27,957	17,768	41,200	3,626	90,551

TABLE 6
BREAKDOWN BY ETHNICITY FOR INFORMATION TECHNOLOGY MAJORS

	Research	Regional	Universities	Colleges	Total
Black	0%	34%	37%	25%	32%
White	0%	61%	51%	67%	59%
Other	0%	5%	12%	8%	9%
Total Enrollment	0	121	380	372	873

TABLE 7
BREAKDOWN BY ETHNICITY FOR INFORMATION SYSTEMS MAJORS

	Research	Regional	Universities	Colleges	Total
Black	6%	41%	29%	0%	26%
White	76%	53%	60%	0%	62%
Other	17%	6%	11%	0%	12%
Total Enrollment	406	297	1,231	0	1,934

TABLE 8
BREAKDOWN BY ETHNICITY FOR COMPUTER SCIENCE MAJORS

	Research	Regional	Universities	Colleges	Total
Black	6%	37%	26%	0%	18%
White	68%	52%	60%	0%	63%
Other	27%	11%	14%	0%	19%
Total Enrollment	1,719	218	2,104	0	4,041

TABLE 9
BREAKDOWN BY ETHNICITY FOR WOMEN IN SELECTED DEGREE PROGRAMS

	IT Degree Programs	IS Degree Programs	CS Degree Programs	All Programs
Black	45%	37%	33%	21%
White	44%	51%	47%	71%
Other	11%	11%	20%	15%
Total Enrollment	274	693	758	52,790

TABLE 10
BREAKDOWN BY ETHNICITY FOR MEN IN SELECTED DEGREE PROGRAMS

	IT Degree Programs	IS Degree Programs	CS Degree Programs	All Programs
Black	25%	20%	15%	16%
White	66%	68%	67%	75%
Other	8%	12%	19%	8%
Total Enrollment	599	1,241	3,283	37,761

CONCLUSIONS

In Georgia there is evidence that the gender gap exists. While 58% of all undergraduates in the state are female, females account for a much smaller percent of those selecting IT, IS, or CS as their major. It appears that there is also a difference among students seeking these degrees when comparing ethnicity of these students versus the undergraduate population as a whole. IT, IS, and CS majors appear to be more diverse than the student population as a whole. This diversity appears to be greater at institutions that are not classified as research institutions.

While this research supports the belief that a difference exists in the gender and ethnicity of students in technical degree programs, it does not address why. This study is a pilot study. Future research will likely include discussions with focus groups composed of undergraduates who have chosen IT or an IT-related major at select Georgia institutions. Interaction with these groups may help provide information on how and why students select their field of study. However by itself this research may help guide graduate schools and companies that are seeking to increase diversity within their programs and corporations to recruit at institutions which offer a greater diversity in their student body.

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APPENDIX A
INSTITUTIONS RESPONDING TO SURVEY ON UNDERGRADUATE ENROLLMENT DATA

Research Institutions:
- University of Georgia
- Georgia Institute of Technology

Regional Institutions:
- Georgia Southern University
- Valdosta State University

State Universities:
- Armstrong Atlantic University
- Augusta State University
- Columbus State University
- Fort Valley University
- Georgia College and State University
- Georgia Southwestern University
- Kennesaw State University
- North Georgia University
- Southern Polytechnical University
- West Georgia University

State Colleges:
- Macon State College

INSTITUTIONS FAILING TO RESPOND TO SURVEY ON UNDERGRADUATE ENROLLMENT DATA

Research Institutions:
- Georgia State University

State Universities:
- Albany State University
- Clayton College and State University
- Savannah State University

State Colleges:
- Dalton State College

CIS EXAM ADMINISTRATION: OPEN VS. CLOSED NOTES

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ABSTRACT

This paper summarizes findings of teaching six sections of the same college course in the same style with one exception. Section 1, 3, 4 and 5 had notes available for reference during the final exam whereas Sections 2 and 6 did not. The author's hypothesis that students in the 4 sections using notes would perform significantly better than the other sections on the exam was disproved.

INTRODUCTION

Students often ask about use of reference aids during exams in most disciplines. These aids are most commonly notes they have taken, textbooks, handouts, or perhaps access to information stored on computers and/or the Internet. Although this practice may be common, the author was unable to locate any directly relevant research.

METHODOLOGY

Two hypotheses were formulated:

H0: Use of reference notes will significantly improve performance of students on an exam.

H1: Use of reference notes will not significantly improve performance of students on an exam.

To test these hypotheses the professor proceeded to teach six sections of the same course at the same university in the same way with the exception that Sections 1, 3, 4 and 5 were allowed to use reference notes during the final exam whereas Sections 2 and 6 were not.

The Subjects

Subjects were enrolled in six sections of a computer information systems (CIS) course within the business school at a mid-sized state university in the USA. The full professor who taught all sections holds a Ph.D. in business with an emphasis in information systems and also holds professional certifications.

Sections 1, 5 and 6 met 3 times a week for 70 minutes per session during the day. Section 3 met two times per week for 110 minutes per session in the afternoon. Sections 2 and 4 both met two times per week for 110 minutes in the evening.

All students in the six sections had the same reading assignments, the same two exams and the same five sets of homework, comprised of using spreadsheet, data base, internet, powerpoint and diagramming software. Students were expected to participate in class and the majority did.

Students enrolled in the day sections (1,3, 5 and 6) were slightly younger than those in Sections 2 and 4 and tended to be full time students. Section 2 and 4 students mostly worked full time during the day and were enrolled in one or two evening classes.

More females than males were enrolled in all six sections with the highest percentage of females being enrolled in the Section 4, an evening class. Section 5 students attended class most regularly (83%) and Section 2 students attended class least often (69%). The demographic profile of students is summarized in Table 1.

TABLE 1
DEMOGRAPHICS

DEMOGRAPHIC ITEM	SECTION 1	SECTION 2	SECTION 3	SECTION 4	SECTION 5	SECTION 6
NO. OF STUDENTS TAKING FINAL EXAM	33	28	35	28	44	34
TIME OF MEETING	Day	Evening	Day	Evening	Day	Day
FREQUENCY OF MEETINGS	3 days per week	2 evenings per week	2 days per week	2 evenings per week	3 days per week	3 days per week
STUDENT MAJOR	Business Administra-tion, wide range of options	Admini-stration, wide range of options	Business Administra-tion, wide range of options	Business Administra-tion, wide range of options	Business Administra-tion, wide range of options	Business Administration-wide range of options
PORTION OF TIME WORKING	Most part time	Most full time	Most part time	Most full time	Most part time	Most part time
RELATIVE AGE	Younger	Older	Younger	Older	Younger	Younger
GENDER DISTRIBUTION	68.8% female	62.1% female	55.6% female	71.4% female	56.8% female	61.8% female
ATTENDANCE: portion of class meetings attended	74.4%	69.3%	77.7%	75.0%	83%	76.6%

The Exams

All students took the same midterm and final exam. Both exams were comprised of 80 questions. All questions were multiple choice and had four items to choose from. Questions were based on a combination of lecture and reading assignments. The instructor made sure the material tested was covered in lectures and could be found in reading assignments as well. Students had at least 100 minutes to complete the final exam. They took approximately 12 minutes longer on average when using notes. Exams were machine scored.

No section was allowed the use of notes during the midterm. Four of the six sections were allowed use of one page (8 ½ by 11 inches) of handwritten notes for the final exam. Sections 2 and 6 were not allowed to use any notes.

FINDINGS AND ANALYSIS

Table 2 summarizes by section the averages of scores on exams and the number of students taking the exams. Interestingly, all six sections had higher average scores on the final exam than on the midterm. Although sections 2 and 6 did not use notes, they showed substantial improvement. Sections 1 and 3 showed the least amount of improvement even though they were both allowed to use notes. Thus the null hypothesis is supported.

Possible Explanations

- Since use of notes is optional, many students may choose not to use them and thus negate the potential impact.
- Allowing notes may instill a false sense of confidence such that students do not prepare thoroughly for the exam.
- Limiting reference notes to one page may be too similar to allowing no reference notes.
- The final exam may be inherently easier than the midterm.
- The instructor may have been more proficient in teaching sections 2 and 4 in the evening after having rehearsed in sections 1 and 3. (One must note, however, that sections 5 and 6, both day classes, showed the greatest improvement on the final.)
- This may have been an anomaly. Two sections as the control group may be insufficient.

TABLE 2
SUMMARY OF EXAM RESULTS FOR
CIS 3060 COMPUTER INFORMATION SYSTEMS IN MANAGEMENT

	Midterm # Students	**Midterm Average Score of 80 Questions**	**Final Exam # Students**	**Final Exam Average Score Of 80 Questions**	**Change in Score**
SECTION 1	33	50	33	**52.27**	**+2.27**
SECTION 2	32	55	28	60.25	+5.25
SECTION 3	35	58.43	35	**61.37**	**+2.94**
SECTION 4	29	57.62	28	**61.18**	**+3.56**
SECTION 5	43	53.6	44	**59.2**	**+5.6**
SECTION 6	36	50.9	34	55.7	+4.8
AVG ALL SEC.	34.67	54.26	33.83	58.33	**+4.88**

CONCLUSION

There was insignificant evidence to support the primary hypothesis that use of notes CIS exams enhances student performance.

In the virtual classroom of the future, research such as this will be more challenging to conduct because of the difficulty in controlling reference materials available to students during exams. Exams as we know them today may cease to exist!

POSSIBILITIES FOR FUTURE RESEARCH

Several possibilities exist for additional research on ways to improve student perfomance on exams:

- A larger population of students taking this course should be tested to verify results; this should include at least one more section of students taking the final exam without use of notes.
- Since use of notes was optional, the performance of students who choose to use notes should be compared with performance of those not using notes.
- Other variables worthy of study include student demographics (portion male/female, etc.), attendance, time of day the class meets, and internet-based vs. face-to-face sections.

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COURSE ASSESSMENT IN AN INTERDISCIPLINARY, INTEGRATIVE TEAM-TAUGHT E-COMMERCE COURSE IN THE COLLEGE OF BUSINESS

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ABSTRACT

This paper provides an assessment of an interdisciplinary, integrative, team-taught course in electronic commerce. The goal of the course was to first, integrate ecommerce within the functional area of marketing and information systems and then to integrate both these two functional areas of business. The result was an integrative team taught course that provided an innovative and holistic approach to strategic electronic commerce issues that exist in the current global market economy. The course design was a collaborative effort between a department of information systems and a department of marketing in the college of business at a Midwestern university. The assessment of the course covered: Student learning, students' attitudes toward the integrative curriculum and faculty perception of success in the team teaching environment.

INTRODUCTION

In higher education today, there has been a proliferation of interdisciplinary teaching (Edwards, 1996; Gaff & Ratcliff, 1997; Klein, 1996). Although there are numerous reasons for this proliferation, one in particular is a paradigm shift in teaching style that has occurred within the last two decades. Academics in all disciplines have been moving from a lecture style pedagogy that promotes passive learning to an active learner focused, problem centered environment that incorporates active learning and collaboration. The natural outcome of this paradigm shift is interdisciplinary or integrative teaching. With the Internet as a learning tool by their side, it has become easier than ever for academics to organize course materials regardless of disciplinary boundaries. As more and more academics engage in the integration of different disciplines, a broadened context of ways to construct knowledge is established. (Newell, 1998; DeZure, 2002). Furthermore, given the move toward globalization, both students and academics alike have began to crave connected learning and coherence in their curriculum (DeZure, 2002).

In business schools in particular, the rapidly changing business environment has led many business schools to make the integration of curriculum a top agenda item. Furthermore, accrediting organizations such as, AACSB and ACBSP outwardly encourage schools of business to embrace interdisciplinary curriculum (Barber, Borin, Cerf & Swartz, 2002). Currently, these interdisciplinary course offerings can be found in all areas of the business school curriculum. Barber, et al, in their paper, "The Role of Marketing in an Iterative Business Curriculum," cite three general models for integrating business curriculum. These models include 1) integration across disciplines 2) integration of functional areas in business 3) integration within a functional area.

Although all three areas cited by Barber, et al. (2002) have been embraced, where integration appears to be the most prevalent is in new emerging disciplines. Therefore, when ecommerce exploded onto the scene in the 1990's, many business schools quickly integrated ecommerce within the functional areas of either their marketing or information systems curriculum. It did not take long before faculty began to marry the ecommerce sides of marketing and information systems, whereby creating a new and exciting interdisciplinary and integrative approach to discovering and delivering ecommerce.

This paper examines one such course. The course design was a collaborative effort between the department of information systems and the department of marketing and it was team taught by marketing and an information systems professor. This paper provides an assessment of the course within the following areas: student learning, students' attitudes toward the integrative curriculum and faculty perception of success in the team teaching environment.

METHODS

At the beginning of the semester, students who were registered for the team taught electronic commerce course were asked to participate in a study to assess the effectiveness of the course they were about to undertake. Students that agreed to participate were instructed that they would be required to fill out a pre and post course evaluation questionnaire. Students were instructed that this was strictly voluntary and they were free to stop participating in this assessment anytime throughout the process. Students were told explicitly that failure to participate had absolutely no impact on their course grade. A total of thirty-nine students, 54% (21) male and 46% (18) female, initially agreed to participate. The study finished with a total of34 students, 56% (19) male and 44% (15) female.

The course evaluation questionnaire focused on the following three major areas of interest: students' anticipated comfort level with an integrative team teaching environment, students experience with technology and students expertise with electronic commerce. To assess faculty perception, no assessment tool was used. Instead, a qualitative approach was taken. Both faculty members agreed that at points in time throughout the semester they would journal their thoughts and feelings regarding the course and their perceptions regarding the effectiveness of the integrative team teaching experience.

This research utilized a repeated measures design, whereby differences between the pre-course and post-course evaluation questionnaires were examined. The findings that follow cover three major areas: Student learning, Students' attitudes toward team-teaching and faculty perception of success in the team teaching environment.

FINDINGS

Student Learning

The goal of this electronic commerce course was that students would not only significantly increase their knowledge of electronic commerce, but that they would also increase their knowledge base when it came to certain technological applications. On both the pre and posts course evaluation questionnaires, students were asked to rate their level of experience regarding certain computer software and technology. Students' experience regarding software technology stayed consistent, however, when it came to web based technology there was a significant increase in their knowledge base. All four questions regarding web based technology showed a statistically significant increase in learned experience from before to after the course. Table 1 reports the finding for experience regarding computer software and technology before and after the course.

Regarding their level of expertise in electronic commerce, students were asked to rate their level of expertise regarding electronic commerce for the same nine questions both on the pre and post course evaluation questionnaires. Students in the beginning of the course had little, if any expertise, after the course their knowledge and expertise increased significantly for all ten questions. These findings are listed in Table 2.

Based on the above findings, it is clear that the course did provide students with a significant knowledge base. Students have a greater understanding of web-based technology as well.

Students' Attitude Toward Team Teaching

To assess students' attitudes toward team teaching, students were asked to rate their comfort level working

TABLE 1
EXPERIENCE WITH COMPUTER SOFTWARE AND TECHNOLOGY
Scale 1 to 7 (1 = not comfortable to 7 = very comfortable)

Rate your level of expertise with the following computer software and/or technology.

	Before	After	t	p
Microsoft Word	6.16	7.03	-1.324	.195
Microsoft Excel	5.13	5.55	-1.491	.146
HTML	3.52	3.06	1.394	.174
Converting to HTML	2.94	2.84	.346	.731
Web Browsers	4.88	5.19	-.807	.426
Downloading Information from the Web	5.34	5.97	-2.552	.016*
Purchasing Items Off the Web	4.94	5.50	-2.119	.042*
Creating a Web Page	3.29	4.19	-2.373	.024*
Maintaining a Web Page	2.97	4.06	-2.884	.007**

*significant at the .05 level **significant at the .01 level

TABLE 2
STUDENTS EXPERTISE WITH ELECTRONIC COMMERCE
Scale 1 to 7 (1=not experienced, 7=very experienced)

	Before	After	t	p
1. Preparing a business proposal for a new e-commerce initiative	1.55	4.55	-9.242	.000**
2. Conducting a market/competitive analysis of an e-commerce industry	1.66	4.50	-8.691	.000**
3. Determining how e-commerce products/services can be produced, distributed, and serviced	2.26	4.68	-7.182	.000**
4. Developing a financial plan for an e-commerce business	1.56	3.75	-7.661	.000**
5. Conducting web-based advertising, promotion, and other marketing activities	1.91	4.59	-6.984	.000**
6. Developing interactive web sites that track purchases, process credit cards, etc.	1.56	3.63	-5.532	.000**
7. Analyzing and selecting payment systems, web hosts, web development software, and other e-commerce resources	1.52	4.29	-8.163	.000**
8. Understanding threats to e-commerce security and privacy	2.28	5.38	-7.458	.000**
9. Recognizing the relationship between EC and other information systems	1.84	4.44	-8.439	.000**
10. Analyzing the impact of EC on such social and legal issues as censorship, privacy, international cultures, and equity among social classes	2.25	5.09	-8.308	.000**

TABLE 3
STUDENTS COMFORT LEVEL WORKING WITH TWO FACULTY MEMBERS FOR THE SAME COURSE
Scale 1 to 7 (1=not comfortable, 7=very comfortable)

	Pre	Post	t	p
Obtaining course feedback	5.94	5.09	2.655	.012*
Receiving proper assessment	5.94	4.65	3.712	.001**
Being graded fairly	5.97	4.84	3.000	.005**
Receiving consistent information	5.69	4.41	3.772	.001**

*significant at the .05 level **significant at the .01 level

with two faculty members for the same course. They were also given the opportunity on the post test questionnaire to discuss their feelings toward the team teaching experience. A univariate repeated measures design was utilized to test for differences before and after the course. Statistically significant differences were found on all four questions pertaining to comfort level. Students comfort levels clearly decreased by the end of the course. Table 3 displays the four questions along with the means and significance levels.

Faculty Perception of Success in the Team Teaching Environment

Regarding faculty perceptions, both professors expressed initial concern regarding the particular challenges that they may face in the team teaching environment. Obstacles to team teaching cited by Campbell et al. (1997) were reiterated by both faculty members. These potential pitfalls included, teaching load, ego of faculty, professional sharing, coordination and communication. However, in spite of the potential pitfalls, each faculty member initially expressed great enthusiasm regarding their collaboration and believed the course would be successful. By the end of the semester, both faculty members still appeared positive. They both felt it was a positive learning experience for the students as well as each other.

CONCLUSIONS

This paper provides an assessment of an integrative team taught course in electronic commerce. The course was successful in providing an innovative and holistic approach to strategic electronic commerce issues that exists in the current global market economy. The course design was a successful collaborative effort. Student learning was significant in the areas of web based technology and electronic commerce. Students' attitudes toward team-teaching overall was moderately comfortable, it did however decline from the beginning of the semester.

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UNDERSTANDING AND MANAGING THE EXPECTATIONS OF FOUNDATION MIS STUDENTS

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ABSTRACT

Following the implementation of a strategy to overcome challenges associated with teaching a foundation MIS course to large cohorts of Business students, two surveys were conducted. The surveys were designed to enable faculty to understand the attitudes, expectations, and computer experience of students, as well as to gauge the success of the new strategy. Analysis of the responses explores the association between students' attitude to using computers, experience and self-rated expertise with a variety of applications, and actual performance in course assessments.

BACKGROUND

Teaching an introductory MIS course involves overcoming challenges such as increased emphasis on flexible delivery, technology-experienced students, competition for technology and faculty resources, the dynamic nature of course content, and students' expectations in teaching technology. Last year, in an effort to overcome these challenges, the University of Southern Queensland adopted a 4-pronged PATT strategy (Table 1).

TABLE 1
PATT STRATEGY

Publisher Partnerships	Collaboration with publishers can be leveraged to provide access to state-of-the-art information and up-to-date textbooks.
Flexible Assessment Styles	Employed by lecturer and teaching assistants (tutors) to target teaching at an appropriate level of students' skills and experience (moran 1996).
Team Teaching	Continuity of course development, supports collaborative teaching, and offers complementary skills
Internet Technology Utilisation	Used as an information dissemination tool, a discussion forum to encourage active participation and online assessment to increase accessibility and improve learner control (nunan 1996).

Source: Low, Genrich, Cater-Steel 2001

In terms of student attendance, student performance and faculty satisfaction, the PATT strategy returned positive results. However, it was found that understanding the characteristics, attitudes and expectations of the diverse, technology-smart entry-level cohort is a critical factor in developing and delivering MIS courses to first year Business students. Bates (1994) argues that peoples' attitudes towards IT and their access to it will be influenced by educational experiences and technologies utilised in work and leisure.

METHOD

The students involved in this study are all undergraduates enrolled in the Faculty of Business foundation MIS course. These students are working towards qualifications in a program of Accounting, Finance, Business, Information Technology (IT), or Economics. Within the program, students choose one major, or a combination of two major areas of study. The most popular majors offered by the Faculty of Business include Computer Software Development; IT Management; Marketing; Human Resources Management; e-Technologies; e-Commerce; Accounting; Law; and Economics and Resource Management.

A two stage approach was taken to determine students' attitudes towards the usefulness of computers while studying the foundation MIS course. Firstly, a web-based survey was conducted early in the semester to determine students' perceptions about using computers. This questionnaire also collected data about the breadth and depth of students' expertise with a range of computer applications, and how frequently they used the applications.

The second stage of this research involved another web-based survey administered towards the end of the course. The focus of the second survey was on the students' perceptions about the current foundation MIS course, and whether their expectations were met. In a course evaluation survey, students made positive qualitative comments about all aspects of the PATT strategy. However, further analysis of quantitative measures towards "attitude to using computers" revealed little correlation between survey indicators and attitudes.

ANALYSIS

In an effort to understand the students enrolled in the course, the following data were obtained: age, gender, whether the students had formal classes with computers at high school, type of school they attended, whether they owned a computer, when they first purchased a computer, the number of hours spent working on the computer, their self-rated skills in different applications of computers, and the frequency of use of the different applications, and their "attitude to using computers."

With a population size of 590 students enrolled in the Semester 1 offering of the foundation MIS course, 197 students responded to the initial survey and 137 responded to the second survey.

"Attitude to using computers" is a modified version of a scale developed by Roberts (1991) to measure the attitudes of pre-service teachers towards computers. Some of the items in the original scale were considered inappropriate for business students, and hence the scale was reduced to eight items, with a resultant coefficient alpha of 0.86.

The "attitude to using computers" measured on a five point scale (1 = strongly disagree, 5 = strongly agree) at the beginning of semester was 3.9183 (s.d. 0.7871) and at the end of semester was slightly less 3.7482 (s.d. 0.6687). Possible explanations for this slight decline may be the timing of the surveys. The first survey was conducted before classes commenced and students may have been full of high expectations and may have been over-confident about their own ability and knowledge. The second survey was conducted just after Assignment 3, and their performance on this assignment may have had a negative influence. The students' initial view of computing may have been 'blinkered' by their experiences at high school, compared with the broader view they were exposed to within the course.

Correlations between the items and the "attitude to using computers" were examined and found to be moderate for the hours of using a computer ($r = .403$, $p = 0.000$). The following section summarises the data collected in both surveys.

TABLE 2
USAGE HOURS

Hours/week spent on Computer	Survey 1	Survey 2
0-2 hours	8.9%	3.7%
3-6 hours	23.2%	17.6%
7-10 hours	16.3%	16.2%
More than 10 hours	51.6%	61.8%

There has been a shift upwards in the amount of time the students spend on the computer during the semester as shown in Table 2. This could be attributed the demands placed on the students in their enrolled courses.

As shown in Table 3, the students rated their expertise with email (4.28) and word processing (4.05) very high ahead of all surveyed applications. The correlations with "attitude to using computers" are significant, but too small to be meaningful. Even though the students use e-mail, and word processors frequently, and they rate themselves highly with these applications, they are not good indicators of a positive attitude to using computers. Further studies need to be undertaken to identify factors that would be better indicators of positive attitude to using computers.

As expected, the packages that the students consider themselves to be best with are the packages they use the most. Once again, the correlations with "attitude to using computers" are significant, but low. None of the items tested correlated highly with "attitude to using computers." An interesting point is that the students use the word processor, e-mail and Web browsers the most; perhaps they view the computer as a "tool for communication."

FINDINGS

In analysing "attitude to using computers," it was discovered that age, gender, computer education at high school, ownership of a computer, length of usage of computers, and perceived expectations all have little bearing on the respondents' attitude to using computers. These findings could be attributed to the fact that those students who perceive themselves to have high skills and who frequently use computer applications do not necessarily have the most positive attitudes to using computers. Contrary to expectations, high school computer education, and ownership of a computer at home were not significantly associated with positive attitudes about computers. These findings challenge the 'nerd' stereotype that positive attitudes are associated with young, male, students. The results obtained are consistent with the findings of an earlier study which focused on students in an Education Faculty. Table 4 explains the possible reasons for the lack of correlation.

TABLE 3
SELF-RATED EXPERTISE AND FREQUENCY OF USE CORRELATED WITH "ATTITUDE TO USING COMPUTERS"

	Self-rated expertise			Frequency of Use		
	Mean	**Std. Dev.**	**R (sig. 1-tail)**	**Mean**	**Std. Dev.**	**R (sig. 1-tail)**
E-mail	4.28	.898	.363 (.000)	2.30	1.128	.272 (.000)
Word Processor	4.05	.776	.282 (.000)	2.59	1.112	.252 (.000)
Web Browser	3.90	1.177	.445 (.000)	2.20	1.153	.324 (.000)
Spreadsheet	3.63	.879	.306 (.000)	1.99	1.140	.302 (.000)
Presentation Software	3.33	1.050	.318 (.000)	1.08	.807	.246 (.000)
Mail Merge	3.30	1.383	.371 (.000)	1.17	.969	.248 (.000)
Database	2.98	1.003	.253 (.000)	1.49	1.133	.275 (.000)
Newsgroups	2.93	1.605	.372 (.000)	1.03	.988	.211 (.001)
Desktop Publishing	2.67	1.333	.262 (.000)	.83	.798	.244 (.000)
Chat	2.65	1.742	.300 (.000)	.89	1.135	.131 (.033)
Accounting	2.55	1.549	.211 (.001)	1.32	1.479	.183 (.005)
Drawing	2.05	1.384	.212 (.001)	.55	.780	.198 (.003)
File Transfer Protocol	1.78	1.608	.239 (.000)	.41	.687	.210 (.002)
Gopher	1.10	1.300	.187 (.004)	.27	.546	.169 (.009)

TABLE 4
LACK OF CORRELATION BETWEEN INDICATORS AND "ATTITUDE TO USING COMPUTERS"

Indicator	Reason
Formal Classes at High School	It was discovered that almost all respondents have had some formal classes with computers.
Ownership of a Computer	The majority of respondents own a computer.
Length of Computer Ownership	Most the respondents have had computers in their homes for many years—belonging to parents or older siblings.
Length of Usage	Most respondents spend time on computers, regardless of their attitude towards them, either for study or work. Therefore, time spend on the computer was found to not be optional. It is the accepted norm that Foundation MIS students have to use applications such as word processors, and e-mail for study and work, and do so frequently, so skill in using these and how frequently they are use explains little about their attitude to using computers.

Further analysis compared the students' perceived expertise with actual performance in course assessments. There is a tendency for students with perceived high skill levels to become overconfident and consequently perform poorly possibly because they think they have an adequate grasp of the foundation MIS content. Initial analysis of the survey confirmed this tendency: students with high perceptions of skills did not gain high assessment results.

FURTHER RESEARCH

The survey is being improved and further smaller surveys conducted at periodic intervals throughout the semester. This is aimed to allow the measure of student's attitude more frequently to determine the pattern of fluctuations in attitude. Focus groups will be conducted to determine the underlying causes of attitude variation.

As well as providing the course team with an insight into curriculum design for future offerings of this introductory MIS course, this study has also assisted in further examining the efficacy of implementing the PATT strategy and its impact on student attitudes towards computing. Many students have strong prejudices, positive or negative, which impact on their performance. This study could assist both pre-tertiary and tertiary educators in aligning their curriculum, to facilitate the smooth transition from pre- to tertiary-level MIS studies.

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A MODEL OF CASE TOOL ADOPTION AND USE FOR INFORMATION TECHNOLOGY CURRICULA

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ABSTRACT

This research explores the role of CASE tools in information technology (IT) education. What principles of systems development do CASE tools promote? Tools may allow students to more efficiently design and develop effective information systems (IS) but does automating design result in more effective learning? Or have IT faculty enabled students to learn bad habits more efficiently? The research identifies factors that influence the adoption and use CASE tools in academic settings. In a recent inquiry, IT academics shared CASE tool experiences and presented evaluations. Analyses of their responses lead to preliminary interviews with employers about the pervasiveness of CASE tools and the rationale behind their use. Insights from the comments and theory from research in IS development and diffusion of innovation theory are presented to offer a theoretical model of IT academic CASE tool adoption and use. The research will help develop future research venues dealing with the choice of tools and the complexity of these decisions. Do the selection criteria used by faculty match those of practitioners? What obstacles affect the decisions to adopt CASE in general or certain tools specifically, in terms of both time and cost, both initially and over its lifetime? Results can provide insight into the ability of the IT discipline to advance theory and practice in systems analysis and design.

INTRODUCTION

Computer-Aided Systems Engineering (CASE) tools are software used by systems developers to support the diagramming, analysis, and debugging of data and process models used for application development. These tools, in use since the 1970s, were often only in large firms that could afford to deploy them due to their expense, training requirements, and learning curve for IT staff. More recently less-expensive packages have increased the pervasiveness of their use. Academia has mirrored practice by offering instruction in CASE tools for systems analysis and design. However the artificial classroom setting imposes limitations on how well students can acquire expertise not only in using particular tools but also more importantly in understanding modeling concepts. Academic experiences take into account many different aspects of systems development by offering a variety of courses. Each program designs offerings based on their emphasis and philosophy; some programs have more technical approaches, while others accent business analysis. The delivery reflects these themes and is operationalized in resource choices. The lack of IT standardization results in many tool choices in practice and many options for academics to teach modeling.

Questions arise about differences between academic and business settings. Academics' concern is their ability to teach the appropriate methodologies and techniques. In industry the ability to improve efficiency and increase quality over the total development and maintenance of applications takes precedence. These differences and others influence the decision of what tools to use and inevitably impact the teaching of modeling. Classroom adoption of CASE tools is influenced by factors similar to adoption of innovation factors but can differ in how they are operationalized due to different objectives for using CASE tools by academia and practice. In summary, context matters with regard to CASE tool adoption.

The paper examines the systems development principles that IT academics espouse in using CASE tools and how academics choose diagramming tools to teach process and data modeling. Discussion does not include other CASE features such as debugging and code generation. This paper discusses, the value of using CASE tools across the IT curriculum and not merely in an isolated course, the criteria applied in curriculum decisions using innovation adoption theory as a base, and preliminary results from a survey of IT academics that can shed light on the criteria that faculty use for making tool choices. A model for CASE tool adoption and use in informatics education is proposed along with a plan for further research.

WHAT INFLUENCES THE ADOPTION OF CASE TOOLS?

How does the use of CASE tools help students understand how to model information requirements and business processes? IT faculty teach students how to identify, scope, and solve information problems in organizations. One of the most difficult skills to develop in systems analysis is to organize user-articulated information needs. IT faculty also teach methodologies, techniques and tools. For instance, modeling helps students learn to analyze and identify problems in an existing system, define and set its boundaries, and decompose the system's components in order to minimize its complexity. Examples include data flow diagrams (DFDs) and entity relationship diagrams (ERDs). Other underlying principles taught in IT programs are methods and standards, teamwork, project management, user involvement, and documentation among others. CASE tools offer a repository of documentation that is accessible by a project team of users and developers. They help enforce standardization of name conventions and allow balancing checks.

The argument for using CASE tools is based on systems development concepts. Students follow methodological approaches from systems theory, as well as techniques, which hopefully leads to improved learning, and relevant experience modelling practice. Theories should guide teaching practices, including methodological approaches and techniques, which in turn influence adoption and use of tools. An underlying theme for using CASE tools is to walk the talk. Systems specialists who cannot apply technology to their own craft need to reconsider arguments for espousing it to users. Therefore, practice grounded in theory should guide and influence adoption and use of tools.

CASE tool adoption and use in industry has received attention from IS researchers examining motivations for adoption and use both quantitatively to identify predicting factors and qualitatively to develop insight into social and political forces (Fichman, 2000; Fichman and Kremerer, 1999; Iivari, 1996; Aaen, et al, 1992, Orlikowski 1993, Rojas *et al,* 2001). Notable are research findings showing that CASE acquisition does not insure adoption or use (Fichman, 2000). To measure the effectiveness of the tool, it is important to measure its adoption and use as well as its acquisition. CASE is an example of second order innovation, or type-two technology affecting organization routine with potential barriers to adoption and use.

IT faculty in their role as CASE tool adopters reflect different priorities than practitioners. Academics focus on tools' ability to support teaching appropriate methodologies and techniques. Classroom adoption of CASE tools is influenced by factors similar to practice but due to different objectives. The context influences CASE tool adoption. The objectives of the adoption that define successful adoption and use must be defined distinctly. Practitioners focus on tools' ability to improve efficiency and increase the quality of software development and maintenance. Aaen (1996) examined industry CASE acquisitions and use by measuring perceived productivity and quality effects. To measure successful adoption and use of tools for teaching and learning, Aaen's measures need to be changed to fit the academic objectives of perceived understanding, comprehension or retention. The efficacy of CASE tools may be qualitatively different for pedagogical purposes. Context appears to matter in consideration of factors influencing CASE adoption and use; therefore, measures of effectiveness should be reconsidered, as should the operationalization of predicting factors.

An important consideration for CASE curricula decisions is minimizing the complexity for students and faculty. In practice allows long-term learning. Despite periods of high turnover, most firms expect to retain IT staff longer than a few months. In fact, they often make investments in their training anticipating years of productivity. In academia the artificial time constraint of a school term impedes long-term learning. If faculty could integrate one or a minimal number of tools over several courses, students become more familiar and gain more experience. This could lower the learning curve. As a result, students could graduate with increased skill level and an understanding of the power that vendors purport CASE offers.

Faculty of highly cohesive IT programs are more likely to make tool choices collaboratively with the intent of fewer tools. Despite other reasons, the rationale for an integrated tool across courses is often financial. Different tools for different courses and models confuse students and prevent them from acquiring depth of understanding. Lab support necessitates centralized approval, thereby forcing faculty to discuss merits and concerns in making choices.

The rationale for an integrated tool across courses is often financial. Cost considerations affect faculty, student, and administrative funds and time presenting obstacles for choosing some tools. Some tools have 1-2 hour tutorials that can provide enough expertise because the tool is not robust. Other choices such as Oracle necessitate multiple weeklong classes to reinforce understanding to exploit the tool's power. The quality of faculty training impacts the quality of student training. Most packages come shrink-wrapped with a textbook. The practice of purchasing used texts confounds the purchase of bundled software in a course. Students without computers of their own and those trying to save on book expenses may find some products prohibitive making lab facilities a necessity. Maintenance requires IT services support and/or release time for a faculty coordinator. This entails not only technical support, server allocation and security, but also administration of files by someone who understands the nature of class assignments, their objectives, and the interrelationships of courses. Technical support staff cannot be expected to have that type of breadth. It necessitates faculty time and involvement.

RESPONSE RESULTS

In response to a request on ISWorld, 39 IT academics shared diagramming products used and comments about the efficacy of these products. Table 1 contains the list and Web sites, if available, of those mentioned. The list only includes those products where a sample of IT academics has indicated their use. The last entry links to a more exhaustive set of products. Forty per cent were using Visio. Although comments were sparse about why Visio was chosen, what was more interesting was comments about why other products were not chosen. Many of the concerns reflected issues discussed above about how to integrate CASE tools in the curriculum. Table 1 contains a brief description of the issues that surfaced.

TABLE 1
IT ACADEMIC CASE TOOL CHOICE ISSUES

Issue	Description
Faculty training support	Time and funding for seminar/ class attendance Recognition or course reduction for self-taught training
Financial Costs	License cost Lab/network configuration costs Cost to students Maintenance support
Multi-use tool	Most tools excelled at one function Integrated use desired e.g. one tool for multiple course covering multiple modeling techniques
Ease of Learning	Students ability to use the tool and focus on methods rather than on the tool itself
Maintenance	Technical lab/network support Faculty methodology repositories
Textbook Publishers' collaboration	Ability to package tool with textbooks

DISCUSSION

The investigation provoked a number of issues. Recent emphasis on assessment of IT programs (Noll and Wilkins, 2002) has forced faculty to look in the mirror and to evaluate their program's performance. Feedback from students, employers, and alumni often focus on software training. The choice of tools can directly impact how students grasp basic systems development principles and concepts. The implementation of that choice through adoption and use varies widely. What are the factors that explain the variance and then impact the effectiveness of its use for students? The Aaen, *et al* (1996) model and research in innovation adoption and IT adoption (Davis et al., 1989; Moore and Benbasat, 1991; Fichman, 2000) proves relevant. Taking into account the contextual differences that may affect CASE adoption in IS curriculum, the model is customized to examine the importance of overall objectives that influence academic adoption criteria and behavior. Factors include those from IS implementation, diffusion of innovation, and IS adoption research.

Factors from IS Implementation Research: Participation, Management Support, Training, and Expectation Realism

Participation looks at the degree to which users participate in its acquisition class (Hartwick and Barki 1994). Faculty not participating in the selection process may circumvent or undermine mandatory use in a curriculum or in a specific course reflecting beliefs that the tool is inappropriate or too complex. The investigation found departments where adoption preceded faculty hiring. Classroom use in some of those cases was erratic and highly inconsistent. The construct's conceptualization is consistent with Iivari (1996), investigating the number of faculty involved in an adoption decision.

Top management support for financial and technical resources may predetermine adoption decisions. Iivari included the management of the technical support department. Failure to update a tool's versions, hardware, and operating system could easily impede ongoing use or adoption by potentially new adopters. The financial cost associated with tools was repeatedly raised from the respondents and was even as an inhibitor to choose desired alternatives. Larger commercial CASE tools require a commitment not just to increased licensing fees, but also to dedicated servers, adequate client PCs with operating systems and memory suitable to their demands.

Faculty training is an important factor. Faculty trained on the software tool or who have access to quality materials are more likely to increase adoption and use. Training helps faculty understand the full potential of the tool and how best to exploit its capabilities. Investment in training also has practical implications; the time it would take to learn another tool would present potentially significant switching cost for faculty and departments. Iivari included in-house training, vendor courses, and self-study material. The factor was measured in terms of adequacy and quality. For the academic community, additional material may pertain to and support their process of instructing students, as well as understanding the tools themselves. Course material supplied through instructor's manuals for the software, Web sites hosted by vendors, user groups through universities or professional organizations, and integration with the textbook represents a variety of training.

Expectation realism measures the difference between the expected perceived benefit of adopting and using a CASE tool and the resulting perceived performance. Unrealistic expectations can cause success to be elusive (Ginzberg, 1981). Faculty expectations about how easily students can learn and use a tool, how well it communicates the concepts, and how effective the overall experience is may diminish quickly if the tool is overly complex or difficult to use. All the more reason to involve faculty in the choice decision. Iivari used five items for this factor which primarily measured performance outputs such as impact on speed of development, functional quality of new applications, productivity, cost and quality of development, and the cost of maintenance. The measures for a curriculum setting require slight modification to focus on pedagogical performance. For instance, speed of development time will be influenced as much if not more by the amount of experience students have had with modeling techniques as by the CASE tool.

Factors from Diffusion of Innovation Research: Complexity, Compatibility, and Relative Advantage

The Iivari (1996) model drew from the technology acceptance model (TAM) with measures of complexity representing perceived ease of use (Davis, *et al*, 1989). He altered the focus from the user interface quality to whether "underlying concepts, limitations and assumptions of the tool are easy to understand." While this conceptual turn proves insightful and useful, additional dimensions of complexity need examination that goes beyond perceptions and deals with some specific problems that CASE presents to students. CASE tools present a paradigm shift for developers by moving beyond a set of stand-alone functions to exploiting a set of integrated tools capturing interrelationship among design components. For example, some tools allow developers to place restrictions on the data field of an ERD that a DFD process can modify. These dependencies, implemented as design rules, constrain designers by enforcing methodology that prevents mistakes and functional and technical problems. As students modify their designs, students are not always aware of the interrelationship do to the way they are technically implemented. This can confound iterative development as students become frustrated and halt the design process prematurely. The integrative nature of CASE can pose problems for students working in teams.

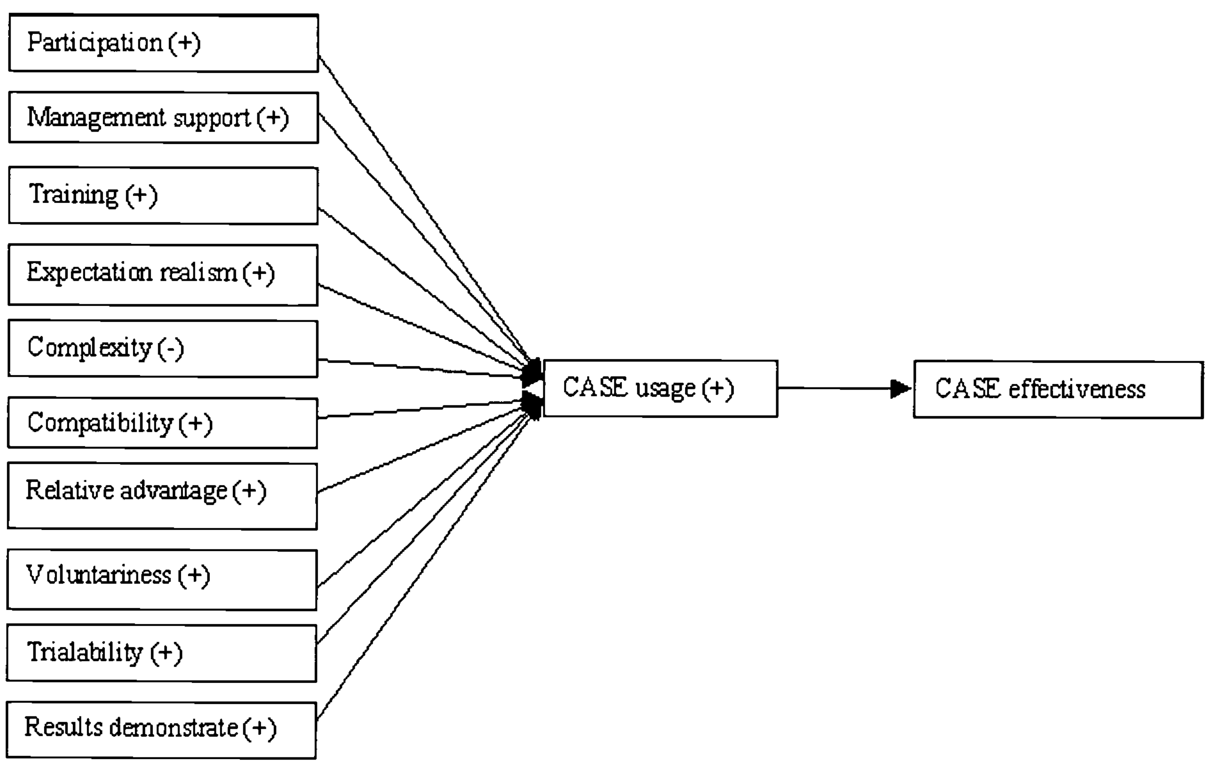
Compatibility is the degree to which a new technology is perceived to be consistent with values, needs and experiences of adopters (Moore and Benbasat,). CASE needs to be compatible on two levels: technical infrastructure and course content. Updating or purchasing computers, operation system software or servers that increases the cost and complexity beyond the organization's ability could negatively influence the adoption decision. Therefore faculty would favor tools relatively compatible with the existing environment. A tool's embedded techniques and methodologies may restrict alternate methods. For example, Oracle Designer employs traditional structured design but not object oriented methods.

Relative advantage measures the degree to which faculty perceive an innovation as better than its precursor. The set of responses indicated many departments were changing or had done so recently. The degree to which they believe that a new tool is better relative to the old should predict the likelihood of use, for example, the function to balance DFD levels.

Factors from IS Adoption Research: Voluntariness, Trialability, Demonstration of Results, and Ease of Distribution

Since the use of some tools is mandated in organizations, voluntariness asks if the use is required or voluntary. However, mandatory use of a tool in a department may not always be correlated with high degrees of use, since the faculty member may limit the degree to which they use the tool. Trialability is the degree to which users can experiment with an innovation before its adoption. Most faculty become aware of new teaching material through publisher samples or vendor trial versions. Results demonstrat-ability combines observability and communicability to yield the tangibility of the results. Faculty rely on observing students and on their feedback about their lab and home experience. Favorable results will therefore, be made apparent to the instructor in these two ways. Ease of distribution facilitates students' repeated access, unlike one time as in many adoption studies. For instance, textbooks offer software at little additional cost.

FIGURE 1
MODEL OF FACTORS AFFECTING ACADEMIC CHOICE OF CASE TOOLS



CONCLUSION AND IMPLICATIONS FOR FUTURE RESEARCH

The research presented in these proceedings is a work-in-progress. A refined model is anticipated by the time of the conference. A more exhaustive literature search will probably encourage restructuring the model indicating causal and precursor relationships. For the short term, measures of the constructs will be determined to validate the model and pilot those. Model testing will proceed using a sample of faculty solicited from ISWorld who have recently been involved in a CASE acquisition or review of existing tools.

The refinement of constructs and relationships as a result of the data and its analysis will give us a closer look at issues. A major premise is the difference between academic and practitioner settings. Future research could expand on Iivari's model for industry data collection and compare that analysis to the findings to confirm the differences and similarities. Although the time frame is one of the major limitations for academics, the nature of learning may be more similar than expected. If academics indeed are mirroring practice in their choices and the research indicates that the differences question mirroring the choices, researchers need to explore what type of criteria are important for educators to consider so students assimilate successfully in the practitioner world. A more pointed question is does it matter? Many students might be employees at firms that have no CASE tools. Others may use CASE tools upon graduation but they may not be ones as robust as they used in an academic program. Does that experience hone their modeling and problem solving skills offering an indirect benefit to industry? Or are the classroom exercises a waste of resources?

A neglected stakeholder is the student. Although they do are not directly responsible for the acquisition decision, their indirect input is vital and may need more weight than some faculty allow. One avenue to explore student input will be a pilot in an undergraduate systems analysis class. Students will respond to skill assessment and attitude measures before instruction in a CASE tool. After three months of adoption and use, the attitude measures will be repeated along with open-ended responses concerning the learning experience. Seven months after initial instruction the students will repeat the attitude measures and respond to perceived performance success measures. This pilot will help test the constructs. IT educators need to review the objectives for using CASE tools and question their efficacy. In addition to role of CASE in enhancing student's placement and having long-term benefit to their career, does a more robust tool achieve one goal to help students understand the complexity of systems and their interrelationships?

Feedback for vendors to improve CASE tools that meet the needs of both industry and education is another outcome of this stream of research. IT academics and practitioners depend on vendors for the tools but they depend on educators to train future users in practice and depend on researchers to question issues and advance knowledge. The latter can offer improvements that the vendors bring to market. CASE tool vendors have a stake in the research outcomes. Besides helping them to determine target markets, research about how students learn modeling can help the design of their products and how to deploy training. Other aspects of the model as proposed and how it evolves can lead to improved CASE tools that benefit all stakeholders.

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APPENDIX A
CASE TOOLS USED BY IT PROGRAMS

Product	Web site
ABCFlowcharter	
ADONIS	www.boc-eu.com
ASCENT	
AXIOM	www.stgcase.com/casetools/axiomsys.html
ConceptBase	www-i5.informatik.rwth-aachen.de/CBdoc/
CoolGen	www3.ca.com/Solutions/Product.asp?ID=256
Decamerone	
DBMain	
Edge Diagrammer	www,pacestar.com
Embarcadero ER-Studio	www.embarcadero.org/products/erstudio/index.asp
Embarcadero Describer	www.embarcadero.org/products/describe/index.asp
ERD	
ERWin	www3.ca.com/Solutions/Product.asp?ID=260
InterProcs	www.euridis.fbk.eur.nl/?view=Interprocs
MetaCase/MetaEdit+	www.metacase.com/
Omnigraffle	www.omnigroup.com/applications/omnigraffle/
Oracle Designer	www.oracle.com/ip/develop/ids/index.html?designer.html
Rational Rose	www.rational.com/products/rose/index.jsp
Relationship Diagrammer	Relationship Diagrammer
Select SSADM	www.aonix.com/content/products/select/select_ssadm.htm
SmartDraw	www.smartdraw.com/specials/diagram.asp?id=2541
Systems Architect	www.systemsarchitect.com
Together Control Center	www.togethersoft.com/
Visible Analyst	www.visible.com/Products/Analyst/overview.html
Visio	www.msdnaa.com
MetaEdit+	www.metacase.com/
Graphical tools link pages	www.methods-tools.com/tools/modeling.html

IS 2002—FINAL REPORT OF THE UNDERGRADUATE INFORMATION SYSTEMS MODEL CURRICULUM[1]

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ABSTRACT

The Information Systems discipline has a long history of applying model curricula to guide the particular course offerings of academic institutions. This paper provides a synopsis of the final report of IS 2002—The Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems. The last major update, IS'97, was completed several years ago. The need for the update is warranted due to the advent of the Internet, the changes in student computing literacy, and the recent Information Systems accreditation movement. The curriculum updates follow the recommendations of three collaborating organizations: AIS, ACM and AITP. After presenting an introduction and discussion of the need for a curriculum update, the paper describes the key principles and guiding assumptions about the Information Systems field. Next, the exit characteristics of IS graduates are presented. This motivates a discussion and presentation of the scope of the current curriculum update. The paper concludes by presenting the course architecture, sequence and high-level catalog descriptions.

INTRODUCTION

The Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems (IS 2002) is the latest report on model curriculum work in Information Systems. The previous report was presented in 1997 (IS'97). The first information systems (IS) curriculum effort took place in 1972 (ACM'72, Ashenhurst, 1972) and then again in 1982 (ACM'82, Nunamaker et al., 1982) by the Association for Computing Machinery (ACM). Other organizations, including AIS (Association for Information Systems), AITP (Association of Information Technology Professionals), and IFIP (International Federation for Information) have published IS model curricula. IS'97 was the first major collaboration of the three key organizations with a worldwide membership in information systems: ACM, AIS and AITP. IS 2002 is the second collaborative effort between ACM, AIS and AITP. IS 2002 is also part of the Computing Curricula 2001 project (CC2001), which is a joint undertaking of the Computer Society of the Institute for Electrical and Electronic Engineers (IEEE-CS) and the Association for Computing Machinery (ACM) to develop curriculum guidelines for undergraduate programs in computing.

In addition to the cooperating organizations ACM, AIS and AITP, IS 2002 had by the end of October 2002 been endorsed by the Decision Sciences Institute (DSI), the International Association for Computer Information Systems (IACIS), the International Academy for Information Management (IAIM), and the Society for Information Management (SIM). Endorsements by AITP Special Interest Group for Education (EDSIG), ACM Special Interest Group on Management Information Systems (SIGMIS), and INFORMS Information Systems Society (INFORMS-IS) were at that time pending.

Although ACM, AIS and AITP are worldwide organizations, IS 2002 does not represent a universal global IS curriculum. It does not seek to harmonize the curriculum to meet the requirements of different educational systems around the world. The model curriculum for undergraduate degree programs in information systems is based on the typical degree structure in USA and Canadian universities. The IS model curriculum can serve as a useful reference by curriculum designers and developers outside North America in designing and developing information systems degree programs as its predecessors have done over the past decades.

The most recent undergraduate curriculum model, IS'97 (Davis et al., 1997) was circulated in draft form in 1994 (Gorgone et al., 1994; IS'95, see Longenecker et al., 1994) and 1995 (Couger et al., 1995) and finalized in 1996. Members of the Joint Task Force presented drafts of IS'97 at numerous conferences from 1994 to 1996 and received significant feedback that substantially strengthened the report. It has been approximately seven years since the current model curriculum has been updated since much of the work was actually completed between 1994 and 1995. Since 1997, the task force members have collected survey data to better understand the changes that have occurred in the Information Systems discipline. This paper provides a progress report on the updating of IS'97.

The next section is a brief discussion of the need to update IS'97. This is followed by key principles and guiding assumptions about the IS profession that helped to shape the curriculum design and evolution. The exit characteristics of IS graduates are presented next. The scope of the curriculum update is then discussed so that programs transitioning from IS'97 to IS 2002 will better track the model's evolution. This is followed by a brief presentation of course architecture and intended course sequence. Finally, the paper concludes by providing course prerequisites and high-level course catalog descriptions of the IS 2002 model curriculum.

NEED FOR CURRICULUM UPDATE

Since the last revision of the undergraduate curriculum guidelines, three major factors have spurred the need to reexamine and update the existing standard. In particular, the advent of the Internet, the changes in student computing literacy, and the information accreditation movement all motivate the need to update the curriculum. In this section, we briefly review each of these motivating factors.

During the development of IS'97, the true importance of Web and Internet systems development and related concepts such as Web-based distributed architectures, Internet protocols, and IP-based internetworking was not yet foreseen. Although it was known that the impact of these then novel concepts could be enormous, their real effect was at the time unrealized and not fully understood. In the intervening years, the Internet has grown to become a major aspect of all IS environments.

Over the past decade, there has been a significant change in basic computer literacy of incoming university students. In the past, very few students entered a university having significant skills in using a desktop computer, with even fewer students owning or having easy access to a computer. Today, with the advent of the Internet revolution and low cost PCs, most students entering a university today have at least a modest level of computer literacy.

There has been interest in the accreditation of programs in Information Systems since the accreditation of programs in computer science was begun in mid-1980s. The work on IS'97 with its support from the major IS professional societies provided the much needed catalyst for IS accreditation to move forward. With the support of the National Science Foundation, the Criteria for the Accreditation of Programs in Information Systems have been developed with IS'97 serving as the basis of the IS curriculum criteria. ABET is the agency with responsibility for accrediting all programs in computing, engineering and technology (Gorgone & Lidtke, 2002). The Computing Accreditation Commission (CAC) has responsibility for accrediting Computer Science and Information Systems programs. The first IS accreditation visit of an IS program was completed during Fall 2001.

KEY GUIDING PRINCIPLES

The key principles that guided the IS 2002 development effort were as follows.

1. The model curriculum should represent a consensus from IS community.

2. The model curriculum should be designed to help IS faculty produce competent and confident entry level graduates well suited for workplace responsibilities.

3. The model curriculum should not be prescriptive; by using the model curriculum guidelines, faculty can design their own courses.

4. The model curriculum should be based on sound educational methodologies and make appropriate recommendations for consideration by IS faculty.

5. The model curriculum should be flexible and adaptable to most IS programs.

GUIDING ASSUMPTIONS ABOUT THE IS PROFESSION

In conceptualizing the role of information systems in the future and the requirements for IS curricula, it seems apparent that several elements have been (ACM'72, ACM'82, IS'95, IS'97, and ISCC'99) and remain important and characteristic of the discipline. These characteristics evolve around four major areas that permeate all aspects of the IS profession and therefore must be carefully integrated into any IS curriculum:

1. IS professionals must have a broad business and real world perspective. Students must therefore understand that:

   - IS enable the success of organizations;

   - IS span and integrate all organizational levels and business functions; and

   - IS are increasingly of strategic significance because of the scope of organizational systems involved and the role systems play in enabling organizational strategy.

2. IS professionals must have strong analytical and critical thinking skills. Students must therefore:

   - Be problem solvers and critical thinkers;

   - Use systems concepts for understanding and framing problems;

   - Be capable in applying both traditional and newly learned concepts and skills; and

   - Understand that a system consists of people, procedures, hardware, software and data.

3. IS professionals must have strong ethical principles and interpersonal communication and team skills. Students must understand that:

   - IS requires the application of professional codes of conduct;

   - IS requires collaboration as well as successful individual effort;

   - IS design and management demands excellent communication (oral, written, and listening); and

   - IS requires persistence, curiosity, creativity, risk taking and a tolerance of these abilities in others.

4. IS professionals must design and implement information technology solutions that enhance organizational performance. Students must therefore:

   - Possess skills in understanding and modeling organizational processes and data, defining and implementing technical solutions, managing projects, and integrating systems;

- Be fluent in techniques for acquiring, converting, transmitting, and storing information; and
- Focus on the application of information technology in helping people and organizations achieve their goals.

EXIT CHARACTERISTICS OF IS GRADUATES

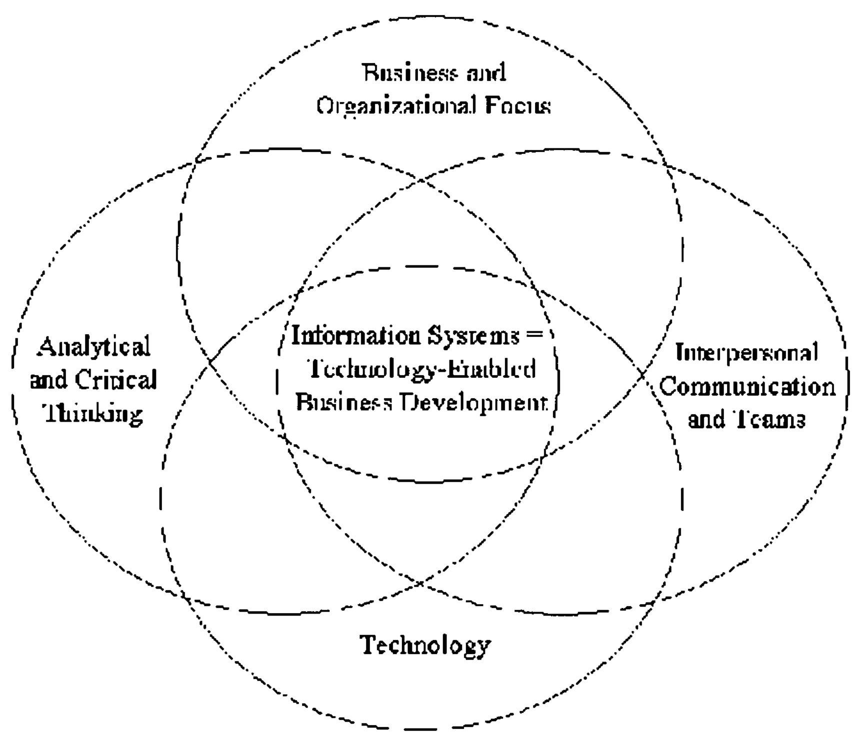
The graduates of an undergraduate IS program should be equipped to function in an entry-level position and should have a basis for continued career growth (Lee, Trauth and Farwell 1995; Landry et al 2000). Figure 1 presents a high-level categorization of the exit characteristics that emphasizes the central role of Technology-Enabled Business Development at the intersection of the four major areas that were identified in the initial assumptions about the IS profession. Although not presented here, the full curriculum report divides the main categories further into subcategories and presents concrete, practical representative examples of the exit characteristics in each subcategory. The overarching objective for IS professionals is to enable organizations to utilize information technology to achieve their strategic objectives with a customer service orientation.

SCOPE OF CURRICULUM UPDATE

Recently a survey of computing faculty in the United States was conducted to ascertain information in two areas. The first was to determine their current view of the appropriate depth of mastery for each of the elements in the IS'97 body of knowledge. The second was to gather similar information for key skill areas identified within IS'97. Some of the observations based on this research have been published (Longenecker et al., 1999; Landry et al., 2000). The primary conclusions can be summarized as:

1. IS analysts have specific skills at approximately IS'97 skill depth level 3 (the ability to *USE* know-ledge) in areas of Interpersonal and Team Skills, Business Knowledge, Organizational Process Development (including IS Systems Analysis and Design), Project Management, Database, Software Development, Web Programming, and Systems Integration.

FIGURE 1
FUNDAMENTAL CATEGORIES OF EXIT CHARACTERISTICS OF IS GRADUATES



2. Skills identified in IS'97 as Exit Curriculum Areas match expectations of the computing industry as well as IS faculty.

3. Skill areas produced by programs of Information Technology match expectations of Information Systems faculty.

4. The model courses of IS'97 are acceptable to both IS and IT faculty. Interestingly, both Computer Science and Software Engineering faculty also feel that IS'97 courses are relevant.

When analyzing the survey data and the IS'97 curriculum in summer of 2001, the missing element in the curriculum was a course focusing on Internet-based commerce. At most universities, this course has been a popular required course for several years and so there was a clear discrepancy in the existing model curriculum and what was being operationalized in most universities. Thus, a new course was added to the model curriculum, IS 2002.2–*Electronic Business Strategy, Architecture and Design*, to address this limitation. Without restructuring other aspects of the model curriculum, the addition of a new Internet-based commerce course to the model curriculum would result in curriculum of eleven required courses. There was a desire by the committee to limit model curriculum to a target of ten courses, or 30 semester units, which therefore would result in the elimination of one of the existing IS'97 courses. This decision was driven by recently approved accreditation standards and by the practical credit hour constraints realized by many IS programs.

IS'97 had a prerequisite course, IS'97.P0–*Knowledge Work Software Tool Kit*, that assumed students had elementary exposure to a suite of software tools useful for knowledge workers (spreadsheets, databases, presentation graphics, database retrieval, statistics, word processing, and electronic mail). It was also assumed that students could gain this knowledge through a formal course or through self-study modules. Beyond this course, IS'97 had a required course, IS'97.2–*Personal Productivity with IS Technology*, that focused on improving student skills in using packaged software, in both individual and group work, by designing and developing solutions. Given the need to limit the IS 2002 curriculum to ten courses and the rapid and significant improvement in the general computing literacy of entering students, IS'97.P0 and IS'97.2 were merged into a single prerequisite course, IS 2002.P0–*Personal Productivity with IS Technology*.

Beyond the addition of the Internet-based commerce course, IS 2002.2, and the merging of IS97.P0 and IS'97.2 into a single prerequisite course (or self-study modules, see below for more details), the remaining courses were retained with appropriate updating of the course "Scope" and "Topic" descriptions. In most cases, this resulted in the addition of Internet centric-content and more contemporary terminology and concepts. For all but one, course names remained unchanged. However, IS'97.9–*Physical Design and Implementation with a Programming Environment* was changed to IS 2002.9–*Physical Design and Implementation in Emerging Environments*. This change was motivated by the continual evolution in rapid application development and programming environments. A mapping of the courses and a summary of the changes is represented in Table 1.

COURSE ARCHITECTURE AND SEQUENCE

The IS 2002 curriculum assumes that students have a prerequisite knowledge of desktop computing. Specifically, it is assumed that students have an elementary exposure to a suite of software applications useful for knowledge workers such as word processing, spreadsheets, Email, and Internet browsing. In addition, students are assumed to also have knowledge and skill of IS technology to be a successful knowledge worker as described in the prerequisite course IS 2002.P0–*Personal Productivity with IS Technology*.

Figure 2 shows the course architecture and sequence of courses within IS 2002, including the prerequisite course IS 2002.P0. The structure is a "suggested" architecture and sequence with the appreciation that each university's situation is somewhat unique. In any event, this architecture allows the entire program to be completed within a scope of two years. This model will therefore fit within the broader curricula constraints of most business schools. For IS programs housed outside business, great flexibility in the sequence can be employed.

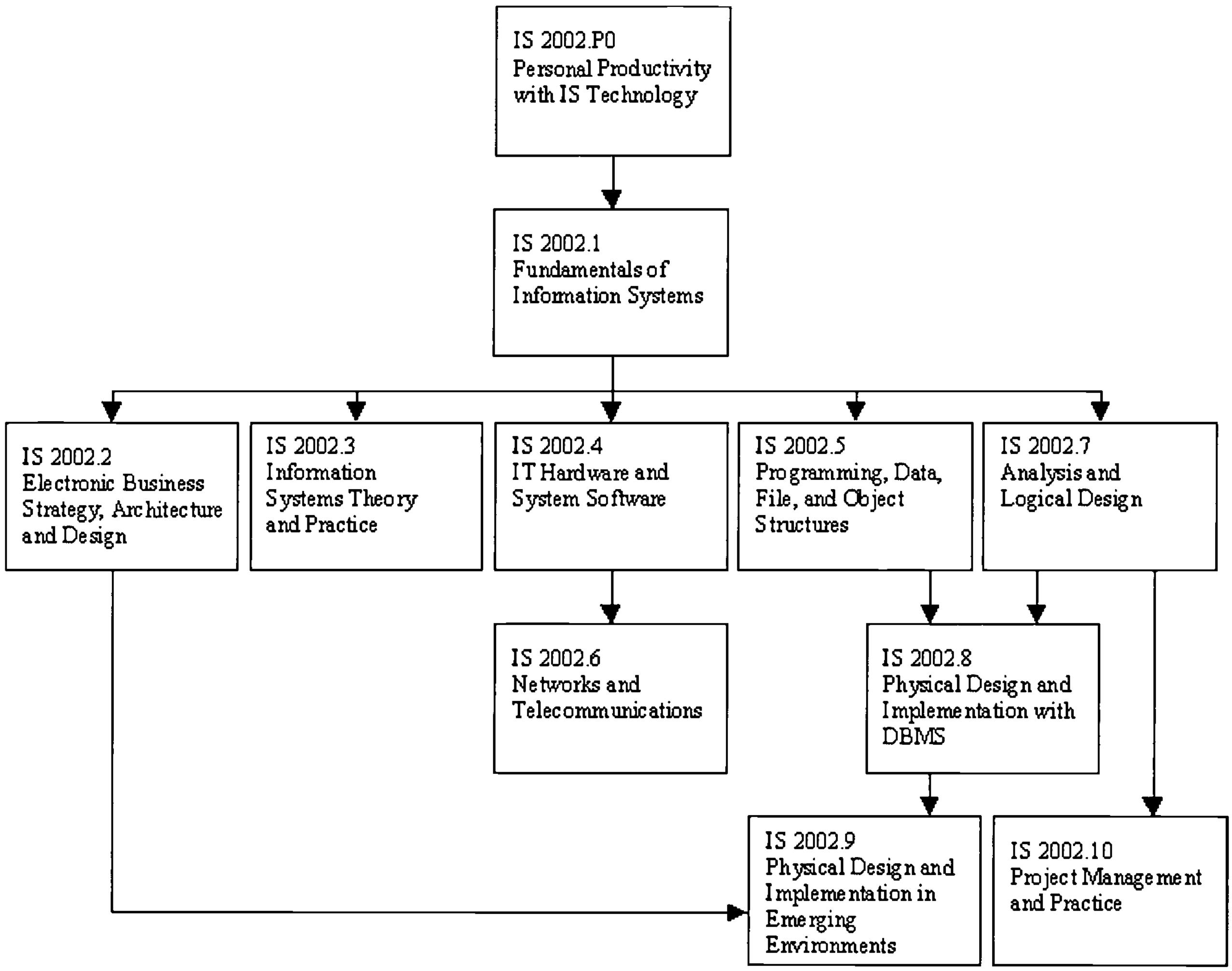
COURSE DESCRIPTIONS

In this section, we conclude by providing high-level course catalog descriptions for IS 2002. These include the prerequisite Personal Productivity with IS Technology (IS 2002.P0) course plus the ten courses within the Model Curriculum. Presented in Table 2 below is the title, prerequisite and catalog description for each of the courses.

TABLE 1
MAPPING OF IS 2002 COURSES TO IS'97 COURSES

IS 2002 Courses		IS'97 Courses
IS 2002.P0 – Personal Productivity with IS Technology	← MERGING ←	IS'97.P0 – Knowledge Work Software Tool Kit IS'97.2 – Personal Productivity with IS Technology
IS 2002.1 – Fundamentals of Information Systems	UPDATE ←	IS'97.1 – Fundamentals of Information Systems
IS 2002.2 – Electronic Business Strategy, Architecture and Design	NEW	**NO EXISTING COURSE**
IS 2002.3 – Information Systems Theory and Practice	UPDATE ←	IS'97.3 – Information Systems Theory and Practice
IS 2002.4 – Information Technology Hardware and Systems Software	UPDATE ←	IS'97.4 – Information Technology Hardware and Systems Software
IS 2002.5 – Programming, Data, File, and Object Structures	UPDATE ←	IS'97.5 – Programming, Data, File, and Object Structures
IS 2002.6 – Networks and Telecommunication	UPDATE ←	IS'97.6 – Networks and Telecommunication
IS 2002.7 – Analysis and Logical Design	UPDATE ←	IS'97.7 – Analysis and Logical Design
IS 2002.8 – Physical Design and Implementation with DBMS	UPDATE ←	IS'97.8 – Physical Design and Implementation with DBMS
IS 2002.9 – Physical Design and Implementation in Emerging Environments	UPDATE ←	IS'97.9 – Physical Design and Implementation with a Programming Environment
IS 2002.10 – Project Management and Practice	UPDATE ←	IS'97.10 – Project Management and Practice

FIGURE 2
IS 2002 COURSE ARCHITECTURE AND SEQUENCE



SUMMARY AND CONCLUSION

This paper presented a status report on the current updates to the information system model curriculum for 2002. Discussed were the key motivations behind the need to update IS'97, key principles and guiding assumptions about the IS profession that helped to shape the curriculum design, and the exit characteristics of IS graduates. The scope of the curriculum update was discussed so that programs transitioning from IS'97 to IS 2002 will better understand the model's evolution. This was followed by a brief presentation of the course architecture and intended course sequence. Finally, the paper concluded by providing high-level course catalog descriptions of the IS 2002 model curriculum.

It could be easily argued that the curriculum updating process is too slow and not responsive to the pace of change encountered in practice. In the future, as information technologies continue to evolve and change at an increasingly rapid pace, the need for even more timely updates is clear. Arguably, the largest motivation for the current curriculum update was the advent of the Internet. This global architecture will provide a necessary foundation to ease the updating process and facilitate broader involvement by the IS academic and professional community. Just as the Internet has fundamentally changed business, we too feel that this medium can be used to fundamentally change the curriculum design process. As we move forward, we urge the reader to embrace this opportunity to shape the

TABLE 2
IS 2002 COURSE NUMBER, TITLE, AND CATALOG DESCRIPTION

Course Number & Title (prerequisite)	Catalog Description
IS 2002.P0–Personal Productivity with IS Technology (basic word processing, spreadsheets, e-mail, and Web browsing)	Students with minimal skills will learn to enhance their personal productivity and problem solving skills by applying information technologies to problem situations and by designing and using small information systems for individuals and groups.
IS 2002.1–Fundamentals of Information Systems (IS 2002.P0)	Systems theory, quality, decision-making and the organizational role of information systems are introduced. Information technology including computing and telecommunications systems are stressed. Concepts of organization and information system growth and re-engineering are introduced.
IS 2002.2–Electronic Business Strategy, Architecture and Design (IS 2002.1)	The course focuses on the linkage between organizational strategy and networked information technologies to implement a rich variety of business models in the national and global contexts connecting individuals, businesses, governments, and other organizations to each other. The course provides an introduction to e-business strategy and the development and architecture of e-business solutions and their components.
IS 2002.3–Information Systems Theory and Practice (IS 2002.1)	Students who have constructed personal information systems will be exposed to the theory of the IS discipline. Application of these theories to the success of organizations and to the roles of management, users and IS professionals are presented.
IS 2002.4–Information Technology Hardware and System Software (IS 2002.1)	Principles and application of computer hardware and software will be presented through lecture, installation, configuration, and operations experiences.
IS 2002.5–Programming, Data, File and Object Structures (IS 2002.1)	This course presents object oriented and procedural software engineering methodologies in data definition and measurement, abstract data type construction and use in developing screen editors, reports and other IS applications using data structures including indexed files.
IS 2002.6–Networks and Telecommunications (IS 2002.4)	Students will gain in-depth experience of networking and telecommunications fundamentals including LANs, MANs, and WANs. Data communication and telecommunication concepts, models, standards, and protocols will be studied. Installation, configuration, systems integration and management of infrastructure technologies will be practiced.
IS 2002.7–Analysis and Logical Design (IS 2002.1)	Students with information technology skills will learn to analyze and design information systems. Students will practice project management during team oriented analysis and design of a departmental level system.
IS 2002.8–Physical Design and Implementation with DBMS (IS 2002.5 and IS 2002.7)	Students who have completed the analysis and logical design course will develop a detailed physical design and implementation based on a logical design utilizing a DBMS. The course integrates intensive project work with relevant concepts.
IS 2002.9–Physical Design and Implementation in Emerging Environments (IS 2002.2 and IS 2002.8)	Students who have completed the analysis and logical design course will extend their knowledge by implementing an information system using a contemporary development environment capable of interacting with a local or a remote DBMS. Teams will use project management principles to implement an information system.
IS 2002.10–Project Management and Practice (IS 2002.7)	Advanced IS majors operating as a high-performance team will engage in and complete the design and implementation of a significant information system. Project management, management of the IS function and systems integration will be components of the project experience.

IS academic discipline so that we can collectively be more responsive to the changing curricular needs of both academia and industry.

ENDNOTE

1. An earlier version of this paper was published in the *Proceedings of the 2002 American Conference on Information Systems*, Dallas, Texas.

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