DOCUMENT RESUME

ED 457 829 IR 020 899

AUTHOR	Boger, Stephanie, Ed.
TITLE	Instructional Design. [SITE 2001 Section].
PUB DATE	2001-03-00
NOTE	216p.; In: Proceedings of Society for Information Technology & Teacher Education International Conference (12th, Orlando, Florida, March 5-10, 2001); see IR 020 890. Figures may contain very small and illegible font.
PUB TYPE	Collected Works - General (020) -- Speeches/Meeting Papers (150)
EDRS PRICE	MF01/PC09 Plus Postage.
DESCRIPTORS	*Computer Uses in Education; *Educational Technology; Elementary Secondary Education; Higher Education; *Instructional Design; *Instructional Development; Teacher Education; Technology Integration
IDENTIFIERS	Learning Environments; Technology Utilization; Web Based Instruction

ABSTRACT

This document contains the papers on instructional design from the SITE (Society for Information Technology & Teacher Education) 2001 conference. Topics covered include: an adaptive e-framework for teacher training; assessing the integration of technology into the curriculum; promoting instructional planning; learning and using World Wide Web page construction to teach preservice teachers how to develop and design integrative middle school curricula for early adolescents; innovative course design as action research; designing Web-based inquiry simulations; principles for designing online instruction; effective presentation design; letting teachers interact with the idea of "interactivity"; qualitative data analysis to ascertain the benefits of a Web-based teacher oriented project; Yekioyd statistics and their interpretation; gLearning--the new e-learning frontier; orchestrating virtual learning; constructing an enhanced instructional presentation; metaphorical representation within a distributed learning environment; implementation of an electronic tutorship support system in a school of business administration; activities for integrating the Internet in teacher education classes; the results of a learning software competition; interactivity as the key to successful Web-based learning environment; scripting a lesson; analysis of large Web-based courses at the University of Central Florida; learners' perceived differences in learning and application; online delivery of multimedia courseware; teaching with geographic information technology; developing Web pages to supplement courses in higher education; toward an adaptive e-framework for teacher education; problem-based learning using Web-based discussions; adapting critical thinking models to a technological approach; sharing teaching experiences in different countries through information and communications technology (ICT); cognitive design of instructional databases; potentials and possibilities in Web-mediated courses; effective online learning at Western Governor's University (Washington); interactive training video as software for staff development; sequence independent structure in distance learning; edu-effectiveness and distance education; assessing student statistical problem-solving skills using interactive Java applets; the formative evaluation of a computer-managed instruction module; online teaching tools; a model to design technology for a teacher training program; designing

Web-based constructivist learning environments; using ICTs to develop a learner-centered approach with preservice elementary school teachers; a model for the implementation of socio-constructivist principles in multiple classrooms; Web-based pedagogical strategies; incorporating research on attention into e-design; strategies to reduce online cheating; learning styles of student in traditional Web-based courses; and successful implementation in educational and curriculum integration. Most papers contain references. (MES)

INSTRUCTIONAL DESIGN

Section Editor:
Stephanie Boger, *University of Houston*

"As we stand at the edge of this new millennium, gazing out into its uncharted expanse, some of us feel as if we are stepping out onto a launching pad; others feel at the brink of an abyss. Some see the challenges and the marvels to come and are exhilarated; some see only the certainty of change and its uncertain outcomes and are apprehensive. How amazing it is that the influence of technology is a primary force shaping both perspectives. All of us recognize the vital role computers and other electronic tools have played in bringing us to the place where we stand now" (p. v, Roblyer & Edwards, 2000).

As the field of technology continues to develop at an accelerated rate, it brings new opportunities for teacher educators to share skills and information. The importance of instructional design during this growth has not been overlooked as shown by the quality and quantity of papers included in this year's section. There are three main categories of papers represented: (1) the discussion of theoretical constructs supporting different instructional design models, (2) the application of instructional design models in various learning situations, and (3) the assessment of how these models work.

In the past, instructional design has largely been based on behavioristic premises; however, it is adjusting to new methods and computer design tools which allow for greater flexibility in the creation of learning environments (Wilson, Jonassen, & Cole, 1993). In this section, some authors explore traditional behavioristic designs, while others investigate constructivist and cognitive possibilities as well. Many theoretical foundations of instructional design are represented here.

The application of design ranges from web-based instruction to traditional classroom settings. How should teachers be taught? Which methods of design are appropriate for the content being taught and the delivery system be utilized? Are old methods being used in new situations with a new kind of student? It is questions like these that are addressed in the following papers.

To complete the design process, several papers discuss evaluation techniques used to assess the application of instructional design models employed. Both qualitative and quantitative methods of assessment are represented.

References

Roblyer, M. D., & Edwards, J. (2000). *Integrating educational technology into teaching (2nd ed.).* Upper Saddle River, NJ: Merrill/Prentice Hall.

Wilson, B. G., Jonassen, D. H., & Cole, P. (1993). Cognitive approaches to instructional design. In G. M. Piskurich (Ed.), *The ASTD handbook of instructional technology* (pp. 21.1-21.22). New York: McGraw-Hill.

Stephanie Boger is a Clinical Assistant Professor in the Department of Curriculum and Instruction in the College of Education at the University of Houston, 4800 Calhoun, Houston, TX 77204-5872. E-mail: sboger@uh.edu

Toward an Adaptive e-Framework for Teacher Education

M. Adamo[1], M.G. Dutto[2], I. Gatti[2], M. Lancia[3], G.F. Mascari[1] , M. Vitale[4], S. Vigiani[1]

[1]Istituto per le Applicazioni del Calcolo "M.Picone" (IAC) - Italian National Research Council (CNR),
[2]Coordinamento Formazione Insegnanti (CFI)– Italian Ministry of Education
3 Centro Elaborazione Dati (CED) - Italian National Research Council
[4]Servizio Reti di Comunicazione (SRC) - Italian National Research Council .

adamo@iac.rm.cnr.it, mgdutto@istruzione.it, igatti@istruzione.it,
lancia@cedrc.cnr.it, mascari@src.cnr.it, vitale@src.cnr.it, vighouse@mail.lina.it

Abstract

The Italian Ministry of Education in collaboration of the Italian National Research Council are engaged in joint activities concerning the modeling, design and prototype implementation of an adaptive e-framework supporting the interactions of various actors of the national teacher training system. The framework includes patterns of static and adaptive versions for resources-services allocation and management.

Introduction

In the knowledge society, knowledge is a primary resource at various levels including: the know what, the know how and the know why. The processes acting on knowledge: creation, acquisition, processing, evaluation, storing and transmission, and their interrelationships contribute to determine a new social dynamics. The education systems are complex organizations in the knowledge society: they offer services based on the exchange of knowledge between "knowledge providers" (research centers, universities, laboratories, museums, etc…) and "knowledge clients" (school students, enterprise employees,) by means of "knowledge intermediaries" (teachers, pedagogical resources, etc…). Teacher training can be considered as the interaction between providers and intermediaries in education systems.

The information and communication technologies are enabling factors for the development of the knowledge society and hence of the education systems. In particular teacher training is becoming a strategic issue that requires new advanced web based solutions.

The Italian Ministry of Education and the Italian National Research Council are engaged in joint activities concerning the modeling, design and prototype implementation of an adaptive e-framework supporting the interactions of various actors of the national teacher training system.

The e-framework includes patterns of static and adaptive versions for resources-services allocation and management: a teacher training system can be modeled by composing patterns, according to its complexity: In particular:

- the static resources-services allocation: services are provided by teaching agencies to the teachers;
- the adaptive resources-services allocation: the system takes care of the teachers and training agencies profiles for matching their respective needs and supply;
- the static management of the system behavior according to the cycle: planning, monitoring, evaluation, change management and planning
- the adaptive management of the system dynamically coordinates the planning, monitoring, evaluation and change management subsystems.

Up to now a prototype of information dissemination of teacher training services, called SIF and based on the static resources-services allocation pattern, has been realized with a high degree of scalability scalabilty: (around 25.000 teachers and 250 training agencies). Design and implementations of advanced teacher training systems, based on more complex patterns, are in progress.

1. Resources-Services Patterns

1.1 Static Resources-Services Pattern

Training agencies and teachers interact trough the matching between training resources offering and training services request. The matching is realized according to a matching schema associated to a kernel component which is specified once for all w.r.t the evolution of the overall system (i.e. "statically").

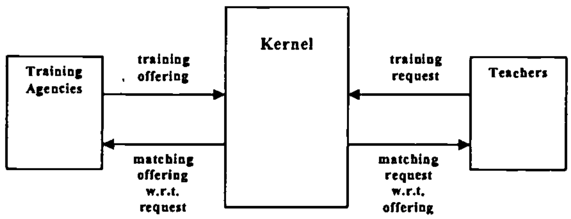
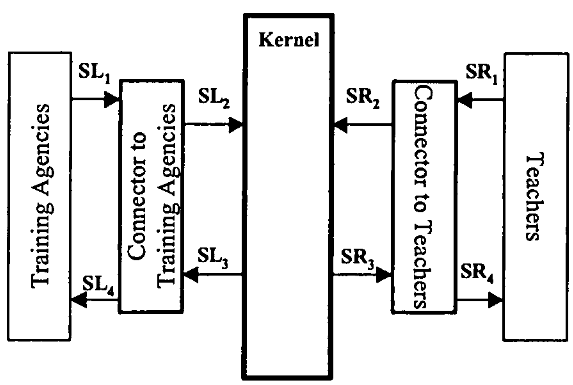


Figure 1: ***Static Resources-Services*** **Pattern**

1.2 Adaptive Resources-Services Pattern

Training agencies and teachers interact trough the matching between training resources offering and training services request. The matching is realized according to matching schemas chosen by the connectors among those available from the kernel component (i.e. "dynamically"), as specified in the following figure.



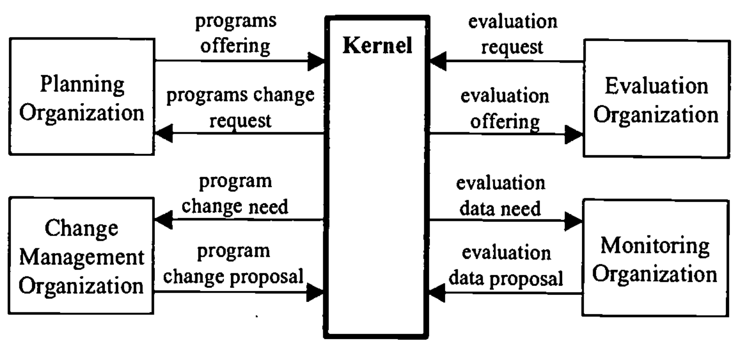
L-labels	Flows	Flows	R-labels
SL_1	training offering	training request	SR_1
SL_2	available training offering	available training request	SR_2
SL_3	matching offering-request availability	matching request-offering availability	SR_3
SL_4	matching offering-request	matching request-offering	SR_4

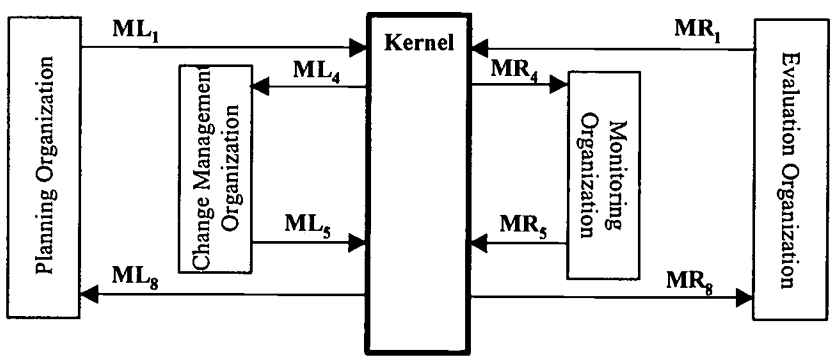
Figure 2: ***Adaptive Ressource-Services*** **Pattern**

2. Management Patterns

2.1 Static Management Pattern

The global management of a teacher training system is obtained by composing local interactions of four organisms (planning, monitoring, evaluation and change management) with the kernel component. The interactions rules are specified once for all w.r.t the evolution of the overall system (i.e. "statically").



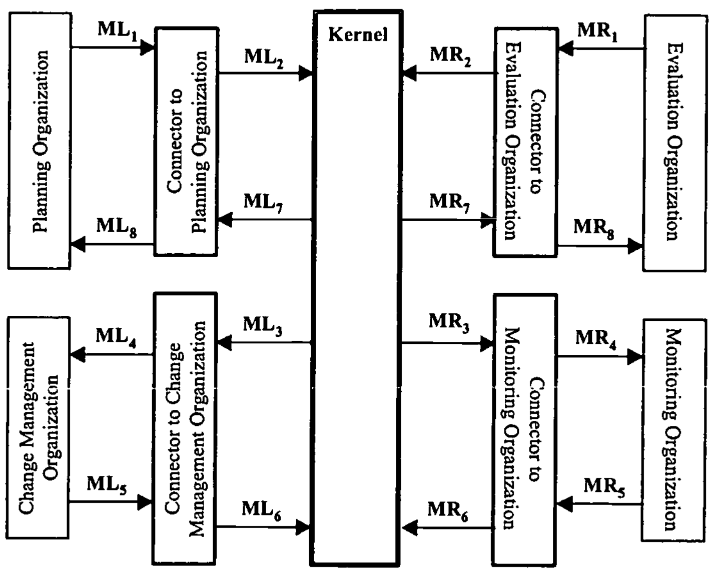


L-labels	Flows	Flows	R-labels
ML_1	programs offering	evaluations request	MR_1
ML_4	program change need	evaluation data need	MR_4
ML_5	program change proposal	evaluation data proposal	MR_5
ML_8	program change request	evaluation offering	MR_8

Figure 3: *Static Management* Pattern

2.2 Adaptive management Pattern

The global management of a teacher training system is obtained by composing local interactions of four organisms (planning, monitoring, evaluation and change management) with the kernel component. The interactions follow rules chosen by the connectors according to the availability for interaction from the kernel. (i.e. "dynamically").



L-labels	Flows	Flows	R-labels
ML_1	programs offering	evaluations request	MR_1
ML_2	actions offering	indicators request	MR_2
ML_3	matching actions-indicators availability	matching indicators-actions availability	MR_3
ML_4	program change need	evaluation data need	MR_4
ML_5	program change proposal	evaluation data proposal	MR_5
ML_6	actions change proposal	indicators data proposal	MR_6
ML_7	actions change request	indicators data offering	MR_7
ML_8	program change request	evaluation offering	MR_8

Figure 4: ***Adaptive Management*** **Pattern**

3. Patterns-based Teacher Education Systems

Teacher education systems can be modeled by composing the previous patterns: the more complex model is obtained by composing the adaptive resources-services pattern with the adaptive management pattern, as illustrated in the following diagram.

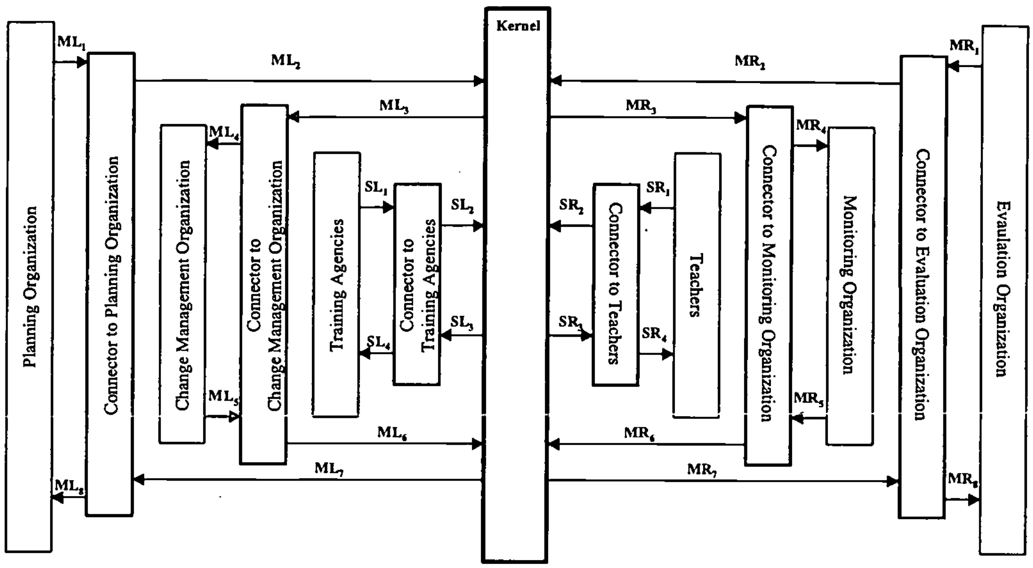


Figure 5: ***Adaptive Resources-Services and Management*** **System**

The design of such kind of complex system requires a rigorous modeling methodology. A long way in front of us !

References:

[1] IEEE 1999: LTSA Specification - Learning Technology Systems Architecture (http://edutool.com/ltsa/)
[2] Association for the Advancement of Computing in Education (www.aace.org)
[3] University of Massachusetts - Center for Computer-Based Instructional Technology (http://ccbit.cs.umass.edu/ccbit/)
[4] B.P. Woolf, V. Lesser, C. Eliot, Z. Eyler-Walker, M. Klein: "A Digital Market Place for Education", SSGRR 2000, L'Aquila (Italy) 2000
[5] G.F. Mascari: Frameworks for Complex Adaptive Systems, in preparation

Acknowledgments:

to Gianni di Fiandra (ITIS Fermi), Daniela Merella (CED CNR), Paolo Sartorelli (CED CNR), Gianfranco Timpano (CED-CNR), Giovanni Guerrieri (CED-CNR), Silvio Scipioni (CED-CNR) for their contribution to the SIF project.

Assessing the Integration of Technology Into the Curriculum

Mac Adkins, Ed.D.
Office of Instructional Design and Technology
Troy State University
United States
maca@trojan.troyst.edu

Abstract: An online, self-assessment is being used to measure the amount and type of technology integration by the faculty of the Troy State University College of Education. Usage of this instrument has created baseline data to track individual and group levels of technology integration. Measures of presentation, administration, collaboration and research are gathered for both faculty and students. Technologies such as Internet, e-mail, discussion boards, chat, PowerPoint, word processing, spread sheet, database, digital camera, video camera, and video tapes are measured. Analysis of the first academic year's data is presented in this article. This project was funded in part by a PT3 grant and is designed to gather data congruent with NCATE and ISTE standards for technology integration.

As I look into my crystal ball I can see that your school has invested thousands of dollars and hours into the purchasing of technology for your campus. I can also see that you have also well invested in the training of your faculty and staff to use the equipment and software. Something else is also coming into view ... You have also assessed your faculty's technical competencies and designed training to meet their needs. But is the technology actually being integrated into your curriculum? To what degree are your faculty members really using it in their teaching? Oh, I wish I could tell you, but that information is very gray and fuzzy. All that I can see is that most faculty members are saying that "sometimes" they are using it. I'm sorry I wish I could give you a more specific answer.

Do you feel like the assessment of the integration of technology into your curriculum is gray and fuzzy? Do you wish that you could gaze into a crystal ball and get specific answers?

As Director of Instructional Design and Technology for the College of Education at Troy State University I felt the same way. We have invested well in the infrastructure, implementation, and training of our faculty to use technology. But when asked if it was really being used in the classroom, the best I could say was, "I think so." But as you know, budget requests based on "I think so" do not continue to be funded. I needed authentic, quantifiable data to document our usage of technology.

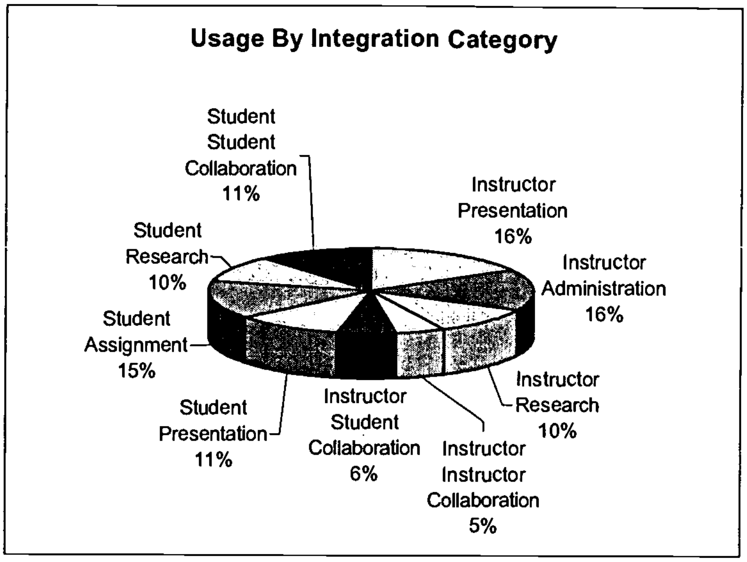
So I developed the Technology Integration Assessment. This online, self-assessment allows faculty members to quickly and conveniently report the integration of various technologies into each of their courses. The instrument not only measures what technology items are being used, but also how they are being used. The real data resulting from this authentic assessment has guided our data-driven decision process for future technology purchases and training.

Several similar assessments currently exist which measure an individual's current technology competency levels. Assessments also exist which measure faculty and student perceptions of the impact which technology is making. But instruments designed to measure precisely which pieces of technology are being and how they are being used were lacking. This void led to the development of the Technology Integration Assessment.

The online instrument is located at http://spectrum.troyst.edu/~coe/departments/technology/integration.htm. Each faculty member is asked to complete the instrument for each course they are teaching. The instrument is administered near the beginning of each semester. Through the use of checkboxes arranged in a grid, the faculty members can quickly identify which technologies are being used in what ways. This format allows the instrument to be quickly completed thus resulting in higher response rates. The average time to complete the assessment is less than five minutes per course.

The information submitted by faculty members is automatically sent to a database. After the submissions have been received, the Technology Integration Report is prepared for that semester. A sample of the data can be seen above. The complete report is available at http://spectrum.troyst.edu/~coe/departments/technology/TIR_5-11-00.doc. This report allows information in the following categories to be reported: Usage By Technology Item, Usage By Integration Category, Technology Integration Index By Faculty By Term, Technology Integration Index By Faculty, and Technology Integration Index By Faculty.

We identified the following twelve technology items for which we wanted to track integration: Internet, e-mail, discussion boards, chat, PowerPoint, word processing, spread sheet, database, digital camera, video camera, and video tape. We also identified the following nine integration categories: instructor presentation, instructor administration, instructor research, instructor-instructor collaboration, instructor-student collaboration, student-student collaboration, student presentation, student administration, student research. **Figure 1**: Usage by integration category.



The assessment also allows us to establish baseline data in the form of a faculty integration index. This quantifiable information allows us measure increases in integration for each faculty member over a period of time. This serves as an authentic assessment of the results of our faculty technology training program. Some of the conclusions drawn from the data include:

- Internet usage has almost equaled word processing usage for course preparation.
- Technology usage categories of presentation, administration, research and collaboration are roughly equivalent for faculty and students.
- The technology integration index for faculty members ranged from 5 to 38.33. The average was 19.58.
- Email usage surpassed Internet usage. This indicates that faculty members are using their network connections largely for communication and collaboration.

This instrument was developed specifically for the Troy State University College of Education but it can be tailored to measure specific technologies being used by any school. In the presentation I will provide the history of the development of the assessment, demonstrate the use of the assessment, show the resulting report from the assessment, and report how this data has been used in the decision making process of the College.

PROMOTING INSTRUCTIONAL PLANNING: AN EXPERIMENT

Amy L. Baylor, Ph.D
Department of Educational Research, Instructional Systems Program
Florida State University
USA
baylor@coe.fsu.edu

Anastasia Kitsantas, Ph.D
Department of Educational Research, Learning & Cognition Program
Florida State University
USA
akitsant@mailer.fsu.edu

Abstract: This study investigated the impact of the Instructional Planning Self-Reflective Tool (IPSRT), on students' attitudes toward instructional planning with 114 pre-service teachers from seven sections of an introductory educational technology course. All participants in the experimental and control groups were taught how to develop an instructional plan as part of the course. For the intervention, the experimental group was provided with instruction how to use the IPSRT while instructional planning, whereas the control group received a review of instructional planning. It was hypothesized that the IPSRT would positively affect students' performance, attitudes, and self-efficacy beliefs towards instructional planning. It was found that the experimental group showed greater skill acquisition, more positive attitudes and higher perceived importance of instructional planning. In terms of self-efficacy, participants who were initially high in self-efficacy reported significantly lower self-efficacy following the tool intervention. In contrast, participants initially low in self-efficacy showed significantly higher self-efficacy following the tool intervention. Findings are discussed from a social-cognitive perspective.

Many teachers learn to systematically design instruction through methods of instructional planning. A number of instructional planning models have been developed (e.g., Dick & Reiser, 1989; Dick & Carey, 1996; Seels and Glasgow, 1990) with the goal of improving teacher instruction. Reiser & Dick (1996) state that instructional planning consists of the six following phases: goals, objectives, instructional activities, assessment, revision, and implementation. Four key principles underlie these six instructional planning phases: 1) identifying goals and objectives that students will be expected to attain; 2) planning instructional activities that correspond with the objectives; 3) developing assessment instrument to measure attainment of objectives; and, 4) revising instruction based on student performance and attitudes.

While it is widely believed that instructional-planning skills are critical for instructional effectiveness in the classroom, there is no strong evidence that teachers (or even superior teachers) actually use these processes (Martin, 1990; Young, Reiser, & Dick, 1998). Research evidence suggests that teachers typically do not follow procedures acquired in pre-service teacher education programs (Kagan, 1992; Reynolds, 1993). However, Neale, Pace & Case, (1983) indicate that experienced teachers believe in the value of instructional planning and that it should be taught to novice teachers. Along this line, Reiser (1994) indicates that pre-service teachers taught to use systematic instructional planning express more enthusiasm in using these skills in the future.

Based on this research evidence, how can we better prepare pre-service teachers to both incorporate and increase their awareness of critical instructional planning components? One possibility is by providing them with tools that promote self-regulation. Self-regulation refers to self-generated thoughts, feelings, and actions that are systematically designed to achieve a goal (Zimmerman, 2000). Two core components of self-regulation are self-monitoring and self-evaluation. Self-monitoring refers to tracking one's performance whereas self-evaluation refers to comparing one's performance to a standard.

The purpose of this study was to test the effectiveness of the IPSRT (see Baylor, Kitsantas, & Chung, in press), a self-regulatory tool designed to promote monitoring and self-evaluation in instructional planning on skill acquisition, attitudes and self-efficacy beliefs of pre-service teachers regarding instructional planning. It was hypothesized that the pre-service teachers presented with the IPSRT would report a) greater skill acquisition, b) more positive attitudes, c) higher self-efficacy beliefs, and d) greater perceived instrumentality regarding instructional planning than the control group participants.

Methods

Sample

The total sample consisted of 92 pre-service teachers, in seven sections of an "Introduction to Educational Technology" course. The mean age of the sample was 20.43 years (SD=2.68). Of those reporting ethnicity, 81% were Caucasian, 8% were Hispanic, 7% were African American, and 4% were of other groups. Of those reporting gender, 22% of the sample were male and 78% were female.

Measures

Post-test achievement

All participants developed an instructional plan as a post-test measure of achievement that was implemented as a graded quiz as part of the class. Each instructional plan was scored according to three sub-components on a scale of 1-5: goals/objectives, procedure, and assessment. The overall quiz score was the compilation of these three sub-scores. After satisfactory inter-rater reliability for scoring the quizzes was established, one researcher scored the remainder of the instructional plans. The scorer was blind as to the conditions of the participants.

Attitudes

To assess pre-service teacher attitudes toward instructional planning, all participants were asked to list two adjectives to "describe what you think about instructional planning." These adjectives were coded as -1 if both were negative, as 0 if 1 was negative and the other positive, and as +1 if both were positive. The items were coded by two raters independently. There were disagreements about two sets of adjectives which were resolved through discussion. Two adjective pairs were discarded because they could not be classified.

Self-Efficacy

This scale measured the students' self-efficacy beliefs about instructional planning. It was developed based on Bandura & Schunk's (1981) guidelines. All participants were asked, "how sure are you that you can write a lesson plan" on a scale from 10 being not sure to 100 being very sure. The inter-item reliability of this scale was alpha= .96.

Perceived instrumentality

To assess the participants' perceived importance of instructional planning, the participants were asked to rate "how important is writing a lesson plan to you as a future professional" on a scale of 1 to 5, 1= not important, 2=fairly important, 3=important, 4=very important, and 5=extremely important.

Procedure

All participants answered a demographics questionnaire including questions regarding gender, ethnicity, age, and grade point average. Following this questionnaire, the participants' attitudes were assessed. Self-efficacy beliefs regarding instructional planning were assessed at two different times for both groups. For both the experimental and control groups, self-efficacy was assessed initially to establish a baseline. In addition, for the experimental group it was assessed again after the quiz and for the control group it was assessed following the introduction of the tool. Next the instructor demonstrated writing an instructional plan; additionally, for the experimental group, s/he modeled the use of the IPSRT while writing the instructional plan. Following this demonstration, all participants were instructed to write a lesson plan. All participants were given a case study for which to write a lesson plan for homework, and were notified of a quiz the next week. The next week, before the quiz, participants were queried about their self-efficacy. For the quiz, the experimental group had the IPSRT attached to their quiz while the control group did not. Following the quiz, all participants were asked about self-efficacy beliefs, perceived instrumentality, and attitudes regarding lesson planning. The control group's lesson plans from the quiz were xeroxed and returned to them. Next, a demonstration regarding use of the IPSRT was conducted for the control group students and they were allowed to modify their xeroxed lesson plans using a red pen. Following their modifications to the quizzes, they were queried about their self-efficacy perceptions regarding writing future lesson plans.

Results

Independent sample t-tests were conducted to determine differences between the two groups (experimental, control) and paired-sample t-tests were conducted to determine differences within each group over time.

Achievement

In terms of the effect of the IPSRT intervention on achievement, it was found that the experimental group ($\underline{M}$=11.27) outperformed the control group ($\underline{M}$=9.32), $\underline{t}(53)=-3.53$, $\underline{p}<.001$. Achievement was based on the overall quiz scores of participants in both groups.

Attitude

A t-test was performed to determine initial differences between the control and experimental group regarding attitudes toward instructional planning. There were no statistically significant differences between the two groups regarding their attitudes about instructional planning initially, $\underline{t}(74)= -.999$, $\underline{p}>.3$. However, following the intervention, there were significant differences between the two groups $\underline{t}(69)= -2.64$, $\underline{p}<.01$. Specifically, participants in the control group ($\underline{M}$=-.094) were slightly negative towards instructional planning whereas the experimental group participants were positive ($\underline{M}$=.41), where the possible range of scores was from -1 (negative) to 0 (neutral) and 1 (positive). See Table 3 for examples of positive and negative attitudes.

Self-efficacy

The mean score for self-efficacy regarding instructional planning for all participants following the intervention was $\underline{M}$=80.35, with a standard deviation of 15.37. Given this distribution, low self-efficacy was defined as 70% or below ($\underline{N}$=28) and high self-efficacy beliefs as above 80% ($\underline{N}$=31), so participants who scored 80% were not included.

In the experimental group, those who had <u>low</u> self-efficacy ($\underline{N}$=17) regarding instructional planning prior to the intervention ($\underline{M}$=60.67) reported significantly <u>higher</u> self-efficacy beliefs regarding instructional planning ($\underline{M}$=72.00) immediately following the quiz, $\underline{t}(14) =-3.52$, $\underline{p}<.01$. In contrast, those who had <u>high</u> self-efficacy beliefs ($\underline{N}$=15) regarding instructional planning prior to the intervention ($\underline{M}$=94.62) reported significantly <u>lower</u> self-efficacy beliefs regarding instructional planning following the quiz ($\underline{M}$=83.85), $\underline{t}(12) =3.48$, $\underline{p}<.01$.

Similar results were found with the control participants when the instructor demonstrated the IPSRT tool and they used it to modify their already-submitted quizzes, see Table 2. Of the control participants with low self-efficacy regarding instructional planning (N=11), it was found that their self-efficacy beliefs significantly improved from the initial self-efficacy assessment (M=62.73) to the final self-efficacy assessment following their presentation with the IPSRT tool (M=71.82), $t(10)$ =-3.62, p<.01. Of the control participants with high self-efficacy (N=16), it was found that their self-efficacy beliefs significantly decreased from the initial self-efficacy measure (M=95.00) to following their presentation with the tool (M=90.63), $t(15)$=2.78, p<.01.

A paired t-test was conducted to determine whether there were practice effects over time for the control participants' initial reports of self-efficacy beliefs with their self-efficacy beliefs following the third instructional plan (the quiz). It was shown that there were no significant differences in self-efficacy beliefs about instructional planning over time by the control group (M=82.5 vs M=83.13), $t(31)$ =-.403, p=.69.

An additional t-test was performed to examine differences in quiz performance between the low and high self-efficacy groups. It was shown that those with higher self-efficacy scored significantly higher on the quiz (M=13.18) than those lower in self-efficacy (M=7.53), $t(32)$=-16.83, p<.000.

Perceived instrumentality

For perceived instrumentality, a measure of utility value, the experimental group reported higher perceived instrumentality (M=4.06) than the control group (M=3.64) following the quiz $t(84)$=-1.706, p<.10. While it was only marginally significant, the difference in the means indicated that the experimental group participants viewed instructional planning as more important to them as future teachers than did the control group participants.

Discussion

The results confirmed that the IPSRT improved pre-service teachers' performance and attitudes, and perceived instrumentality regarding instructional planning. However, the results regarding instructional planning self-efficacy were different from what was hypothesized. Participants that were initially high in self-efficacy beliefs reported significantly lower self-efficacy beliefs while those initially low in self-efficacy reported significantly higher self-efficacy beliefs following IPSRT intervention.

Findings showed that pre-service teachers who were instructed to use the IPSRT scored higher on the quiz than the control group participants. Baylor & Kitsantas & Chung (in press) and Baylor & Kitsantas (2000) found that the IPSRT is perceived as valuable by pre-service teachers because it encourages them to self-monitor and subsequently to self-evaluate their performance. Consequently, given that both groups were instructed in a similar manner, we attribute the students' better performance on instructional planning to the self-monitoring and subsequent reflection of the IPSRT. Similarly, Schunk (1983) suggests performance feedback (such as the IPSRT) provides individuals with information on how well they are performing. Studies conducted in other areas (e.g., writing, math achievement) have found that self-monitoring enhanced students' achievement (e.g., Zimmerman & Kitsantas, 1999; Schunk, 1996)

It was also found that the IPSRT positively affected pre-service teachers' attitudes regarding instructional planning. Specifically, following the intervention, the pre-service teachers using the IPSRT tended to use more positive adjectives (e.g., "important," "helpful") to describe instructional planning than their counterparts in the control group. In fact, the control group was slightly negative about instructional planning (e.g., using adjectives such as "time-consuming," "pointless"). Perhaps the IPSRT, by facilitating reflection and illuminating the underlying systematic process of instructional planning, elicited more positive attitudes. Similarly, Driscoll & Klein & Sherman (1994) found that pre-service teachers taught to employ a systematic planning process expressed more enthusiasm about using these skills in the future.

Concerning self-efficacy, of interest was that those who were initially high in self-efficacy reported significantly lower self-efficacy regarding instructional planning following the quiz. In contrast, those who were initially low in self-efficacy reported significantly higher self-efficacy regarding instructional planning following the quiz. In confirmation of these findings, similar results were found for the control group, who received the tool at a later time.

These results suggest that for the high self-efficacious group the IPSRT highlighted the complexity and comprehensiveness of instructional planning; thus, leading them to re-evaluate their self-efficacy beliefs regarding instructional planning more negatively, or perhaps more realistically, following use of the IPSRT. On the other hand, the use of the IPSRT may be detrimental for high self-efficacious participants because it leads them to be less optimistic about their instructional planning capability.

On the contrary, the low self-efficacious group participants reported significantly higher self-efficacy perceptions following the quiz. This suggests that those initially low in self-efficacy became more confident in their ability to write an instructional plan given the IPSRT. By enhancing pre-service teachers' self-efficacy perceptions it is expected that they would be more likely to engage in systematic instructional planning in the future. In support of this interpretation, Bandura (1986) proposes that self-efficacy beliefs influence the choices that individuals make, the effort that they expend, the perseverance they apply, and the emotional reactions they experience. Further, consistent with Bandura's (1997) theory of self-efficacy, high self-efficacious participants performed better on the quiz than the low self-efficacious participants.

In terms of perceived instrumentality, or utility value, of instructional planning, results showed that instructional planning was more important to the experimental group than the control group although it was only marginally significant. The tool enabled them to view instructional planning as a more substantive and significant part of instruction, and engendered more respect for the instructional planning process. Consequently, use of the IPSRT may increase the likelihood to change pre-service teachers' attitudes regarding the importance of instructional planning.

Conclusion

This study indicated that self-regulatory processes such as self-monitoring and self-evaluation, promoted through the IPSRT, guided students' learning, enhanced their performance, and improved their attitudes regarding instructional planning. In terms of self-efficacy, the IPSRT facilitated the high self-efficacious pre-service teachers to realize the depth and complexity of instructional planning whereas it facilitated the low self-efficacious pre-service teachers to feel more competent.

Additionally, the IPSRT promotes a reflective dialogue for the pre-service teacher instructional planner, fulfilling the role of Moaellem's (1998) description of teacher reflection-in-action. Given that instructional design is a highly complex and spontaneous task and cannot be reduced to a set of procedures, this reflective dialogue is critical. These findings are important for instructors who must prepare their students to practice writing instructional plans effectively on their own.

Future research should examine the value of the IPSRT for more experienced teachers, and/or pre-service teachers later in their academic careers. Follow-up structured interviews would be useful to determine the specific reasons for the changes in pre-service teachers' existing self-efficacy beliefs. In addition, longitudinal studies could examine whether the pre-service teachers' instructional planning-related attitudes and beliefs change once they enter the classroom.

References

Bandura, A. & Schunk, D. H. (1981). Cultivating competence, self-efficacy, and intrinsic interest through proximal self-motivation. Journal of Personality and Social Psychology, 41, 586-598.

Bandura, A. (1986). Social foundations of thought and action: A social-cognitive theory. Englewood Cliffs, NJ: Prentice Hall.

Bandura, A. (1997). Self-efficacy: The exercise of control. New York: W. H. Freeman.

Baylor, A. L., Kitsantas, A., & Chung, H. (in press). The Instructional Planning Self-Reflective Tool (IPSRT): A Method for Promoting Effective Lesson Planning. Educational Technology.

Baylor, A. L. & Kitsantas, A. (2000). Enhancing Students' Instructional Planning Performance: A Strategic Approach. Manuscript submitted for publication.

Dick, W. & Carey, L. (1996). The systematic design of instruction. Addison-Wesley Longman.

Dick, W., & Reiser, R. A. (1989). Planning effective instruction. NJ: Englewood Cliffs.

Driscoll. M. P. & Klein, J., & Sherman, G. (1994). Perspectives on instructional planning: How do teachers and instructional designers conceive of ISD planning practices? Educational Technology, 34(3), 34-42.

Kagan. D., & Tippins, D. (1992). The evolution of functional lessons among twelve elementary and secondary student teachers. Elementary school journal, 92(4), 477-489.

Kitsantas, A. (2000). The role of self-regulation strategies and self-efficacy perceptions in successful weight loss maintenance. Psychology & Health, An International Journal (forthcoming).

Martin, B. (1990). Teachers' planning processes: Does ISD make a difference? Performance Improvement Quarterly, 3(4), 53-73.

Moallem, M. (1998). An expert teacher's thinking and teaching and instructional design models and principles: An ethnographic study, Educational Technology Research and Development, 46(2), 37-64.

Neale, D.C. Pace, A.J. & Case, A.B. (April, 1983). The influence of training experience, and organizational environment on teachers' use of the systematic planning model. Paper presented at the annual meeting of American Educational Research Association, Montreal, Canada.

Reiser , R. A.(1994). Examining the planning practices of teachers: Reflections on three years of research. Educational Technology, 34(3), 11-16

Reiser, R. A. & Dick, W. (1996). Instructional Planning: A Guide for Teachers. Allyn and Bacon.

Reynolds, A. (1993). What is competent beginning teaching? A review of the literature. Review of Educational Research, 62, 1-36.

Schunk, D. H. (1983). Progress of self-monitoring: Effects on children's self-efficacy and achievement. Journal of Experimental Education, 51, 89-93.

Schunk, D. H. (1996). Goal and self-evaluative influences during children's cognitive skill learning. American Educational Research Journal, 33, 359-382.

Seels, B. A. & Glasgow, Z. (1990). Exercises in instructional design. Columbus, OH: Merrill Publishing.

Young, A. C., Reiser, R. A. & Dick, W. (1998). Do superior teachers employ systematic instructional planning procedures? A descriptive study. Educational Technology Research and Development, 46(2), 65-78.

Zimmerman (2000). Attaining self-regulation: A social cognitive perspective. In M. Boekaerts, P. Pintrich & M. Seidner (Eds), Self-Regulation: Theory, Research and Applications. Orlando, FL: Academic Press.

Zimmerman, B. J. & Kitsantas, A. (1999). Acquiring writing revision skill: Shifting from process to outcome self-regulatory goals. Journal of Educational Psychology, 91(2), 241-250.

Learning and Using Web Page Construction as a Vehicle to Teach Preservice Teachers How to Develop and Design Integrative Middle School Curricula Appropriate for Early Adolescents

Dr. Candy Beal, Department of Curriculum and Instruction, North Carolina State University, USA
candy_beal @ncsu.edu

Abstract: This research paper examines a unique curriculum design project that was introduced to teach web page construction in the context of an undergraduate middle grades teacher education course. College students, some novice and some experts, developed learning components for a theme based technology driven unit whose lessons met the developmental needs of early adolescents. The process used by the preservice teachers to develop and construct the website proved that when technology is used in a risk free, supportive environment to build a high interest unit it empowers students and guarantees their further use of technology.

In a sense, we are all preservice teachers. At some point in our lives we will teach another how to do something. Research supports the view that to do this teaching we will fall back on the model used to teach us. For this reason, my Foundations of Middle Level Education course examines preservice teachers' memories of their middle school classes and teachers. They study best and worst practices in teaching and learning, as well as early adolescent development characteristics, in the context of their own experience. Their findings suggest everyone has a different style and stage of learning and teaching, thus validating Gardner's multiple intelligences (Gardner, 83), Piaget's concrete and abstract learning (Piaget, 72) and Vygotsky's cognitive socialization (Vygotsky, 78). Another finding, the importance of service learning to build character and establish a sense of place, echoes Arnold & Beal (Arnold & Beal, 95), Garbarino (Garbarino, 83) , Erikson (Erikson, 68) and Kohlberg (Kohlberg, 72). Once students have become familiar with teaching and learning styles, developmental characteristics and the nuts and bolts of writing a lesson plan, they tackle the issue of integrating technology into their classroom. So they don't see technology as an add on or gimmick to capture the students' attention, they work in teams to prepare a totally integrative theme based unit that blends all core subjects and delivers the unit via technology. At this point, I should own up to the fact that curriculum design is my passion and technology is not. However, like my students, I fully appreciate the power of technology and am learning, as my students learn, to incorporate it into my lessons.

Because of our earlier study, students already have a firm foundation in middle level teaching and learning before we begin our project. Teams discuss the theme, study grade specific curriculum and brainstorm ways to weave the unit together. Besides the technical aspects of webpage construction, both the students and I must consider the following:

1. Audience: The material must be developmentally appropriate, of high interest and deal with big questions and issues that would interest and inform early adolescents, be colorful, and be in an easy to read format.
2. Mechanics: The page must be easy to navigate, have clear instructions, an easy to read font, a reasonable text size and a print color that shows up well on a colored background.
3. Community outreach: The unit must incorporate service learning.
4. Team work: In addition to college students experiencing team work, the unit must provide opportunities for the middle school students to work together.
5. Learning outcomes: The unit must provide alternative forms of assessment.
6. Finally, the overall experience both in development and use of the unit must be positive and empower students to continue to learn and use instructional technology.

For this particular class, the teacher education students investigated a global environmental issue, the world's use of water resources, on a trip to the Exploris Childrens' Museum of the World. Ostensibly, they were at the museum to study how to put together a meaningful field trip, but were intrigued at how a teacher, whose class was visiting the museum, could make a world issue relevant to the lives of children in North Carolina. Because of the hurricanes, floods, local water shortages, runoff of hog waste and the appearance of dangerous organisms in rivers in North Carolina, the students decided to address the issue of use and abuse of water resources in North Carolina.

The class attended a research retreat at the Trinity Conference Center in Salter Path, NC. This was sponsored by NCSU's Humanities Extension Publications, a department of the University that supports education in southern coastal issues. At the workshop, students spoke with experts in the field of water resources. NCSU graduate students and professors helped the students research their topics and learn about the technology that would enable them to construct their web pages. Students learned how to use digital cameras and make a panoramic display. Laptops enabled teams to begin their web page construction. Time together away from the university enabled greater team bonding. Upon returning to the university, the students spent the rest of the semester researching their topic and learning about how to construct a website.

Teams, following the six points already noted, made their components stand-alone lessons. After numerous critiques and corrections, they combined them into one large website called SwimDog. SwimDog was the character that appeared on the homepage and helped students navigate through the entire website. Website components include: household tips on how to conserve water, study of specific local waterways, hurricanes and their effect on the coastal plain and beyond, the impact of the hog industry on the economy and the environment, the use of water by coastal NC Native Americans, young adult literature dealing with the coast and how to help your parents landscape the yard to retain moisture and conserve water. Students did much of their own research about their topic on the web, incorporated maps, photos and graphs into their activities, used digital pictures and built a variety of assessment forms into the lessons. They posed reflective questions that addressed moral considerations and the seriousness of the use of water resources issue.

This exercise demonstrated that a unique and meaningful topic can be a hook that makes learning basic technology exciting. It also illustrated that teachers do not have to be driven to incorporate technology for technology's sake, but that technology can be used as a vehicle to enable students to expand their approaches to teaching. Data collection by this researcher showed that by the end of the semester students had greater comfort and skill level in using technology. Those who were initially lacking in technology confidence felt better able to use it and incorporate it in their own teaching. Finally, the complete product, tailored for early adolescents, enabled students to see theory become application in dealing with adolescent development, integrative unit construction, team building and technology integration.

References:

Arnold, John, Beal, Candy. (1995). *Service with a Smile: Service Learning Projects in North Carolina Middle Level Schools*. Raleigh, North Carolina: North Carolina Middle School Association.

Erikson, Erik H. (1968). *Identity, Youth and Crisis*. New York, New York: W.W. Norton, Inc.

Gardner, H. (1983). *Frames of Mind: The theory of multiple intelligences.* New York: Basic Books.

Garbarino, James, (Ed.). (1985). *Adolescent Development, An Ecological Perspective.* Columbus, Ohio: Charles Merrill Publishing Company.

Kohlberg, Lawrence, Mayer, Rochelle. (1972). Development as the Aim of Education. *Harvard Educational Review, 42*(4), 449- 496.

Piaget, Jean (1972). *The Child and Reality, The Problems of Genetic Psychology*. New York, New York: Grossman Publishers.

Vygotsky, Lev. (1978). *Thought and Language*. Cambridge, MA: The MIT Press.

Innovative Course Design as Action Research: Instructional Technology for Teacher Education

Madhumita Bhattacharya
Instructional Science
National Institute of Education
Nanyang Technological University
Singapore
mitab@nie.edu.sg

Cameron Richards
Instructional Science
National Institute of Education
Nanyang Technological University
Singapore
crichards@nie.edu.sg

Abstract: This paper reports on an innovative approach adopted in the training of tertiary education teachers in instructional technology. An integrated approach was adopted to increase the motivation of teachers to use Information and Communication Technologies (ICTs) in their teaching-learning practices. The researchers describe their 'action research' efforts to design a course where participants learn and apply new ICT skills in a context of becoming 'designers' themselves of online learning resources. The notion of 'course design as action research' provided a focus for a flexibly structured course relevant to students needs and responsive to ongoing feedback in terms of a more proactive reflective practice. The paper argues that in the fast changing Internet age all teachers need to go beyond traditional approaches if they are to use ICTs well in their educational practices.

Introduction

The ability to use ICTs has become-is becoming as fundamental to a person's ability to navigate through both school and society as traditional skills like reading, writing, and arithmetic. In Moore's (1991) words, teachers awaken one day with computers in their rooms without having requested them. Most colleges and universities have Internet connections that provide students and faculty access to a world of information resources. The challenge for teachers and the administrators is integrating these resources into the curriculum.

According to 21st Century Teachers Network (21CT) Director Wade D. Sayer, persuading teachers to use new technologies has been tough. Unlike the GenX or NetGen of younger students, most teachers did not grow up around computers and the Internet. So using technology does not come naturally to them. Indeed, the thought of presenting a lesson in PowerPoint or of creating an interactive Web-based lesson is alien to many (Kurkowski, 2000).

McKenzie (1999) designates teachers in particular as late adopters and reluctant technology users. He outlines the following strategies for reaching late adopters and reluctant users: clarify the bottom line, focus on student performance, deliver a complete package eliminate, risk and surprise, speak their language, emphasise teams, find out what turns students on, provide rewards and incentives, and don't rely on pioneers alone to plan for reluctants. Similarly, we have discussed elsewhere our strategies for converting reluctant or intimidated students (especially teachers) into keen users of Internet in education (Richards & Bhattacharya, 2001a).

Effective integration of 'instructional technology' (IT) in teaching and learning demands the teachers to flexible, innovative, and effective reflective practitioners ready to trial and apply ICTs within their own educational setting. In other words, rule-based and transmission approaches to teaching are no longer sufficient in the "internet age" to productively address changing educational needs and requirements.

Background Information

All the participants in this course were teachers of English as a second language in China. These in-service teachers were invited to come to National Institute of Education, Singapore to pursue a Postgraduate Diploma Course in English Language Teaching. They were also required to undertake a unit on instructional technology. Many of these teachers were reluctant to learn about ICTs.

The strategic approach we adopted for this unit represented a refinement of our previous 'action research' experience and projects in and outside the classroom in India, Japan, and Australia teacher education Program. Both of us were newly arrived when asked to work together to take this particular course almost immediately. Little background information was available to us about the course-content for the course on "Instructional Technology". Some prior information about the participants was collected through casual conversation with the faculty members who had taught this course before and from the computer laboratory technicians. The gathered data was not very encouraging. As one source put it: "Some of these participants never handled a keyboard. It would be enough if they learn to do word processing".

All these bits and pieces of information served as a challenge for us to come up with an innovative course where the planned activities would act as motivator as well as help the participants to understand the relevance and application of ICT in education today. Also the course design aimed to have participants develop a core range of generic 'learning technology' skills relevant to the internet age especially, and applicable in various educational contexts. For instance, culminating activities in the course had participants upload and publish their animated presentations on web pages.

Design Procedure vis-à-vis Action Research

Traditionally, 'instructional design' refers to the process of instructional program development from start to finish. Many models exist for use by different levels of instructional designers and for different instructional purposes. However, the process can be summarized into five general phases as summarized by Braxton (1995): Analyze, Design, Develop, Implement and Evaluate (Fig. 1). Sometimes phases overlap and can be interrelated. The evaluation phase measures the effectiveness and efficiency of the instruction. Evaluation should actually occur throughout the entire instructional design process - within phases, between phases, and after implementation.

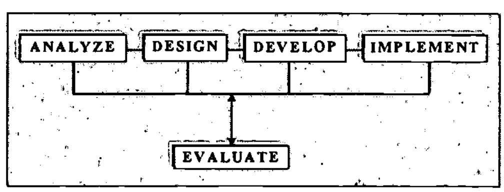


Figure 1: General Instructional Design Phases

According to Norman (1999) the focus of action research should be a specific problem in a specific setting. The emphasis is on precise knowledge for a particular situation and purpose. A proactive model of action research is concerned with innovation, change, and the ways in which new approaches; methods or even ICT programs may be implemented in on going systems. Such a framework of reflective practice is appropriate to any context where a specific problem needs solving.

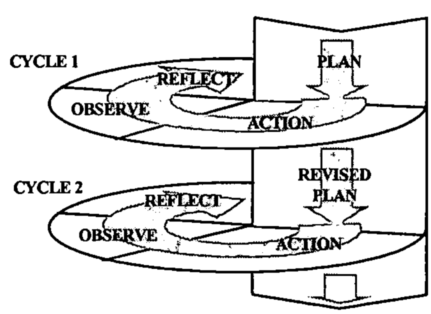


Figure 2: Action Research Design

BEST COPY AVAILABLE

Therefore, an action research approach was most appropriate to the situation described above where there was no prior preparation time was available for the design and development of the course.

The cycle of an action research project involves the identification of a problem, the collection and analysis of information, plan the action or intervention for implementation, followed by implementation and finally, monitoring the outcomes (Hitchcock & Huges, 1995). A representation of an AR protocol by Kemmis (cited in Hopkins, 1985) is given in Fig. 2. The protocol is iterative or cyclical in nature and is intended to foster deeper understanding of a given situation, starting with conceptualizing and particularizing the problem and moving through several interventions and evaluations.

In the present study we have used the action-reflection cycle as a means of in-service teachers' training, and thus a context for equipping teachers with new skills and methods. We came up with an innovative design procedure, which is a hybrid form of traditional instructional design and the action research design (Fig. 3).

Innovative Course Design

In accordance with the traditional instructional design, phases the we started with a pre-course survey questionnaire in order to establish the participants' previous experiences in computer and Internet usage in their day-to-day teaching situation. This established that the participants of the course consisted of mixed ability (mostly low ability) group of people in terms of computer skills and knowledge. We concentrated on the following conditions for effective adult learning (Engel, 1991) in the framing of an 'innovative course design model':

- Active learning through posing own questions and seeking the respective answers.
- Integrated learning, learning in a variety of subjects concurrently through learning in the context in which the learning is to be applied in real-life situation.
- Cumulative learning to achieve growing familiarity through a sequence of learning experiences that are relevant to the learner's goals, experiences that become progressively straightforward but more complex, as well as less non-threatening but progressively more challenging.
- Learning for understanding, rather than for recall of isolated facts, through appropriate opportunities to reflect on their educational experiences, and through frequent feedback, linked with opportunities to practice the application of what has been learned.

We faced a number of problems in the process of designing the activities and assignments in accordance with the conditions for effective adult learning. For example, the participants were not well known to each other, and did not seem enthusiastic about the idea of working together on a project or even helping each other. Therefore, group activities were organized in such a way as to allow the participants to become familiar with each other and work collaboratively towards a common goal. It took us some time to establish a rapport with participants, and for the participants to develop their confidence with ICTs.

Motivational strategies used for designing a model of instant course delivery were based on ARCS Model of Motivation developed by John Keller. According to Keller, 1983 there are four categories of motivation – namely; attention, relevance, confidence, and satisfaction. These categories represented a useful model for increasing the motivation of our course participants.

An action research methodology became the basis for strategically developing the course to the stage where it was increasingly being seen by participants as relevant and useful. An action-observation-reflection cycle was followed in the process of course design, development, implementation and evaluation.

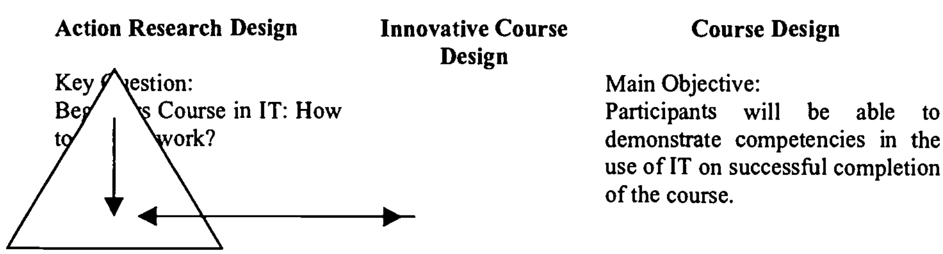


Figure 3: Innovative Course Design

The course design was an ongoing process of refining approaches to, and connections between, some of the core skills and knowledge in terms of ICTs. This process also involved motivational strategies for emphasizing realistic practical relevance, and promoting confidence and a sense of achievement in learners.

Our own enthusiasm and belief in the materials we were using was crucial in convincing the participants that instructional technology is a useful, important and relevant component of their teaching. A list of about twenty activities was made including the following: composing text in Microsoft word, demonstrating of skills such as cutting and pasting, opening email account and sending emails to the members of the group by forming mailing list, searching the internet for information on certain topics and listing the search strategies used, booking marking internet site for resource development and converting the same as a web page, evaluating web pages and learn about web page design, preparing slide show on MS power point, developing own homepages, uploading files in the web pages, etc..

Every week a hand out containing a short description of activities was given to the participants. The link between the different activities was crucial. Different activities listed according to Tab. 1 were skillfully interwoven to reinforce each other. The role of the 'teacher' in this course involved being part of a learning community as well as a general facilitator of learning.

What We Actually Did in the Course
Administration of Pre-course survey and test: • To establish the entry profile of the students • To survey the availability and usage of IT facilities in the actual work place.
Formulation of objectives: • To Develop a list of topics • List the skills and competencies related to each topic • Link different activities with the skills and topics • Ensure the internal link among the various activities.
Implementation of the course: • Catch attention through various activities • Show relevance by linking the activities • Monitor and observe students performance • Communicate continuously through email • Provide immediate feedback on students work • Establish rapport with the students • Provide support through help sessions for improvement • Facilitate learning and give confidence • Look back and modify objectives, strategies and activities.
Students' role: ➢ Demonstration of competencies by accomplishment of various activities individually and through group work ➢ Presentation of major task (integration of skills and competencies) established through group activities ➢ Completion of reflection survey, teaching and course evaluation forms.

Table 1: The Implementation Process of the Course

Typical examples of some of these activities are described in another publication (Richards & Bhattacharya, 2001b). While the activities are presented in an order, the sequence in which they are undertaken in practice is likely to be far less ordered. Recursion to previous stages in the process was possible because of the flexible nature of the framework, which avoided imposing arbitrary constraints. This was important to cater for the different skill levels, and the different stages of temporary frustrations encountered by learners.

Assessment and Feedback

The achievement of various ICT skills and general knowledge was assessed in terms of different activities and assignments to be completed or demonstrated by the participants within a stipulated time frame. This was necessary to bring all the participants up to a certain desired level of ICT competency at a particular period of time. Help sessions were provided whenever required for establishment of the given task. Formative evaluation was carried out through out the course. Finally, the demonstration of learning outcomes, i.e., the integration of ICTs in various educational activities, was done through both online and classroom presentations by the participants.

In addition to responding to all the problems faced by the participants throughout the process of teaching-learning, we also carried out a 'course and teaching evaluation' at the end by collecting feedback from the participants about the design and delivery of the course. An evaluation of 'innovative course design' was done by analyzing and interpreting the results of ongoing action research as well as student artifacts and feedback. The data was collected through various means such as questionnaires, email communications, classroom observations, task performance, and semi-structured interviews. This provided a basis for the research focus on the three key domains of learning: cognitive, psychomotor and affective including attitudinal changes and development of interpersonal skills.

Discussion

Even though educational institutions are busily filling classrooms with computers, a large percentage of teachers remain reluctant and skeptical. Unfortunately, much of the technology professional development of the past two decades was designed by technology enthusiasts with little empathy for reluctant learners - who have failed to convert reluctance into enthusiasm, and to address the very real concerns of many reluctant learners (McKenzie, 1999).

In this study we undertook the challenge of developing a course, which more effectively catered for reluctant ICT learners (the teachers). As a result, we came to appreciate more fully that these teachers have special needs, interests, and learning styles, which must be addressed with respect and ingenuity if we expect to see such teachers embrace the new technologies being placed in their classrooms.

In the training of teachers the main concern should be to make them more confident and enthusiastic about learning technologies so that they in turn apply the skills and knowledge in their own classrooms and outside the classrooms. In the "information age" our instructional methodologies must change from that of the "industrial age". Tab. 2 shows, what and how we, teachers, need to shift our educational paradigm from "old" to "new" according to the demand of the society.

INDUSTRIAL AGE	INFORMATION AGE
Standardisation	Customisation
Centralised control	Autonomy with accountability
Adversarial relationships	Co-operative relationships
Autocratic decision making	Shared decision making
Compliance	Initiative
Conformity	Diversity
One-way communications	Networking
Compartmentalism	Holism
Parts-oriented	Process-oriented
Teacher as "king"	Learner (customer) as "king"

Table 2: Shift from an industrial age to an information age (Reigeluth, 1996)

We must replace the piecemeal assembly of educational knowledge and develop larger chunks of expected knowledge and skills to be mastered in an integrated fashion (Andrews, 2000). We recommend instead a focus on demonstration of applied knowledge and skills.

It is unrealistic to seek "universal solutions" to implement ICTs into courses across different disciplines and subjects. Therefore a flexible 'action research' design complements the requirements to increasingly customise ICT courses for particular audiences and contexts. In sum teachers need to be designers of new courses integrating ICTs as well as effective reflective practitioners.

Conclusions

Integrating technology can be very rewarding for both teachers and students. It need not be daunting as it might appear at first sight. The crucial component of effective ICT integration is a framework, which adequately recognises and caters for learner motivation. The introduction of ICTs into education generally requires more innovative approaches to the teaching and learning situation as well as course materials and learning activities. This paper has argued that an innovative course design is required which is structured, developed and applied as 'action research' in the sense of proactive reflective practice.

References

Andrews, R. (November 29, 2000). A prescription for improving teacher preparation. *Education Week on the Web* from World Wide Web: http://www.edweek.org/ew/ewstory.cfm?slug=13andrews.h20

Braxton, S. (1995). *Models of instructional design*. George Washington University, Washington DC: School of Engineering and Applied Sciences from the World Wide Web: http://www.seas.gwu.edu/student/sbraxton/ISD/general_phases.html

Engel, C.L. (1991). Not just a method but a way of learning, in D. Boud & G. Feletti (eds.) *The challenge of problem based learning*. London: Kogan Page Ltd.

Hitchcock, G., & Hughes, D. (1995). *Research and the teacher-a qualitative induction to school-based research.* London: Routledge.

Hopkins, D. (1985). *A teacher's guide to classroom research*. Philadelphia: Open University Press.

Keller, J.M. (1983). Motivational design of Instruction. In Reigeluth, C. (ed.) *Instructional design theories and models*. Hillsdale, NJ: Lawrence Erlbaum.

Kurkowski, C. (Oct., 2000). *The Internet challenge: Teachers learn to balance Internet and classroom learning* from World Wide Web: http://currents.net/articles/1910,1,4,2,1001,00.html

McKenzie's J. (1999). *How teachers learn technology best*, The Twiggs Company.

Moore, G. F. (1991). *Crossing the chasm: Marketing and selling high-tech products to mainstream customers.* New York, NY: Harper Business.

Norman, E. (1999). Action research concerning technology for design and associated pedagogy. *Educational Action Research,* 7 (2), 297-308.

Reigeluth, C.M. (1996). A new paradigm of ISD? *Educational Technology,* 36 (3), 13-20.

Richards, C., & Bhattacharya, M. (2001a). Silk purses out of pigs' ears?: The conversion of reluctant or intimidated students (especially teachers) into keen users of the internet in education. *Proceedings of Society for Information Technology and Teacher Education International Conference, 2001,* Charlottesville, VA: Association for the Advancement of Computing in Education.

Richards, C., & Bhattacharya, M. (2001b). An introductory ICT skills program for teacher education: A case study. *Proceedings of Society for Information Technology and Teacher Education International Conference, 2001,* Charlottesville, VA: Association for the Advancement of Computing in Education.

Designing Web-Based Inquiry Simulations: Carolina Coastal Science

Alec M. Bodzin, Department of Education and Human Services, Lehigh University, USA amb4@lehigh.edu

Abstract In this paper, the design of Web-based inquiry simulations used in science classrooms for students to explore coastal science issues is discussed. In response to the demand of reform efforts and the lack of an appropriate design model approach, the Carolina Coastal Science project commenced with an idea to develop a Web site that was an organized, non-linear information resource in the context of an inquiry-based constructivist learning environment. Several modes of learning and teaching strategies were developed to be available to the users, including a role-playing simulation-debate, open-ended inquiries, guided inquiries, independent research, and cooperative group learning. The paper concludes with the claim that creating an instructional system in an online environment promotes the use constructivist theories in student learning due to the nature of their engagement within a hypermedia environment.

Introduction

An instructional system may be defined as an arrangement of resources and procedures used to promote learning (Gagne, R., Briggs, L., and Wager, W., 1992). The Dick and Carey (1990) systems approach model for designing instruction is the most well-known systematic instructional design model (Table 1). Traditional systems approach to instructional design by itself is not compatible with the concept of inquiry-based learning required in an online learning environment. The traditional systems approach is most directly applicable to the development of print instruction used in linear environments. The systems approach is being challenged by constructivist theories and models which recognize that social context, roles, and relationships are central to learning (Jones, Kirkup, & Kirkwood, 1993). Non-linear development models also recognize that learning is dynamic and unpredictable and that learners can and do make their own decisions about learning tasks (Thorpe, 1995). The systems model approach can be modified with the application of constructivist tenets to fit the conditions of non-linear, Web-based instruction. Constructivism is based on the premise that knowledge is not something that can be transferred from one person to another, but instead must be built by an individual. In a constructivist Web-based instructional system, students learn by doing. Knowledge is constructed through experience and learning is an active process.

In a constructivist Web-based instructional system, learning is based on students' active participation in problem-solving and critical thinking regarding a learning activity that they find relevant and engaging. The student's role is active, not passive in this setting. The Web-based medium becomes a learning environment that offers more than just text to read followed by a multiple-choice question to answer. This article describes how we used the systems approach model to provide a base for the design and development of an instructional system for an online learning environment for science education.

Reform movements in science education

New reform efforts taking place in science education today are framed by the tenets of constructivism. Constructivist theorists regard learning as an active process in which a learner constructs knowledge and understanding in an active manner through personal experience or experiential activities. Constructivism has its roots in twentieth century psychology and philosophy and the developmental perspectives of Piaget (1954), Kant (1959), Bruner (1966), and Vygotsky (1978).

Another focus of the current reform movement in science education is to develop students' ability of inquiry as well as understandings of inquiry (NRC, 1996). The national standard on scientific inquiry defines scientific inquiry as "diverse ways in which scientists study the natural world and propose explanations based on the evidence derived from their work" (NRC, 1996). Inquiry also refers to the activities of students in which they develop knowledge and understanding of scientific ideas, as well as an understanding of how scientists study the natural world. The process of scientific inquiry can be embedded in a Web-based instructional system. In such a system, the learning process is facilitated by an environment that emphasizes active student involvement. The Web-based medium becomes a learning space where students can make observations, classify objects, communicate observations and data, make measurements, formulate inferences, and make predictions. Furthermore, online scientific inquiry can be facilitated by resources students explore from distant geographical locations, including remote environments, laboratories, museums, and reference libraries.

Initial ideas for developing the Web-based instructional system

In response to the demand of reform efforts and the lack of an appropriate design model approach, the Carolina Coastal Science project commenced with an idea to develop a Web site that was an organized, non-linear information resource in the context of an inquiry-based constructivist learning environment. Most of the content would be original, created specifically for the site, while other material would be available via links to other sites.

One of the main goals of this project was to create an online environment for primary, middle school, and upper secondary students of varying abilities to engage in authentic scientific inquiry including: identifying questions that guide scientific investigation, using technology to improve investigations and communications, formulating scientific explanations using logic and evidence, recognizing and analyzing alternative explanations and models, and communicating and defending a scientific argument. This instructional system was created on the World Wide Web due to the fact that the nature of hypertext mark-up language (HTML) supports a user-centered learning environment through a non-linear information landscape. Also, a Web site is not a static entity. It can be a dynamic, changing entity in ways that are simply not possible with traditional printed material. Designing effective materials for science educators that provide instructional strategies based on constructivist approaches and various uses of technology was a challenge of this project.

Another important goal of the design and development process was to create a user-friendly interface that would make it easy for novice teachers and students to navigate within the Web site. Several modes of learning and teaching strategies were chosen to be available to the users, including a role-playing simulation-debate, open-ended inquiries, guided inquiries, independent research, and cooperative group learning.

The Carolina Coastal Science Web site

The resulting Web site, Carolina Coastal Science (available online at http://www.ncsu.edu/coast), contains 6 separate areas to engage students in different types of inquiry including:

1. An inquiry simulation in which students investigate the issues concerning the fate of the Shell Island Resort and then debate the future of this and other oceanfront structures threatened by coastal erosion;
2. An interactive photojournal that students can use to construct their own set of inquiry questions to explore;
3. An inquiry exploration in which learners investigate the issues concerning the relocation of the Cape Hatteras Lighthouse.
4. A section of "Inquiry Images" which can be used as whole class guided inquiry activities;
5. A "Coastal Research Technology" section that students can use to identify the scientific instruments used by oceanographers and coastal geologists to collect data;
6. An educator's guide with a variety of teaching suggestions to assist teachers with incorporating the Web site into primary, middle, and upper secondary school classrooms. The educator's guide also shows the correlations of the activities in the Web site with the goals stated in the National Science Education Standards and the North Carolina Science Curriculum Standards.

The Shell Island Dilemma simulation

The Shell Island Dilemma is a simulation, in which students investigate the issues concerning the fate of the Shell Island Resort and then debate the future of this and other oceanfront structures threatened by coastal erosion. As students engage in the investigation, they identify the social, political and scientific issues with which different stakeholders must deal. Students place themselves into the role of one of the stakeholders. Questions are used throughout the instructional system to focus student's thoughts during their exploration: "As you explore the resources, remember that you are in the role of a stakeholder. Think about the current North Carolina policies regarding the placement of hard structures in public trust areas such as the beach. How does the current coastal policy affect your vested interests as a stakeholder?"

Students are first presented with a video clip that introduces the dilemma. After being introduced to the problem, students are to select their stakeholder role. The roles for this simulation include: the Shell Island Resort homeowners, the Wrightsville Beach town manager, North Carolina Coastal Resources Commission members, coastal engineers, coastal scientists, and members of the environmental advocacy organization, the North Carolina Coastal Federation

Each stakeholder role Web page includes a brief description of the role and a recommended list of important resources to review. The resources include authentic documents and photographs, including aerial photographs illustrating the recent history of the migration of Mason's Inlet, photographs of the Shell Island Resort, a QuickTime Virtual Reality panorama of the inlet hazard zone, newspaper articles, statements from coastal engineers, permit applications to construct a hard structure, and meeting proceedings from the North Carolina Coastal Resources Commission. After students review the resources, they are to prepare a statement to decide what should be the next course of action regarding the Shell Island Resort. Students present their statement in a debate to decide the future of the Shell Island Resort. Each student also completes a "Position Statement Handout". After students have had enough time to review the resources and prepare their position statements, a class debate is held to decide the next course of action. When the debate is complete, students take a vote on the proposed solutions and conclude the debate when a consensus of 2/3 of the class agrees on a proposed solution. A "Student Record Sheet Assessment" is completed by each individual student at the conclusion of the debate. Both the "Position Statement Handout" and the "Student Record Sheet Assessment" can be easily adapted to be used with other controversial environmental topics such as solid waste disposal, water pollution, and air pollution issues.

Modifying a linear instructional systems model to the Shell Island simulation

Although this instructional system was designed to be delivered in a nonlinear environment, each stage of the Dick and Carey model was applied to the design. The Dick and Carey model was then augmented with constructivist components. The following explains how each component of the Dick and Carey model was implemented with regard to the instructional design and development of the Shell Island Dilemma simulation:

1. Determine Instructional Goal
The instructional goal arose out of a need for good environmental science teaching curricular resources that align with North Carolina Department of Public Instruction instructional objectives within the framework of the National Science Education Standards. There is currently a lack of inquiry-based simulations that North Carolina secondary school teachers can use in their classrooms that pertain to real-life problems in the state of North Carolina. The instructional goal of the system is for learners to identify the social, political and moral issues that different stakeholders must deal with in a current environmental science issue - the fate of the Shell Island Resort.

2. Analyze the Instructional Goal
When students are performing the goal, they investigate the issues concerning the fate of the Shell Island Resort. Students take a position for or against building a hard structure to protect the Shell Island Resort. Students develop a personal view of the issue. Students also identify environmental and economic concerns of various stakeholders regarding the issue.

3. Analyze Learners and Contexts
Learners use technology skills to explore an online Internet resource of information and use data to construct a reasonable explanation for an unresolved issue. Students must use critical thinking skills to explore an issue that is currently unresolved. Learners take a position in their role-playing that they may not necessarily agree with.

Students understand and act on personal and social interests that facilitate development of decision-making skills while experiencing science in a form that engages them in active construction of ideas and explanations. They also communicate investigations and explanations.

4. Write Performance Objectives

- Students will identify environmental and economic concerns that may result from building a hard structure to protect the Shell Island Resort.
- Students will list the 3 strongest arguments in favor of building a hard structure to protect the Shell Island Resort.
- Students will list the 3 strongest arguments against building a hard structure to protect the Shell Island Resort.
- Students will identify all individuals, interest groups, or organizations that are in favor of building a hard structure to protect the Shell Island Resort.
- Students will identify all individuals, interest groups, or organizations that are opposed to building a hard structure to protect the Shell Island Resort.
- Students will prepare a statement to decide what should be the next course of action regarding the Shell Island Resort.

5. Develop Assessment Instruments

Two different assessment instruments were designed to parallel and measure the learner's ability to perform the listed objectives.

1. After students review the resources, they prepare a statement to decide what should be the next course of action regarding the Shell Island Resort. Students present their statement in a class debate to decide the future of the Shell Island Resort. Each student completes a "Position Statement Handout" which is designed to assess the stated objectives before the class debate occurs.
2. A "Student Record Sheet Assessment" is to be completed by each individual student at the conclusion of the debate.

6. Develop Instructional Strategy

The strategy used in the instruction to achieve the terminal objectives was to design a role-playing activity. A current unresolved issue is selected - the fate of the Shell Island Resort, which is in danger of being destroyed by the migrating Mason's Inlet. Background information is collected. A real-life scenario is then developed. Stakeholder roles of real people are identified. Student roles are developed. An online research resource is created. A debate format is selected with set time limits. A time limit of two days (assuming 90-minute block periods) is given for student research and a period of 1-2 days is required for the actual debate.

7. Develop and Select Instruction

The instructional materials are developed in the context of a Web site called "The Shell Island Dilemma" which is a section of the Carolina Coastal Science Web site. An Educator's Guide is provided which recommends teaching strategies and assessments for implementing the instructional unit. A web site was chosen as the delivery mechanism of instruction because many resources students can explore such as newspaper articles are readily accessible in an online environment.

8. Design and Conduct Formative Evaluation of Instruction/Revise Instruction

The Shell Island Dilemma's formative evaluation was conducted in a small group setting with a group (n=13) of primary, middle, and upper secondary school educators enrolled in a graduate course on instructional design and evaluation of educational materials at North Carolina State University. According to Reiser and Kegelmann's (1994) review of current methods of evaluating instructional software, teachers are recommended as the individuals who should be responsible for rating software designed for delivery in classroom settings. Our evaluation group was presented with an overview of the activity and was then instructed to review the activity as a teacher and then as a student. Each reviewer completed an evaluation sheet of the Shell Island Dilemma activity. The evaluators were asked to rate the individual program features of the activity using a Likert-type scale, indicating the degree to which the feature is present. The features evaluated included instructional design, content, learning considerations, documentation, and the goals and objectives of the activity. The evaluators were also asked to look at the activity holistically and reach an overall conclusion based on their impressions. After the evaluators completed the evaluation form, a focus group discussion was conducted to discuss the strengths and weaknesses of the activity. The focus group made recommendations to modify the instructional program, including creating a specific description of each stakeholder within the instructional system and developing a "Student Record Sheet Assessment."

The Shell Island Dilemma debate simulation was field tested with a 10th grade environmental science class. The teacher of this class served as the evaluator. The students (n=30) spent two days in the computer lab gathering information on their stakeholder role and one day debating in the classroom. The evaluator stated that "the Student Record Sheet Assessment made sure that they (the students) were well-prepared for the debate." The evaluator also stated that the students' attitudes towards the activity were positive. Additional recommendations after the field test resulted in the creation of a "Position Statement Handout" to be utilized by students during their investigation.

9. Conduct Summative Evaluation

Summative evaluation was conducted by a marine education specialist, a coastal geologist, a university professor with expertise in curriculum and instruction, and two secondary school environmental science teachers. The evaluators were asked to examine the instructional effectiveness of the Web-based activity and provide their overall impressions. Each reviewer was requested to pay attention to science content issues, Web site navigation, Web site design, performance, and multimedia issues. The marine education specialist and the coastal geologist were asked to pay particular attention to the accuracy of the scientific facts and issues presented in the activity. The evaluators were requested to use the North Carolina State University's SERVIT Group's (Science Education Research in Visual Instructional Technologies) "Evaluating Science WWW Resources" paper as a guideline during their review of the Shell Island Dilemma. Reviews were returned to the instructional designer via e-mail. Each review was positive and no further recommended changes to the activity were stated. One reviewer even commented that this activity would be an effective tool for a social studies teacher to discuss the handling of social issues.

Constructivist Elements

The following elements were incorporated into the Dick and Carey model to create a constructivist environment within the instructional system:

- Learning occurs with the context of an authentic learning environment in which students use real information and make decisions in a learning environment.
- Learning occurs within the context of a social experience.
- Learners are provided an experience from multiple perspectives.
- Learners are provided with experience in a knowledge construction process.
- Learners are aware of their knowledge construction process.

Conclusion

The Carolina Coastal Science Web site is an instructional system defined as an arrangement of resources and procedures used to promote learning. Although the Dick and Carey systems approach model for designing instruction was designed for linear instruction, this approach can still be used as part of the instructional design and developmental process in an inquiry-based online learning environment. Creating an instructional system in an online environment promotes the use constructivist theories in student learning due to the nature of their engagement within a hypermedia environment. Although the systems approach is currently being challenged by constructivist theories and models which recognize that social context, roles and relationships are central to learning, the Shell Island Dilemma on the Carolina Coastal Science Web site illustrates that the traditional systems model continues to provide a base for the design and development of instructional systems in an online constructivist environment for science education.

References

Bruner, J.S. (1966). Toward a theory of instruction. New York:W.W. Norton.

Dick, W., & Carey, L.M. (1990). The systematic design of instruction. Glenview:IL: Harper Collins.

Gagne, R., Briggs, L., and Wager, W. (1992). Principles of Instructional Design (4th ed.). New York: H arcourt, Brace, and Jovanovich.

Jones, A., Kirkup, G., & Kirkwood, A. (1993). Personal computers for distance education: The study of an educational innovation. New York: St.Martin's Press.

Kant, I. (1959). Critique of pure reason. London: Dent/Everyman.

National Research Council (NRC) (1996). National Science Education Standards. Washington, DC: National Academy Press.

Piaget, J. (1954). The construction of reality in the child. New York: Basic Books.

Thorpe, M. (1995). The challenge facing course design. In F. Lockwood (Ed.), Open and distance learning today (pp. 175-184). New York: Routledge.

Vygotsky, L. (1978). Mind in society: The development of higher psychological processes. Cambridge, MA:Harvard University Press.

Principles for Designing Online Instruction

Harriett Bohannon, Ph. D.
Course & Faculty Development
Florida Gulf Coast University
United States
hbohanno@fgcu.edu

Abstract: Integration of technology in teaching and learning is part of the unique mission of Florida Gulf Cost University (FGCU) to increase access to higher education, not only in Southwest Florida, but beyond. To gain a better understanding of the web in education, the University organized a study group to review learning theories, and to reflect on the courses designed and taught at FGCU. The group identified guiding principles and best practices for teaching, managing, and supporting web-based instruction at the university. This presentation will address issues in web course design and development, web course management and institutional support. The issues will be examined from the perspective of faculty, administrators, and support staff. The goal of this work is to bring a better understanding of the use of the web in higher education, its impact on teaching and learning, and implications for support staff, faculty, and administrators in the university.

Introduction

Florida Gulf Coast University, America's newest, is part of the Florida State University System and has been chartered as a center for innovation. The state-of-the-art campus, opened in 1997 in a pine and palmetto forest in southwest Florida, weds technological sophistication with a fragile coastal ecosystem. As part of the founding faculty and staff we participated in the development of over 200 courses using the Internet as a major or supplementary part of the course designs.

After two years of operation, a study team of experienced on-line faculty and instructional designers from the colleges and the Department of Instructional Technology reviewed the literature and reflected on their own experiences. This helped to identify a set of principles for online instruction to guide continuing design, development and delivery of online courses at FGCU. This brief article gives a summary of four major topics - instructional design, course management, visual design, and support. The full text of the *Principles for Online Instruction* has been posted at www.fgcu.edu/onlinedesign

Instructional Design

Instructional design is one area in which guidelines are recommended for web-based online instruction at FGCU. After reflecting on our own practices and reviewing related literature, we identified a set of guiding principles for online instructional design. It is recommended that instructors conduct instructional, content, and audience analyses for online courses. The analyses can provide baseline data for online course design and lead to the formation of instructional goals and objectives.

To implement the principles in web-based online instruction design, we ensure that every online course at FGCU is created with clearly defined instructional goals, well thought-out learning activities, and appropriate assessment methods. We suggested using Bloom's (1956) taxonomy to define instructional objectives and determine areas of knowledge and skills for a course. In one online course, for example, we clearly related each instructional goal to 3 levels of learning hierarchy: information, application, and evaluation. This clarified the instructor's expectations and provided a student-centered learning environment in which they can appropriately allocate their time and energy to the course and take responsibility for their own learning.

Clearly defined instructional goals, on the other hand, enable the instructor to design specific instructional activities that are directed toward reinforcing and practicing skills and knowledge. While recommending that instructors engage students in active learning and provide students with meaningful learning experiences, we suggest a list of possible learning activities such as test/quiz, case study, journal, portfolio, simulation/games, and authentic projects for online instruction. Each activity facilitates students' achieving a specific learning goal in a course. For example, a self-assessing quiz in the Health Assessment course in College of Health Professions helps students to recall information such as concepts, principles and rules of health assessment. It draws students' attention to key concepts of the course and directs students to further readings and reinforcement activities if they fail to understand. The case study method is used in the Client Education in Health Care course where critical thinking and problem-solving skills are main course goals. Students were plunged into an authentic learning environment provided by case studies. They were not only asked to recall information, but analyze cases, identify problems, and find possible solutions.

In addition to the learning objective and hierarchy analysis, instructional analysis also involves content analysis, which usually determines the selection and sequence of a course content. Course content analysis for online instruction examines a course's suitability for online delivery. For example, an anatomy course in Arts and Sciences has both lecture and lab sections. Without a sophisticated online lab for students to engage in hands-on manipulation of each anatomic part of a human and assemble/dissemble parts, students will lose the opportunity to reinforce and integrate information learned in lecture sections. Student learning will suffer as a result. Such a course is not the most appropriate candidate for online instruction with present technology. As online labs become reality rather than dreams, the situation may well change. For the courses that are deemed not suitable for online instruction at present, a number of methods can be taken to meet the needs of distance students. Some of these courses are delivered in a flexible mode with both online and campus lab sections. In most cases, the course instructor is the most qualified person who can recommend the suitability of a course for online instruction.

Audience analysis for online instruction goes beyond traditional learner's personal characteristics, intellectual skills, and subject knowledge level. In audience analysis, we try to find students' technology skills and previous experiences with online instruction. For instance, a large number of online courses at FGCU are designed with a technology skill assessment and preparation module. Students are usually required to go through the module during the first week or prior to the first week of a course. Knowing students' technology skills, the instructor can direct students to technical support services for workshops, one-to-one training sessions, or online tutorials according to an individual's skill level. The instructor can even advise those whose technology skills are below the required level to take the course next semester. Since students are coming with different level of technology skills, it is suggested that the instructor should plan for naïve users of technology and provide basic instruction throughout the course so that all students have the same chance of succeeding.

While course design, which consists of instructional, content, and audience analyses, lays the foundation for an online course, appropriate interaction and course management ensure that students follow the course plan and achieve the instructional goals specified in a course.

Course Management

Planning for course management during the development and design stages may alleviate some problems encountered during the delivery of the course. We considered the following factors in the delivery of a successful on-line course: time commitment; tracking and evaluating student progress; providing adequate feedback; and communication.

An increased time commitment exists for both students and instructors. Instructors interact with every student on a regular basis, while students become independent, self-directed learners. Since a sizable amount of our instructors' time is spent on course management once the semester begins, we encourage the completion of total course design and development prior to Internet delivery.

Tracking and evaluating student progress starts at the beginning of the course by ensuring our students are capable of utilizing technology and by presenting consistent, organized lessons and assignments. Most of our students are required to attend face-to-face technology orientation sessions or participate in an on-line technology orientation. The on-line technology orientation is incorporated as the first lesson or part of the first lesson of the Internet course. Student progress is tracked through the course using on-line or hard copy grading grids. Students are evaluated by various methods: projects, homework, examinations (on-line testing or proctored), and on-line discussion.

When providing feedback to students, we use any available method such as e-mail, on-line discussion, telephone, or face-to-face meetings. We establish a clear pattern of response time that students can recognize as being efficient. Some of our on-line instructors tell students how long they can expect to wait for responses to e-mails. For example, some instructors tell students they can expect an e-mail response within 24-48 hours. We also notify students when assignments are received with a simple response of 'got it.' We have found students look for the 'got it' message. If they do not receive it within a reasonable time frame, the students will resubmit the assignment or check with the instructor as to whether or not it was received.

Communication is necessary to create and promote an atmosphere of caring and sharing. By setting clear expectations for students' on-line activity and allowing opportunities for social contact through chat cafes, face-to-face orientations, personal welcome letters, personal photographs, and student web pages with direct links to e-mail, a vibrant and orderly learning community can emerge.

Visual Design

Internet design is neither art nor science, but there is a 200-year history of design theory that informs online design. This theory suggests that form should not be separated from content and design should serve learning (Bull 1998).

Our experiences confirmed some suggestions from the literature. For example, information on a course web page should be organized to enhance learning and artistic design should not be the prime purpose. Navigation devices should also be carefully designed to orient the user and provide a sense of direction. Graphics should be used to support learning by presenting additional information without unnecessarily extending download time.

In the fast changing world of multimedia our designers not only had to determine the optimum use of text and pictures, but also consider various methods of incorporating audio and video. Numerous questions resulted. Should media be linked or streamed? Should web pages incorporate linear media such as PowerPoint presentations? Should web sites or pages be narrated and/or streamed? When are animations effective or irritating? The limitations of both student and equipment are critical when multimedia elements are incorporated. Do students have the right "plug-in" to display the multimedia? If not, can they install or download the plug-in? Are student modems fast enough to transfer information? An error in judgment here can create an absolute barrier to learning (Pavio, 1971).

Support

At FGCU we learned very quickly that the integrity of our on-line instruction, directly related to the support services we provide to the faculty and students who were involved in these courses. We divide our support services into three categories: Technical Services and Support, Academic Services and Support, and Library Support Services. Each one of these categories offer faculty and students help in facing the challenges of learning and succeeding in our web-based education programs. You will find specific examples of this support system at the following URL: http://www.fgcu.edu/onlinedesign/techsup.html

We provide **technical support services** to our faculty through: 1) workshops on using the technology to develop and deliver courses via the Internet; 2) individual training sessions (house calls) providing one-on-one instruction, and 3) instructional design assistance to faculty requesting their collaboration. Some examples of our technical support services for students are; 1) on-line tutorials, 2) class mentors who assist new students in navigating through the technology, 3) computer labs that provide instruction to students through workshops and lab assistance, and 4) demo courses for students to review prior to taking a web course

Academic support services provide our on-line users with admission forms, registration, and financial aid through the Internet. In addition, on-line tutoring, proctoring services, and on-line book ordering forms support those students who cannot come to campus. Students attending the University through distance receive a *Guidebook for Distance Learning*. This document assists them in their journey from admission to course completion. To assist DL students as they progress through their course of study, academic advisors in each of the colleges provide on-line orientation and advising through email and phone.

Library support services at Florida Gulf Coast University provide reference services and information-literacy instruction appropriate to meet the needs of distance learners. Providing course material on electronic reserve is a primary function provided by the library. In addition students have easy access to the library catalog, WebLuis. The FGCU library provides students with remote access to some full text journal articles directly through the Library web site. Students may use the form on the web site to request information or contact the reference staff for further assistance.

Implications

There are now over 200 web-based or web-enhanced courses being taught at FGCU and the whirlwind of activity that characterized our inaugural years has settled into more predictable routines allowing us to reflect on our experience and identify the implications of our work. First, the *Design Principles* provide a benchmark for quality assurance to guide the continuous improvement of web-based course materials. In addition the *Principles* provide a theoretical framework for designing faculty development activities that can people develop a working mental model of web-based instruction. For example, how can you incorporate an impassioned classroom debate into cyberspace? What will it look like, how will it work, and can it be as powerful a learning experience as its classroom equivalent?

The *Design Principles* also inform the decision-making and policy development tasks. What kind of technical support is adequate? How can we build a development team that provides the complementary skills for online course development while the faculty learn to work as online instructors and students become online learners? Online learning is fast becoming a fact of life in higher education and it requires that some time-honored practices be reconceptualized. It is our hope that the *Principles for Online Instruction* will inform the work of faculty, staff and administrators as they answer the question, "How might I use the Internet to enhance teaching and learning?"

References

Bloom, B. S. (Ed.). 1956. *Taxonomy of educational objectives.* New York: McKay.

Bull, K. S., S. Kimball & S. Stansberry (1998). *Instructional design in computer mediated learning.* (Report No. RC-021-439). Oklahoma State University. (ERIC Document Reproduction Services No. ED 417 885).

Pavio, A. (1971). *Imagery and verbal processes.* New York: Doubleday.

Effective Presentation Design ____

Terence Cavanaugh, Curriculum and Instruction, College of Education and Human Resources, University of North Florida, Jacksonville, FL USA. tcavanau@unf.edu

Cathy Cavanaugh, Curriculum and Instruction, College of Education and Human Resources, University of North Florida, Jacksonville, FL USA. ccavanau@unf.edu

Abstract: Presentation software tool are powerful and adaptable products for creating custom lesson and presentations. Electronic presentations are used for education in three delivery formats: Teacher to Audience; Teacher to Individual; and Student to Audience. Effective presentations follow established design principles and include interactivity such as brainstorming, organizing, and reviewing. Benefits of interactive presentations include sensory engagement through multimedia and easy reuse and updating of saved files. Tutorials, interactive lessons with feedback, review, and even testing, can be created as presentations. Using this approach, people can work at their own pace, and can experience individual remediation or enrichment. As a powerful learning activity, students can share their learning with their class, their parents, their community and the world. By developing a presentation or electronic portfolio, learners gain extensive experience with organizing information, and they experience the real-world task of communicating knowledge to others.

Desktop presentation creation software applications have become more than linear presentation tools. Software such as web page editors, *Inspiration* and *PowerPoint* now support branching navigation, custom buttons, interactive menus, program control, and web interactions. These features can make a presentation software tool a powerful and adaptable product for creating custom lesson and presentations. Realism is enhanced with multimedia elements such as sound, graphics, animation, photos, and movies into a presentation. In addition, a presentation can include Web links, and files such as databases, spreadsheets, and charts.

Presentation software can be used for education in three general formats: Teacher to Audience; Teacher to Individual; and Student to Audience. Teacher to Audience presentations involve the teacher or presenter sharing information with a group in the room or lecture hall or even across the web. A presentation can be used to do more than just to share information; it can also become interactive with brainstorming, organizing, and reviewing. Benefits of interactive presentations include sensory engagement through multimedia and easy reuse and updating of saved files. Teacher to Individual presentations are often delivered by way of a hands-on computer station. Here learners or small groups can work on tutorials, interactive lessons with feedback, review, and even testing. Using this approach, people can work at their own pace, and can experience individual remediation or enrichment. This type of program can be run in a computer lab, through a school's network, or on the World Wide Web. Student to Audience presentations allow a student or group of students to share their learning with their class, their parents, their community and the world. By developing a presentation or electronic portfolio, learners gain extensive experience with organizing information, and they experience the real-world task of communicating knowledge to others.

When creating a presentation, some design considerations are important. The effective application of these considerations make presentations easier to follow and understand and make the presenter appear more professional. A rule of thumb for designing a presentation slide or screen is known as the rule of threes: a slide should contain three base elements. The elements are generally a title or topic, text, and illustration such as diagram or chart. Slides are best understood when they are limited to a maximum of six text items as phrases or bullet points. Any more causes the text to become too small or presents too many points for the audience to keep in mind. More than five or six points should be grouped or "chunked" into subtopics, and then further information can be presented on its own side. Slides should include plenty of white space to avoid clutter. Material should not extend from edge to edge. People read faster and comprehend better when there are margins around material. Using a few high-contrast colors works best for a presentation: too many colors can become confusing, and a lack of contrast between text and background can render a presentation unreadable. While people prefer to read dark text on a light background, light text and dark backgrounds are also acceptable. The contrast must be sufficient.

One of the most basic elements to consider is the structure of text. Text should flow from left to right and down from the top. When adding moving text to a slide, place text so that it moves from the right to the left, because viewers are accustomed to reading from left to right. Younger readers prefer a simple font such as Arial, a sans serif font. Experienced readers change their preference to a serif font such as Roman or Times New Roman. It is best to use clean fonts and large font sizes. Decorative fonts should be avoided; classic Arial or Roman font types are preferable. A 20-36 point font size is effective for distance reading. A small increase in font size may make written material much easier for viewers to understand. While the larger words will occupy more space, the slide will look less crowded, therefore making viewers feel more comfortable. It is recommended to use both upper and lower case letters. The shape of the written word produces an image to a reader that helps in decoding, by providing clues to words. Avoid using multiple fonts within a document or presentation. A change in font or use of bold should be used to make important information stand out. Common word processor functions of bold, italicize and underline text can help viewers recognize important words and phrases. Research has found that the contrast that exists between yellow and black is greater than the contrast between black and white, making items highlighted in yellow much easier for most people spot and recognize. Since web use has become very common, it is advisable to be sparing in the use of the underline and limit it to URLs and references only, so that underlined words will not be interpreted as hyperlinks. Fonts should be clear and simple to read.

Multimedia is the combination of more than one form of media together to create a more powerful message. The media that are combined include: text, sound, graphics, and video. Multimedia is an excellent way to enhance a presentation. Graphics, sound, video, animation, and charts can all add to the message. Multimedia files should be kept small, since they will have to load into the presentation computer's RAM before being displayed and therefore may cause delays or pauses in the presentation. Additional media should be added to a presentation when they improve the quality, increase the impact of the message, or present information better than text alone. No image or sound should be included in a presentation just because it exists or it is possible to do so. An image or sound that has no bearing on the presentation can be more distracting than helpful.

Images included in a presentation should relate to the topic. Images may inform about the topic, to entertain, or to create an emotional response. The developer of the presentation must decide upon the goal of the presentation and which type of image or mixture of images is appropriate. Otherwise, the image may cause confusion, or it may distract from the message. The use of pictures will motivate viewers to read the text by breaking up the slide and creating more white space. Pictures should not be added to the content material in such a way that they interfere with the reading flow. It is not effective to place pictures in the middle of text; instead they should be located near the edges and some white space should be left around a picture to separate it from the text.

Moving pictures can be very disruptive because when we look at a slide our brains and eyes are automatically attracted to the moving object. As a viewer is reading across the screen, attention will be constantly drawn to the moving object. Motion can be added to a presentation in order to demonstrate action. Motion files include digital video, animations, morphs, and virtual reality. Any motion clip should be set to play once or a limited number of times. This approach provides the presenter with more control, and allows viewers to focus attention on other items on the slide after the motion segments stops. It is recommended not to set video clips to automatically start in a slide, but instead to allow the presenter to choose when to start the video segment. It may be better to have a small still image to click on that will start the video in a new window.

Sound adds realism and should be limited to uses that enhance the presentation. Avoid repetitive sound because they usually distract from the purpose of the presentation. A short tone is usually acceptable, but something longer that repeats is often disruptive and distracting.

It is best to test the presentation on other computer platforms and settings from the computer with which it was created. Different computer platforms and settings can cause changes in the display, and can cause disruption of the presentation by having a different contrast level or changing how the images appear. A presentation should also be tested on how it displays on with a projector or television. Computer monitors usually have a much better picture quality and show colors and contrasts much better than television screens or video projectors. A developer should be careful about including new features with a software program without knowing for sure that the presentation computer will have the same features. Also, if possible, test microphones, speakers and any other peripheral multimedia equipment needed before a presentation starts.

Letting teachers to interact with the idea of "Interactivity": What is "Interactive?"

Ozlem Cezikturk
University at Albany, SUNY, Mathematics Education
oc7815@csc.albany.edu

Gulcin Cirik
San Diego State University, Educational Technology
gcirik@hotmail.com

Murat Kahveci
Florida State University, Science Education
mkk8653@garnet.acns.fsu.edu

Abstract: This report is the findings of the research on Interactivity, to find the possible characteristics, contexts, limitations, and ideals, of Interactive Learning Environments for future mathematics and science education areas respectively. A web-based survey was used to gather data on diverse views of the academicians, researchers, and teachers. With the help of their answers and our own questioning, we were able to come up with a four-leave model for Interactivity, with social, intellectual, technical, and physical dimensions constituting the four leaves. We hope that this research would give an idea to teachers for what they should expect from "Interactivity" or not.

Introduction

The main question of this study is "How could we characterize an interactive learning environment?". Recently, interactivity sounds like a magical machine as if when you put something into it, it changes the entire nature of that thing to a something wonderful. We may choose to be puzzled by this "big" idea or we may choose to decide how to use this big idea for the benefit of effective instruction and learning of students through any kind of medium. With extensive research, we were able to come up with a huge range of divergent uses of the same term, in classroom, a textbook, a instructional program, a design issue, feedback-corrective loop, or even metacognitive act (Kirsh, 1997; Rose, 1999; Cezikturk, Kahveci, & Cirik, 2000).

One could be able to find an array of theories underlying the idea and its use in the educational practices. Vygotskian social constructivism stresses the importance of interaction between learners, their peers and teacher for an effective learning environment. One of the first tenets of cognitivism is "metacognition" and it stands for interaction within each person's mind for their own thinking. Informational processing theory points to the both interaction between components of thinking process (short-term memory, long-term memory and senses), and interaction between several media to have a general understanding of something. Behaviorism favors feedback, which can be thought as interaction, either (Duffy & Jonassen, 1992; Pressley & McCormick, 1995).

Procedure

What is Interactivity or what should it be? The answers to this question is thought to be achieved both through the data collection via a web-based survey over Internet (one of the mediums that is generally thought to be "Interactive") and also with some direct questioning and discussions with researchers and teachers. Last year, we have asked to two distinct samples of researchers (one group was our listeners on MSET, 2000, and the other group was ACRIDAT* members in University at Albany, SUNY) on their ideal "Interactive Learning Environment" for students, and faced with a pile of innovative responses ranging from an environment for communication in a variety of learners in which the learners have the capability of observing, experimenting, debating, playing, navigating with and within a huge information system to a learning environment, which looks like star trek module; a holographic n-dimensional shared environment, very powerful palm sized computers, with a lot of opportunities for hands-on experiences or manipulatives.

The survey has included two main web pages, first being the title page, second being the main survey. In the second part there have been two main parts; one for detecting demographics of our sample, and one for main items related to Interactivity. Part two included 19 items, 7 open-ended and 12 closed-ended items respectively. We have thought that close-ended, highly rank order or checklist items would give the respondent a chance o see our stance, and open-ended items would enable them to state their own views directly to researchers. Main items functioned to identify the contexts (social interaction research, technology integration, programmed instruction) in general as well as the specific contexts as discussions, lecture, debates, simulations, narratives, problem solving, etc, the place of occurrence (student to medium, student to teacher, student to content, computer to computer, a novice and an expert, etc.), and the context which would stimulate most (real time and time-delayed, as well as WWW and IRC, MUDs, MOOs, as much as Virtual Reality. Items also designed to identify the examples for both instructional methods, and activities for most Interactivity. We have decided our respondents to be academicians, researchers as well as teachers of subject domains as mathematics and science. Although our study is situated in the context of mathematics and science education, the results of the study may perfectly serve for the purposes of other subject domains as well.

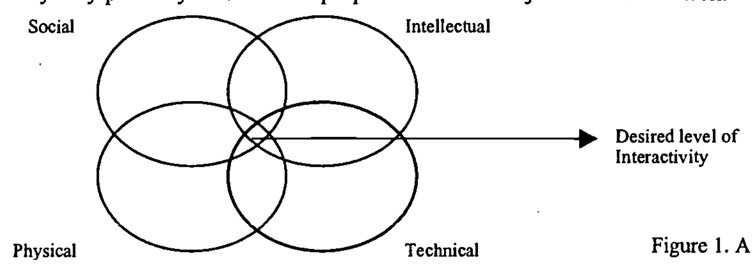


Figure 1. A four leave model for interactivity

Results

Survey data indicated that there are mainly 4 dimensions to Interactivity. *Social* dimension is thought to be including one to one (student to teacher, novice to expert) as well as a group activity (discussions, debates). *Intellectual* refers to interaction with content, or with text. *Technical* is meant to be between computers, human-computer, and between soft wares. Finally, *physical* refers to stimulus-response in especially experiments, student-centered learning, action, movement, etc. These are not distinct categories. They should have in common, as well as different aspects than the others. Figure 1 shows that those 4 leaves can be thought as 4 intersecting sets. Their utmost intersection indicates where Virtual reality lies. It is energetic, it is supposed to be a copy of the reality, hence social (think about role playing, MUDs, & MOOs). It is technical since it requires a highly developed interface of human-computer interaction. And it is intellectual, since it is partly not real. It needs to be interpreted by the brain for common elements to the reality, and differences. It is physical, since it requires movement, and active student engagement as well. We are certainly aware the cost of time, and material of VR technique in the classroom. Even with narratives in a classroom, teacher can make students to learn by doing, with the help of at least a poster, a relevant schema, or a computer with Internet for achieving technical interactivity, with discussion groups and making students to reflect on the narrative, a lot more can be achieved. However, VR can be used for modeling real classroom experiences, and for impossible experiences. The remaining part is to find a way to model VR in a classroom.

References

Cezikturk, O., Kahveci, M., & Cirik, G. (2000). Interactivity in Mathematics and science education. *MSET 2000.*, Association for the Advancement of Computing in Education, San Diego, CA.

Duffy, T. M. & Jonassen, D. H. (1992). *Constructivism and the Technology of Instruction: A conversation.* Lawrence Erlbaum Associates: London, UK

Kirsh, D. (1997). Interactivity and multimedia interfaces. *Instructional Science, 25*, 79-96.

Rose, E. (1999). Deconstructing interactivity in educational computing, *Educational Technology, 1,* 43-49.

Pressley, M. & McCormick, C. (1995). *Cognition, Teaching and Assessment,* Harper Collins College Publishers, NewYork, NY. s

Qualitative Data Analysis to Ascertain the Benefits of a Web-Based, Teacher Oriented Project

April A. Cleveland, Department of Mathematics, Science and Technology Education, North Carolina State University, United States, ajclevel@unity.ncsu.edu

Dr. John Park, Department of Mathematics, Science and Technology Education, North Carolina State University, United States, park@unity.ncsu.edu

Abstract: Qualitative data is often overlooked when judging the success or failure of a web-based project, but can be a valuable resource in evaluating the potential needs and experiences of the participants. Research has determined that the use of both qualitative and quantitative data as an analysis tool to determine the success or failure of a venture provides a holistic look that provides insights that may not have been obvious in a quantitative only type evaluation. This paper will analyze the use of qualitative data to determine the benefit of a teacher oriented web-based project. The participants, who were upper level elementary, middle and high school teachers, participated in the web project in one of two ways. One, by attending a three-hour workshop in which they were introduced to the online project and instructed in its use. Secondly, they could participate online, by completing a registration form and receiving a password that allowed them to access a web tutorial as an introduction to the project. The purpose of this analysis is to determine if and to what extent peer-to-peer interaction and face-to-face interaction with a workshop leader affects the involvement and participation in a teacher oriented web-based project.

Introduction

Qualitative data is often overlooked when judging the success or failure of a web-based project, but can be a valuable resource in evaluating the potential needs and experiences of the participants. Patton (1980) feels that qualitative data "permits one to understand the world as seen by the respondents." By using a form of open-ended questioning, the respondents are free to express their opinions and needs without the predetermination that often is associated with questionnaires and surveys. An example of open-ended questioning associated with this project is a question that gave the participants an opportunity to explain how they planned to use the project in their classroom once they completed the workshop or the web tutorial. This type of question contains none of the predetermination that would be associated with a question that provides a list of options from which the participant can choose. This type of questioning also provided the researcher with the opportunity to evaluate the respondents' comments and place the responses in a category designated by the researcher, if necessary. This is not to say that quantitative data is not useful in evaluative situations, but a combination of both quantitative and qualitative data provides a holistic view of the respondents' use and involvement in the project (Levin, 1990).

Data Collection

The data, which was analyzed, included field notes compiled by the researcher who acted as a participant observer in the role of workshop leader, videotapes of workshop participants, listerv interactions, and individual emails. Videotape data was compiled with the field notes as a means to determine the types of interactions between participants. For example, the formation of work groups as opposed to working individually during the course of the workshop (Winschitl, 1998). The participants took part in the project in one of two ways: by attending a workshop or by participating online with the use of a web tutorial. In the latter case, the data was submitted on a form via email or regular mail depending on the type of data being collected.

The researcher acted as a participant observer, which increased the opportunities for interaction and also allowed a view of the project as seen through the eyes of the participants. As a participant-observer, Patton (1980) feels that the direct personal contact and experience in the project provides the researcher with valuable insights that would otherwise be lost in a quantitative only type evaluation. Patton (1980) feels that the role of a participant observer may change over a period of time. The researcher may begin as an onlooker, almost an outsider, and gradually become involved to the point that he or she may begin to fully experience the program in a similar manner to the participants. This allows the researcher the opportunity to develop an insider's view so that they can see as well as feel what is occurring throughout the duration of the project. In observing and participating in any type of project, it is of the utmost importance to avoid equating the success of the project with only the formal activities of the program.

Patton (1980) also states that a qualitative approach provides a researcher with the opportunity to look at informal patterns and "unanticipated consequences." An example of such an "unanticipated consequence" may be the creation of a teacher support system in which teachers have the opportunity to interact and share resources. Since teaching is traditionally known as an isolating profession, this type of interaction is often not available to teachers during their daily routines. But this type of interaction is necessary for the continual growth and development, which should be an integral part of the teaching profession.

These types of interactions were noted frequently among the workshop participants. For example, as the teachers interacted throughout the course of the workshop they began talking about resources they use or contact people for specific items, oftentimes exchanging email addresses and phone numbers before the workshop concluded. In addition, participants who often seemed to prefer to work alone at the beginning of the workshop were interacting and discussing their findings and results by the end of the workshop.

The participants, both workshop and online, were also subscribed to a listserv as a way to interact with their peers and also the researcher. The researcher sent out messages approximately twice a month to encourage participation by the collection of water quality data and its submission to the water quality database. Participants were encouraged to use this venue as a means to exchange information or ask questions of the other participants. The following is an example of a request from a web participant:

> "Hi-we are testing local stream water in Wilmington DE using the materials from the water what ifs workshop. When we are done we will post the results on the web site. A very capable 6^{th} grade student is helping run the water quality tests. He posed an interesting question: Is there a maximum safe level of dissolved oxygen in a given body of water? Feel free to respond. Thank you!"

This particular request for help received three responses about dissolved oxygen levels. This type of interaction helps to reduce the isolation of the teaching profession and opens doors for teachers to interact not only with other teachers, but also students who may be involved in independent type projects where help is needed after school hours. In addition to the listserv, individual email was also used as a means of contact and enabled the researcher to request information from the participants who were not responding in a timely manner.

Conclusion

For workshop participants to have increased interaction and to form working groups, the number of participants needs to be increased. An increased number of participants tend to facilitate the need to work together due to the size of the facility or the available lab materials. One three participant workshop group worked individually for the majority of the workshop and interacted more often with the workshop leader than the other participants, whereas a workshop group of ten interacted primarily with each other rather than the researcher. As the number of workshop participants increased, so did the number of interactions among the participants. A larger number of participants allowed the workshop leader to maintain the role of a coach or a guide as the participants' questions were normally addressed by their peers.

A major part of the impact of the program may be occurring in the informal, unstructured portion of the project, on the periphery of the structured activities, outside the formal workshop setting. The listserv was one of the activities that occurred on the periphery of the structured activities, but provided a way for the teachers and the researcher to stay connected after the initial interaction. This gave the teachers the availability of a support system on which they can rely for additional help if the need arose. Both the use of the listserv and the availability of the researcher via email, were a support system that was utilized primarily by the web participants in this project. In addition, the majority of the water quality data collected and posted to the database came from the web participants. Interaction between the researcher and the workshop participants was minimal after the initial interaction in the actual workshop. By collecting and evaluating qualitative data, these types of activities and interactions can be evaluated and added to the researcher's report as an additional component in conjunction with the quantitative data analysis. In conclusion, by looking at the informal activities associated with this project, the researcher was able to see that it did provide benefit to a number of the participants in the form of a peer support system. These benefits would not have been established in a quantitative only type study.

References

Brand, G.A. (1998) What Research Says: Training Teachers for Using Technology. Journal of Staff Development, 19 (1), 10-13.

Gagné, R.M, Wagner, W. & Rojas, A. (1981) Planning and Authoring Computer-Assisted Instruction Lessons. Educational Technology, 21, 17-26.

Levine, H.G. (1990) Models of Qualitative Data Use in the Assessment of Classroom-Based Microcomputer Education Programs. Journal of Educational Computing Research, 6 (4) 461-477.

Patton, M.Q. (1982) Qualitative Evaluation Methods. Beverly Hills: SAGE Publications

Windschitl, M. (1998) The WWW and Classroom Research" What Path Should We Take? Educational Researcher, 27 (1) 28-33.

Yekioyd Statistics and Their Interpretation

Steven Dickey and Kevin Zachary
Eastern Kentucky University
United States
ecodicke@acs.eku.edu

Abstract: This paper introduces a family of statistics for item analysis. Their construction is based on a model of perfect internal consistency between each item and the test as a whole. Weighted versions of the statistics mirror the concerns of an educator in evaluating test items. In addition to identifying flawed test items, these statistics also indicate something of the nature of the flaw. Another advantage of the statistics is that their interpretation can be derived directly.

In these two pages, we will introduce three item analysis statistics. We refer to an exam item with difficulty statistics p and q that is answered by n students. In a case of perfect item consistency, the np top scoring students will answer correctly and the nq lowest scoring students will answer incorrectly. Such a situation describes what we will call the Yekioyd model. The cliché that you either knew it or you didn't is the source of the acronym Yekioyd.

Deviations from the model occur when either a student in the nq lower scoring group answers correctly or a student in the np higher scoring group answers incorrectly. The statistic described below, YB, has a value of zero in a situation of no deviation from the model. Its design leads to a value of one in the situation of maximum possible deviation from the model. The students are ranked in descending order by their overall percentage scores on the test and divided into two ranges. These ranges are the upper np students and the lower nq students for the p and q of the question. The maximum possible number of deviations is the smaller of 2np and 2nq. Half of the deviations must necessarily occur in each range. For each range, the deviation variable D is constructed. Its value is one for all upper range students who answered incorrectly and all lower range students that answered correctly. Otherwise, its value is zero. Since the Yekioyd model is a model of perfect internal consistency, the YB statistic is an internal consistency measure. The basic Yekioyd statistic YB is given by:

1. $YB = \sum_{[i=1, n]} D_i \div$ [the smaller of 2np or 2nq]

Imagine a rank ordering of the scores of the higher scoring np students followed by a rank ordering of the scores of the lower scoring nq students. Deviations are of severe concern if they distant from the dividing boundary and of nearly no concern if they are near that boundary. The shortcoming of the YB statistic is that it treats a deviation as equally important no matter where it occurs. The desired construction is a weighted statistic that reflects the greater undesirability of deviations that occur far above or far below the line of division between the upper and lower ranges. Such weights should reflect the distance from the line of division to the number line location at which the deviation occurred. This division point will be calculated by the average of the scores of the two students on the boundary of the np/nq division. This average serves as the boundary value, B.

Once it matters where in the rank order a deviation occurs, deviations in two ranges take place in noncomparable environments for any value of p other than .5. For this reason it is necessary to treat the two ranges separately. Two Yekioyd statistics, an upper range YU and a lower range YL, are the result of this separation. This division brings additional benefits. The measures indicate two different types of question flaws and directions for improving questions (See the discussion of interpretation below.).

For each student, a value of the weighting variable W is constructed from the student's score and B. In the upper range, B is subtracted from the student's score. In the lower range, the student's score is subtracted from B. W is not a weight in its own right. The actual weight given to a deviation occurring with a particular student is the W value associated with that student divided by the base for the weighting. In each range, the base for weighting will be the summation of W values in that range.

Both statistics will be scaled by a factor reflecting the number of locations for deviations divided by the number of possible deviations. Multiplication by the scaling factor provides for a maximum possible value of one for YU for all possible p values. The result of this treatment is that the statistic treats questions with different p values comparably. The scaling factor has a value of one for YU if p ≤ .5 or for YL if p ≥ .5. In these situations, the number of possible deviations is equal to the number of rank order locations. It was noted earlier that the maximum number of possible deviations in each of both ranges was the smaller of np and nq. We will represent this smaller one of the two values with [np:nq].

Let i be the index of the rank order of student scores, with 1 assigned to the highest student score and n assigned to the lowest student score. The value of the upper range Yekioyd, YU, is given by:

2. YU = (Σ[i=1, np] Wi(Di) ÷ Σ[i=1, np] Wi)(np ÷ [np:nq])

The value of the lower range Yekioyd, YL is given by:

3. YU = (Σ[i=np+1, n] Wi(Di) ÷ Σ[i=np+1, n] Wi)(nq ÷ [np:nq])

The contribution of a question to the consistency of a test can be measured in terms of deviations. Deviations occurring are a negative contribution. Deviations not occurring are a positive contribution. A YB value of one means that the question contribution to the test is entirely negative. A value of .5 means that a question is adding to and taking away from the consistency of the test in equal measures resulting in a zero net contribution. At .25, the contribution of the question to the consistency of the test is half of its potential. These statements apply equally in interpreting YU and YL. The table below further summarizes interpretation of the Yekioyd statistics.

Y Value	Deviations Not Occurring	-	Deviations Occurring	=	Net Contribution
1.0	0		2nq		-2nq
.75	.5nq		1.5nq		-nq
.50	nq		nq		0
.25	1.5nq		.5nq		nq
0.0	2nq		0		2nq

(* The table applies the assumption that nq < np. Otherwise, np would appear instead of nq, with no change in implications.)

YU, the upper Yekioyd, primarily responds to `trap' characteristics or vagueness in a test question that are throwing well prepared students off the correct answer. YL, the lower Yekioyd, primarily responds to weak distractor answers and question structure that points out the correct answer. Questions that are easily guessed are identified by the YL statistic.

In this paper, we have introduced three item analysis statistics. Software for calculating these statistics has been developed by Kevin Zachary. Longer versions of this paper are available. Contact Steven Dickey at ecodicke@acs.eku.edu for further information.

gLearning: The New e-Learning Frontier

By Steven Donahue
sdonahue@broward.cc.fl.us

Emerging technologies have always had an innovative impact upon the language : horse-less carriage became car ; steamship became ship; wireless cell phone is becoming just phone. Eventually the "distance" portion of distance learning will also fall away and become just "learning". But, will e-learning be the same mode of learning? Or will it necessarily take on a new meaning; hence, a new linguistic form?

There are three problems associated with translating a face-to-face classroom into a Web-based one. First, there is the CONTENT problem of rendering traditional content suitable for Web delivery. Second, there is the DELIVERY challenge of distributing the learning material anywhere, anytime. Lastly, there is the PARTICIPATION aspect of ensuring that everyone is optimally involved in the learning process .

By learning it is typically meant the process of Recognition, Re-organization , and Regurgitation or sharing of some knowledge object. For example, an ESL learner might learn to recognize the distinction between /f/ and /v/ ; re-organize his or her native phonology system so as to adapt /f/ or /v/ into the new English system ; regurgitate that new knowledge in a reflective test or through peer interaction. The context or the physical setting of this learning experience has been since antiquity a room, seats, a writing board, and written or oral tests of some sort or another.

Imagine that day when you had the perfect teaching experience as a teacher. Or that day when you had the peak learning experience as a student. When all the students are a buzz of activity, the teacher's teaching plan unfolds like an orchestrated piece, and all the pedagogical elements are in harmony. When there are no tardy students, no absences, and no daydreaming. Imagine a day when students smoothly break into groups and help each other learn. A day when the students madly scribble notes as the teacher speaks and fill in those blanks in knowledge so that that magical "learning moment" crystallizes and sends the students out of the classroom with an exhilarating warm glow that has positively transformed lives.

Dream on. The perfect days are rare. The difficulties inherent in having twenty-five students rendezvous at a definite point at the same time and in the same ready-to-learn frame of mind pose daunting barriers. Cars, jobs, babysitters all intervene to thwart the perfect learning moment. On the other hand, the efforts thus far to harness the power of technology to affect the perfect learning moment have been wanting. A simple transfer of the architecture of the face-to-face classroom to a Web-based environment has not been a cure-all for the deficiencies of the onground classroom it was intended to replace. Indeed, the early attempts at distance education have been marked in common by a lack of imaginative re-engineering.

In fact, the "distance" has yet to fall away from "learning". A plethora of terms have been proposed for this new form of e-learning: "Learnativity", "e-Learning", "CALL", "CBT" and so forth. In a linguistic turn, we propose the term **"gLearning"** for a re-engineered learning experience befitting the full, unleashed power of the Internet. The new coinage is composed of "***glean***"—picking up nuggets of sustenance after a rich harvest and "***learn***"—the personal ownership of knowledge. The "g" also harkens to "global" or invokes the phonetic intensive words "gleam", "glint", "glisten" and has connotations of shimmering light; hence, enlightenment through learning.

The definition of "gLearning" [pronounced either "gee-learning" or "glurning"] revolves around three principles: gLearning is <u>Adaptable</u>; gLearning is <u>Ubiquitious</u> ; gLearning is <u>Uniform</u>. In short, "gLearning" is not Learning—it is not place-bound, role-bound, or time-bound. In fact, it is a new form of Learning and Teaching where both learner and teacher assume new, exciting roles.

<u>Adaptable</u>. In the earth-bound, role-bound classroom, whether it be grammar, pronunciation, or math, the teacher delivers a lesson that is new material for some and known material for others. It is the "shotgun " approach. In the gLearning classroom each student receives only the particular lesson or incremental learning step as required. Customized learning objects are filtered to the learner in a hierarchy that maximizes acquisition of new material. Moreover, the student owns this customized material and can interact with it individually until the lesson has been

mastered. Each student owns and controls their personal "Bell Curve" for learning and mastery of a subject area. (Figure 1).

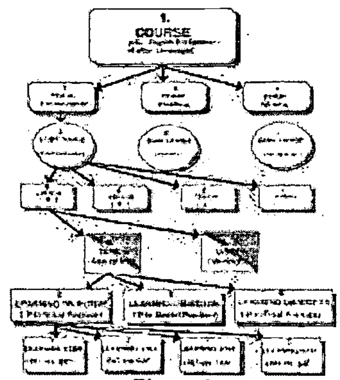


Figure 1

Ubiquitous. The traditional classroom is necessarily place-bound and time-bound. The catchword is that they are "synchronous" or in real time. The online classroom can operate outside of the constraints and be "asynchronous." However, the true power of the Internet has not been realized because the architecture of most course management systems looks suspiciously like the place-bound classroom, and the roles of the teachers and learners eerily echo the role-bound onground class. (Figure 2)

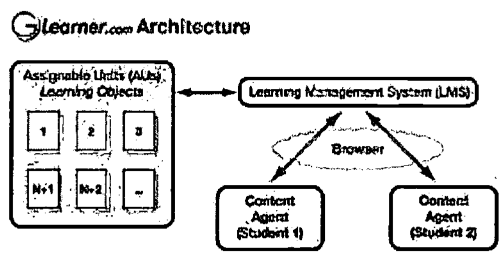


Figure 2.

Uniform. The unevenness of the conventional classroom is a multivariate problem that defies solution. Teachers, students, text, assignments, grading rubrics, exigencies, and policies all conspire to make each class a unique "pot luck" experience. In the gLearning environment the roles of the student and teacher are radically altered. Moreover, their rights are clearly stated and delineated in an Online Gleamer's Bill of Rights. [see note]. With the gLearner, the students exchange purposeful, standardized, pre-formed "Participation Units" or "e-Learning Currency" that must be spent and which ensure that all students cooperate in teams, circles, communities and so forth. (See Figure 3)

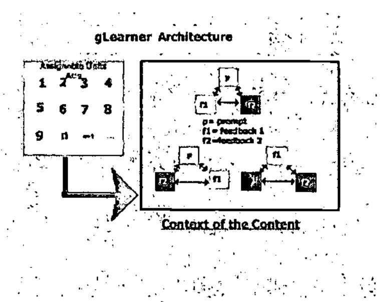


Figure 3.

gLearning sounds great, but how does it work?

Computer-Based Training and Testing (CBT) and has been around almost since computers have been invented. CBT has been used to teach and test everything from accounting to zoology, from how to perform surgery to how to talk to customers on the phone. CBT got a big push in 1974, when the National Science Foundation awarded grants to two universities to further the use of computers in learning. This grant eventually spawned several CBT-based authoring systems (the hardware and software used to create CBT) and through those several thousand courses.

With the advent of the Web in the early 90s, CBT began to move to the Internet, transforming into Web-Based Training (WBT). Whereas CBT was usually delivered over closed networks in an organization or distributed on CD-ROM, WBT allowed a course to be created and placed on one computer (a "server") to which anyone in the world with the proper authorization could connect and learn.

This new approach has provided several distinct advantages, not the least of which is easy maintenance of a course. If a problem is found and fixed, no new CD-ROMs need be sent. A change is made on the server, and that's that.

Normally, learners who are taking a web-based course stay connected to the Internet for the duration of a session, during which time the lesson materials are "streamed" to the user. Streaming refers to the downloading of course materials to the user a little at a time, so that it appears that the course is running smoothly.

Unfortunately, this is easier to envision than to make a reality, especially for those who live in areas where connections to the Web are slow or sporadic. A constant connection may not be possible or the connection may be slow. Other methods must then be employed.

One method is to download an entire lesson at a time. This, however, can be time consuming and the user is not able to study the lesson until it has completed downloading, an obvious disadvantage. In addition, if the connection to the Internet is interrupted during the download, the partially downloaded file would normally have to be scrapped and the download restarted the next time the user connects.

I-CALMS: Adaptable

A more viable approach includes that employed by the gLearner system— I-CALMS : Intelligent Content Adaptive Learning Mangagement System. Here, the user downloads a small diagnostic test first, after which the Internet connection can be broken. After answering the questions, gLearner will determine which items the user needs to study. After checking to see if any of those items are already resident on the user's system, it will proceed to reconnect to the Internet and download in the background any items the user still needs. When it has finished downloading those items, it can then disconnect from the Internet again and the user is able to continue studying. If the Internet connection is accidentally broken (for whatever reason), items already downloaded will not need to be retrieved again.

I-CEGS: Ubiquitous

This basic approach is encompassed in I-CEGS : Intelligent Content Engine Generator System , an " intelligent content engine" which can work with any collection of lesson content files. Following some basic rules, it takes content pertaining to the current lesson and arranges it correctly for the user to study. It also collects data regarding student progress and question item analysis. The "intelligent" part of the content engine is the new role for the teacher or content expert who consult on a page-by-page basis to rapidly "glearn" a course and adapt it to the Web. The role of the teacher has been radically changed. In the recent past, the terms facilitator and coach have been used to describe this new, emerging online role for the teacher. In gLearning, the teacher helps define what is the "learning moment" for a particular knowledge domain. The gLearning teacher becomes a "Participation Expert" who pre-defines the "e-Learning Currency" that must be spent during the course of a particular online course.

Through an Intelligent Content Engine, the teacher helps create "twinned" software that enables them to follow a student's learning progress on a page-by-page basis. It is as if the student and teacher collaborate and create a living and breathing text that contains knowledge mutually constructed. A living text co-constructed out of a vast sea of Internet information, which has been discovered, gleaned, and "gleamed". Thus, the locus of where learning takes place has been radically altered. Teaching shifts from just delivering packet of information to mutually exploring the best way to use that knowledge.

<u>I-PALMS: Uniform</u>

But learning is sharing what a student has acquired. Through I-PALMS: Intelligent Participation Adaptive Learning Management System students are matched with other students in units ranging from Buddies, to Teams, to Circles, to Communities to work on collaborative, competitive, and cooperative tasks that re-enforce learning. The participation involves a variety of tasks: Competitive, Cooperative, and Collaborative in ascending higher order thinking skills. Course content for the most part is standardized with interchangeable learning objects. So the English pronunciation course is more or less the same in Boston or San Francisco.

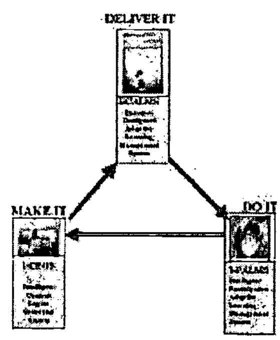


Fig. 4

Why are CBT and WBT so popular? It should be made clear that they can never completely take the place of a live instructor. However, CBT/WBT can be effectively used to teach many of the more elementary lessons, reserving instructors for the higher order thinking tasks.

The best CBT/WBT courses capture the best minds in a discipline of study and present a consistent and rich experience to learners. Learners are able to take lessons anywhere and at any time, even on a small pocket PC. In addition, a well-made CBT/WBT course will customize itself to each learner's need, something that is very difficult for an instructor to do in a classroom setting. Each learner can move at his or her own pace because the computer has infinite patience.

Do we have to wait for fast lines?

Because users will be connecting to the Internet at varying speeds, an elegant WBT will accommodate the different speeds by presenting materials in different ways. For instance, a high-bandwidth (fast) connection will allow the use of digitized video files. The same course when confronted with a narrow-bandwidth (slow) connection may opt to use still pictures and limited audio instead. While the effectiveness of the learning materials may not be as rich, the instruction may be almost as effective. Certainly, at narrow bandwidth connections, a course without video and audio is better than no course at all.

In the gLearning environment , a student and teacher enter into a life-time learning environment. The learning environment is ambient and can be accessed through learning instruments such as PCs, Cell phones, PPCs, and Pagers. In the gLearning environment the learner can begin a lesson in the morning on their home PC, continue the lesson on a mobile phone in a traffic jam, do more on the lesson on the work PC, and finally finish the lesson at night back at home. The course follows the student ; not the other way around. Knowledge objects are acquired in packets at the learner's convenience. A learner's lifetime learning accomplishments are instantly available on an individual URL which can be accessed publicly, as a student wills.

Conclusion

Technology has taught us that there is a critical mass that is necessary for an invention to work. All the ingredients must be in place for a new form to work. When the steam engine was invented, wooden sailboats burned up. The invention would not work until steel hulls were utilized. The analogy is similar to the online classroom. The makers of horse carriages built the same horse-designed vehicle only equipped with an engine. However, not a single horse-less carriage manufacturer went onto become a car maker.

Preliminary results from using the gLearner at Broward Community College this semester show that improvement in mastering English pronunciation is improved on the order of two standard deviations. Raising achievement by two standard deviations in equivalent to raising the performance of 50th percentile students to that of 98th percentile students. In other words, virtually every student is getting an "A". Perhaps, with the help of technology we can say "adios" to the Bell Curve! (Figure 5)

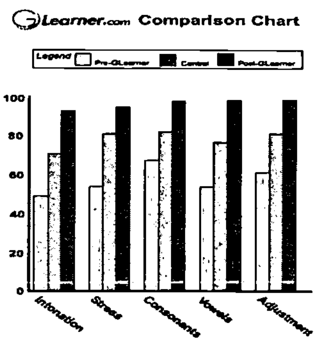


Figure 5

While the future form of online learning is still unclear, it is not going to fail or go away. It will probably look something like the gLearner—Adaptive, Ubiquitous, and Uniform. And teaching and learning will never be the same.

Orchestrating Virtual Learning

Charles E. Elliott, Ph.D.
Assistant Professor of Education
Director, Educational Computing Technology Master's Program
Gannon University
elliottce@gannon.edu

Florence A. Elliott, M.Ed.
Gannon University
School of Education
excelmom5@yahoo.com

Yvonne Waern, Ph.D.
Professor
Department of Communication Studies
Linkoeping University
Sweden
yvonne.waern@tema.liu.se

Teresa Cerrato, Ph.D.
Royal Institute of Technology
Stockholm, Sweden
tessy@nada.kth.se

Abstract: One case study of instruction in a virtual learning environment (VLE) was presented. The instruction was aimed at adult learning as part of a professional development initiative for practicing K-12 teachers. Further, this research concerns the use of the Internet as a text medium for supporting synchronous communication and the coordination of learning activities between teacher and students. The aim is to provide some conclusions useful for the future, as the Internet becomes a knowledge and learning resource. This paper focuses on the challenges that instructional designers must consider and teachers must manage in order to make sure that the students get the benefits of learning in virtual environments.

Teaching in a distance learning environment places many challenges on the instructor and student. In a synchronous virtual learning environment (VLE), many things happen simultaneously. Teaching in this environment may be compared to conducting, playing, and listening to an orchestra at the same time. The role of the instructor is like the role of a music conductor. The conductor must attend to the details of each orchestra section and individual musician, while providing the entire orchestra with a direction for tempo and harmony, based on the outline of the musical score, tempered with the conductor's own interpretation of the music selection. The music conductor uses many tools, extensive planning, leadership skills, instrumental technical knowledge, and an interpretation of the musical score to accomplish a successful performance. What do teachers need for orchestrating a virtual synchronous learning environment?

The Environment

The virtual learning environment used in this study was built on a Multi-User Domain (MUD)-client, called TappedIn (http://www.tappedin.org). This environment enables people to write to one another simultaneously as in a so-called "chat-channel." It offers much more however, such as objects, which participants can use to communicate, interact and share information. It also offers a spatial layout that can be used for moving around to different rooms, libraries, and individual office space.

Hurdles

From this case study, the researchers examined the implications of four (4) hurdles, which were identified as part of the case analysis. Through an examination of these hurdles we begin to see the vision of what is involved with learning today and in the future. This study demonstrated ways in which VLE facilitators can design online coursework so online learners can overcome these hurdles.

Technical Knowledge

Most K-12 teachers in the United States know about computers, yet they are not well versed in the use of the Internet as a knowledge and learning resource. In using the Internet, teachers encounter technical problems and may see these as insurmountable. This frustration leads to increased computer anxiety and anti-technology behaviors.

A key to minimizing this anticipated fear is to carefully select software and Internet sites which require a low learning curve. Since the instructor will not always be logged on when students use a VLE, a strong support network is essential for novice computer users. Online assistance, accompanied by a useful guide (print version) means students can get assistance in navigating the virtual environment and performing object-oriented tasks. A face-to-face start up meeting is recommended if possible.

Online Learning is No Different

Teachers and students engage in computer-mediated learning undergo a paradigm shift in their understanding of thr virtual learning environment. It is the students who will be leading themselves through the online course, built on the framework for learning, which the instructional designer and course instructor have mapped out. Online is different and students must acknowledge this.

There are a number of general guidelines to follow. The assignments for each module of an online course need to be grouped into categories, which are used as advanced organizers for each module of the course. Instructors should scaffold the course with a broad selection of resources to support each module topic or learning unit. It is advisable to diversify the instructional strategies used in the online course to meet the learning needs and technology competencies of each student.

Online Communication

In a text-based, synchronous environment, multiple speakers may submit messages in a short time. Students learn to dissect multiple, interwoven threads of conversation as a class discussion evolves. The role of the teacher becomes one of facilitation. Specific leader strategies may be incorporated to guide the discussion or "conduct the orchestra" in a synchronous environment. As a participant in synchronous discussions, students must learn to listen to the chorus of simultaneous and seemingly chaotic voices.

In a VLE, the communications skills must be learned first. Equip students with distinct tools for the varied types of communications in which they will engage. For each virtual class meeting, it is useful to have a set plan for how you plan to use that time. Safeguards should be in place for the students who arrive late, have schedule conflicts, or encounter technology problems when you have a scheduled virtual meeting.

Use of Objects

Objects are an essential part of many virtual learning environments. Some of the objects have practical applications in that they are used to facilitate communication, instruction, and learning. Other objects are designed to more for entertainment, which may help to relieve some anxiety about the technology intensive atmosphere.

Students should receive object-use introduction and practice in a face-to-face technology orientation session. Print guides and access to online helpdesk professionals is critical to a successful VLE as well. The teacher should work with the instructional designer to develop a progressive object skill acquisition plan for the objects you plan to use in the course.

Conclusions

Various online teaching methodologies can help instructional designers and online teachers to meet the demands of the virtual learning environment. Through careful course design, instructional planning, and training, these methodologies can break down the barriers to creating a successful virtual learning environment. There is no single best method of coping with the hurdles listed in this paper instead, a complement of strategies must be used.

Constructing an Enhanced Instructional Presentation

Leslee Francis Pelton
lfrancis@uvic.ca University of Victoria

Timothy Ward Pelton
tpelton@uvic.ca Brigham Young University

Abstract: In this document we describe the development of an Enhanced Instructional Presentation (EIP). "If a good educational presentation is like a fine string of pearls, then an Enhanced Instructional Presentation puts that fine string of pearls, along with access to any supplementary information needed, into the hands of the learner in order to ensure full appreciation." (Pelton & Francis Pelton, 2000)

Enhanced Instructional Presentations

Although the traditional linear presentation (exposition, demonstration, activity sequence, etc.) is often a useful instructional method, and may be effective for a large portion of the target audience, improvements are possible. We have identified five different issues leading to the loss of learning opportunities or a reduction in learning efficiency in the context of a traditional fixed linear presentation:

1. Presentation rate is either too fast or too slow for individual learners causing selective attention or inattention to presentation content.
2. Short term memory overload or processing delays cause concepts, context, questions and even answers to be dropped before they can be committed to memory (Miller, 1956).
3. Verbal ability in the domain is insufficient to allow the learners to articulate the questions they have.
4. Social constraints (pride, consideration of others) prevent the learners from expressing the questions they have formulated in a classroom setting.
5. Answers to learners' questions are not available in real time.

To overcome these difficulties, and improve learning efficiency from linear presentations, we suggest the construction of an Enhanced Instructional Presentation (EIP). Our EIP model is a hybrid extension of the linear presentation that addresses the learners' needs for organized and synthesized content while providing for individual differences in background experience, learning orientation, and cognitive abilities.

In this paper we present an outline of the plan for constructing a specific EIP to teach the concepts and skills associated with "*Constructions with a Straightedge and Compass*". We add two caveats: First, the process of constructing an EIP is a process, and multiple iterations are intended. We present only the first iteration. Second, only a few of the potential media types and interactive features that might be used in an EIP are included in this example. Ultimately, the EIP model is a hypermedia instantiation of van Merrienboer's 4C/ID model (van Merrienboer, 1997), and is moldable to meet many different educational needs.

The Traditional Linear Presentation of: "Constructions with a Straightedge and a Compass"

0. Introduction to Constructions with a straightedge and a compass
1. Duplicate a line segment
2. Duplicate an angle
3. Duplicate a given triangle
4. Bisect a line segment
5. Bisect an angle
6. Construct a perpendicular line through a point on a line
7. Construct a perpendicular given a line and an external point
8. Construct a line parallel to a given line and through a given point
9. Construct square, rt. triangle, equilateral triangle, parallelogram etc.
10. Construct various angles (90, 60, 30, 45, etc degrees)

Now although we would agree that the ideal presentation of this topic might be more hands-on, we will for the sake of example imagine it being presented as an instructional video. In this format, only a few really quick learners and those with significant background in the topic area would be able to capture all of the concepts and procedures mentioned and demonstrated. For many of the students, the pace of the video would be too fast and their background knowledge too limited to allow them to capture much at all.

The Development of an EIP for: "Constructions with a Straightedge and a Compass"

The conversion of the linear presentation into an EIP involves identifying start/stop points in an existing presentation, generating a supplementary content network and designing a feedback and interaction mechanism. These elements are combined with the EIP shell (under development) to generate the working EIP.

Identifying start/stop points in an existing presentation

We break the video presentation into content segments and describe each with a short statement. A good starting point would be the outline given above, but to enhance the accessibility and playback control further, we would find the start/stop points for each sub-activity. For example:

4. Bisect a line segment
    - i. Set compass width > 1/2 of line length
    - ii. Place compass point on end of line segment
    - iii. Draw an arc above and below the estimated midpoint
    - iv. Repeat ii and iii from other endpoint of line segment
    - v. Draw a line between the intersections of each arc pair

A control matrix (spreadsheet) is constructed with a row for each content segment. With each row containing: item number, item type, file name or URL, start/stop points, description, outline level, confusion rank, and an array of links to other segments. The potential for learner confusion rank will be used by the prompting mechanism to stop the regular playback at key points and prompt the learner with the supplementary content linked to that segment. Segments may be individual files or portions of larger video files (or other internally addressable media files)

Generating a supplementary content network

Our preference is to build an EIP with only a few hyperlinks for anticipated questions, challenges, assessments, etc, and then in a trial of the EIP, collect and respond to authentic questions from learners in order to augment the EIP further. Some anticipated questions and challenges for the segments described are:

A. Why does the compass width have to be >1/2 of the line segment?
B. What do I do if my compass can't stretch that far?
C. Is there another way?
D. Why does this work?
E. Now you try it!

Presentations are generated for each of these supplementary segments (videos, powerpoint presentations, simulations, text, narrated stills, web pages, etc.). These segments are also entered as individual rows into the control matrix with the same parameters as above. Finally, links between segments (original and supplementary) are added to the control matrix to define the supplementary content network.

Design a feedback and interaction mechanism

The feedback and interaction mechanism is accomplished by building a web page containing forms, assessments, surveys, links to other web sites and discussion forums etc. An additional line is added to the control matrix to identify the location and type of the feedback page. Two types of feedback pages can be specified. The first will only be loaded when the learner requests it, and the second will be loaded after each content segment (to facilitate the collection of learner questions or participation in some related activity).

In the current example, we might begin by building a form to collect questions from the learners and send them to the instructor via email. As the supplementary network grows and the demand for additional resources wanes, the feedback page might be replaced with a page offering formative evaluations and links to related geometry sites.

The content segments are then placed in a directory (on a local hard drive, CDROM, or on a server) along with the control matrix. The resulting EIP can be updated as frequently as needed, and adapted to the needs of individual learners by setting the prompting level (confusion parameter). For additional information on the EIP shell please contact the authors.

References:

Miller, G. A. (1956). "The magical number seven, plus or minus two: Some limits on our capacity for processing information." Psychological Review 63: 81-97.

Pelton, T. W. & Francis Pelton, L.. (2000). The Enhanced Instructional Presentation Model. Society for Information Technology and Teacher Education International Conference, Orlando, FL.

van Merrienboer, J. J. G. (1997). Training Complex Cognitive Skills: A Four-Component Instructional Design Model for Technical Training. Englewood Cliffs, NJ, Educational Technology Publications.

Metaphorical Representation Within a Distributed Learning Environment

Ruth Gannon-Cook
Instructional Technology
University of Houston – Clear Lake
United States of America
gannoncook@cl.uh.edu

Carolinc M. Crawford
Instructional Technology
University of Houston - Clear Lake
United States of America
crawford@cl.uh.edu

Abstract: The design and development of preservice and inservice teacher education distributed learning environments, specifically World Wide Web-based (Web-based) courses, emphasize the need to think through numerous issues that may not be apparent within traditional face-to-face environments. A metaphorical representation that emphasizes the conceptual framework through out the Web-based course environment offers the preservice and inservice teacher educators a consistent with the knowledge being presented and based upon the prior knowledge of the learner.

Introduction

The design and development of preservice and inservice teacher education distributed learning environments, specifically World Wide Web-based (Web-based) courses, emphasize the need to think through numerous issues that may not be apparent within traditional face-to-face environments. Since Vannevar Bush "invented the foundation for the World Wide Web in 1945 and founded much of the early thinking about human-centered computing" (Nielsen, 1999, paragraph 2) and Ted Nelson as a "pioneering and vocal advocate of users' right to simple computers that everybody can figure out and use as a communications medium rather than a glorified calculator" (Nielsen, 1999, paragraph 2), the design and development of a nurturing, creative learning environment has been at the forefront of enlightened thought. The creation of a Web-based communal learning environment is one that has gained momentum over the previous five year period, and shows no sign of slowing.

One issue within the online learning environment is the emphasis placed upon developing a conceptual framework through which the learners will begin to develop an understanding of the knowledge presented. A metaphorical representation that emphasizes the conceptual framework through out the Web-based course environment offers the preservice and inservice teacher educators a consistent with the knowledge being presented and based upon the prior knowledge of the learner. Therefore, the three areas of emphasis pertaining to the design and development of preservice and inservice teacher education distributed learning environments shall be Web-based learner support within a preservice candidate's curriculum of study, the building of a learner's conceptual framework, and the developmental importance of a metaphorical representation.

Web-Based Learner Support Within a Preservice Candidate's Curriculum of Study

The design and development of Web-based preservice teacher candidate's professional development curriculum lends a supportive environment through which the preservice teacher can further develop her knowledge within key areas of the curriculum of study. This is also true of the inservice teacher educator's professional development opportunities that may be available online. The creative and nurturing aspects of the learning environment not only model the desired learning environment for the PreK-12 learners, but also create an environment in which the preservice and inservice educators develop a level of comfort and freedom through which to learn. The design of such an environment is of utmost importance to the success of the learner. Design is an imperative aspect associated with an online learning environment, wherein "the key issues in interaction design and the main determinant of usability is: what to say" (Nielsen, 2000, paragraph 5). Usability and appropriate interactive activities are the main concern within an online environment, second only to the content provided to the learner. As has become a distinct feature of discussions surrounding the use of the Web, "People often talk about how the Web changes on 'Internet time', but usability issues seem to change much more slowly since they stem from human capabilities and interests" (Nielsen, 1994, paragraph 2).

Conceptual Framework

The learner's conceptual framework of understanding is imperative towards the creation of a firm knowledge base through which the learner develops a view of the world. The conceptual framework is created through not only the knowledge that is "input", but also deals primarily with the creation of a mental model, a framework, of understanding that is associated with the knowledge acquisition and the melding of the knowledge into the already created and constantly changing conceptual framework. Such a framework through which the learner develops an understanding of the knowledge being attained, and forming this knowledge into useful information within a conceptual understanding of the world and where this knowledge lies within the "larger picture", can be aided through the use of a metaphorical representation. This metaphorical representation can be integrated within the learning environment to aid the learner in constructing appropriate frameworks of understanding. Conceptualizing the knowledge being obtained with in an appropriate framework.

Metaphorical Representation

The emphasis placed upon the metaphorical representation of the information within the Web-based course environment at the beginning of the course design and development will lead to a tightly bound, cooperative, understandable course framework at the conclusion of the course design, development and implementation processes. The preservice and inservice teacher educators must rely upon prior knowledge within any course environment, independent of the subject matter presented; however, the uncomfortable levels of stress and strain felt by many preservice and inservice teacher educators when faced with a Web-based course can impact the learning environment as well as the course objectives. For this reason, the inclusion of a metaphorical representation within a Web-based course emphasizes a heightened level of comfort on the part of the preservice and inservice teachers, which re-focuses the attention towards the information presented and away from the Web-based course environment. Therefore, a discussion surrounding the inclusion of a metaphorical representation within a distributed learning environment, specifically a Web-based course for preservice and inservice teachers, is essential to accentuate the importance of such a necessary technique.

Conclusions

The design and development of preservice and inservice teacher education distributed learning environments, specifically World Wide Web-based (Web-based) courses, emphasize the need to think through numerous issues that may not be apparent within traditional face-to-face environments. A metaphorical representation that emphasizes the conceptual framework through out the Web-based course environment offers the preservice and inservice teacher educators a consistent with the knowledge being presented and based upon the prior knowledge of the learner.

References

Nielsen, J. (1994). *Report form a 1994 Web usability study.* Available Online: http://www.useit.com/papers/1994_web_usability_report. Html

Nielsen, J. (December 29, 1999). *Ten biggest thinkers of the 20th century.* Available Online: http://www.useit.com/papers/thinkers20century.html

Nielsen, J. (2000). *Will voice interfaces replace screens?* Available Online: http://www.developer.ibm.com/library/articles/nielsen1.html

What We Wish Our Teachers Knew: Eighth Grade Students Speak Out

George Bennum, Stowe Vermont Middle School, USA, geob86@yahoo.com

Molly Gibson, Stowe Vermont Middle School, USA, 2cool4us@gohip.com

David Gibson, Vermont Institute for Science, Mathematics and Technology, USA, dgibson@vismt.org

Hannah Marshall, Stowe Vermont Middle School, USA, peachy52787@hotmail.com

Will Sabel Courtney, Stowe Vermont Middle School, USA, fastcat7@stowe.nu

Abstract: What do teachers need to know and be able to do with technology in a middle-grades classroom? This research project by four middle-grades students set out to accomplish two objectives: 1. Survey the staff of a middle school to develop a table of main themes taught during a school year, and 2. Find and organize outstanding resources from a student's point of view that would support learning across the curriculum. Secondary objectives of the research included 1. Providing students with a chance to apply what they had recently learned in an online course "Introduction to html" and 2. Demonstrating that both students and teachers can learn something new about teaching with technology. Parents, working with online resources, have been the impetus and primary supports for the project. The school administration also assisted by making time and space for the activity to be included during the school day.

Introduction

How can teachers better incorporate technology into the school curriculum? This is a paper prepared by 8th grade students at Stowe Middle School in Stowe, Vermont, who have analyze the problem and helped to incorporate technology into their school. The paper discusses what they wish all teachers knew and could teach to other students and compares their thinking to national technology standards for teachers. It also offers some creative and helpful ways to bring technology into the school curriculum to improve learning experiences for students and teachers.

Why Do We Need Better Use of Technology in School?

Technology has become a prevalent driving force that affects every person in the world directly and indirectly, economically, socially and culturally. Students need to understand the impact of technology on the world, and know how to critically evaluate social changes resulting from technology. Therefore, schools today have the responsibility of preparing students for an emerging information-based global society.

According to the Information Technology World Congress, 209 technology jobs are created every hour in the U.S. Additionally, many more jobs use or incorporate computer technology. Students need to be ready to take advantage of these technology opportunities. Technology thus needs to be incorporated into as much school curriculum as possible.

The International Society for Technology in Education (ISTE 2000) has developed a set of standards that can help point the way for teachers to develop the skills we wish they had. In what follows, we first brainstormed what we wish our teachers knew or would teach more thoroughly. Then, our project advisor looked at our work and compared it to the ISTE standards, giving a preference wherever there seemed to be a good fit. We decided to leave the organization in terms of how we thought about things, allowing the standards references to weave throughout our text. Our text is followed by a closing piece by our project adviser, talking about what standards in ISTE we did not mention in our narrative.

Searching and Search Engines

In some of our academic classes, we are expected to do research outside of the classroom using the Internet. For example, we might have to look up an important historical figure for social studies. The students who don't have Internet access at home have to sacrifice other school time to do their research project. *ISTE 6. e.* If teachers brought the students to the computer lab or the library, it would be helpful if he or she could help them get the necessary research completed. *ISTE 3. d.* One way that they could help would be to teach us how to use search engines effectively. *ISTE 3. a.* Many times, students will type in the subject, then randomly choose one site out of a few hundred sites on the topic. Most students don't really know what the best site is. We know how to do "dumb" searches, but we don't know how to do "smart" searches, or advanced logic searches. A dumb search is like flipping through a big resource book trying to find a single subject. A smart search is like using the index.

For example, when of our classmates was recently researching Puerto Rican art. She went to a search engine and typed in " Puerto Rico Art. " She found no good sites but, she did find a site about a person named Art from Puerto Rico. If she had done a "smart" search, she probably would have found more useful web sites.

When using computer encyclopedias and references, teachers need to teach students how to get quotes effectively and use them in their work, as well as find and use primary and secondary sources, a thesaurus, dictionaries, and translators. *ISTE 3. a.*

How to Use Technology to Become More Productive in the Classroom

Instead of handwriting that may make documents or instructions harder for the students to understand, teachers should post clear computer-generated documents. *ISTE 2. a.* For example, a teacher might hand write a math sheet assignment, but a typed one would be easier to read. *ISTE 5. c.* Also, teachers could type papers when discussing an important topic. If there were an area that students didn't understand, computer-generated documents would be much easier to comprehend. Students can generally learn more by *seeing* a complex idea has opposed to *hearing* it in a lecture. *ISTE 3. c.*

Teachers also need to know how to correctly use the technology that is provided for them or available for their use. *ISTE 1. a.* Our classrooms need better incorporation of technology in everyday studies. Some examples might be satellite images and video microscopes. Satellite images can be used in geography to document forestation, light pollution, or cloud cover. Video microscopes can be used in biology to display cells. These are just two small examples of how technology can be used. One thing that might help would be contacting students from other places to share and work with ideas. *ISTE 2. b.*

Teachers Need to Ask Students to Use Technology in Classroom Assignments

One teacher who uses technology often asked us to create a Powerpoint presentation or a computer-generated brochure. It was fun and interesting to learn how to use the programs. However, that has been our only technological opportunity. *ISTE 3. b.* Other technological opportunities could easily be provided. For example, Photoshop could be utilized for science or social studies graphics. iMovie and multimedia productions could be incorporated into our studies.

Middle school education has not moved very far from the traditional way of learning. For example, language arts assignments typically include essays and work sheets. Language arts might not seem like a subject to use technology, but students could be asked to write newsletters, create play scripts, produce page layouts, use e-mail to communicate and get feedback from other students, write in on-line journals, and publish electronically. *ISTE 2. d.* Graphics, movies and multimedia productions will motivate students who don't like reading or writing.

Computer Use Should be Taught Throughout All Grades *ISTE 2.*

Kindergarten, first grade, second grade and third grade children should start using technology. They could use drawing programs, Jump Start programs, CD-ROM games, Thinking Things, and interactive CD books. Typing should start in second grade.

4th and 5th grades should be typing fluently, using word processing and more complex programs. These could include simulations such as Sim City; applied math like Operation Neptune, Operation Express, Oregon Trail, Spellbound, African Trail, Widget Workshop, Adventure series, Carmen San Diego, and other logic games. They should be using spreadsheets in science, be able to make and sort lists, and create number spreadsheets that do simple math.

6th through 8th grades should have already mastered the basics of technology. They should have mastered word-processing, fluent typing, creating indexes, formatting, integrating pictures and graphs, spreadsheets, simple databases, and telecommunications, (Internet, email, Instant Messenger). They should be able to do image processing including scanning photos, importing and exporting photos, and image manipulation. Movies should be used and students should be familiar with animation and editing. Scientific images could be used, such as satellite photos and medical images (body scans X-rays).

Teachers Need to Address the Ethical Issues of Internet Use *ISTE 6. a.*

Teachers need to help students understand the difference between "good" information and "bad" information from the Internet. *ISTE 6.* Students should always compare information from the Internet to multiple sources to be sure of its accuracy. *ISTE 2. c.* These could include books, different web sites, primary sources, or person-to-person interaction. Students need to be able to tell when someone is promoting his or her personal views. Using the knowledge students have learned from writing persuasive essays, they should be able to tell if a piece sounds one-sided. Persuasive writing often only brings up one idea that actually works and shoots down all other ideas that might be mentioned; therefore, you don't know if you are getting all of the truth or just what someone picked to sound supportive of their view. When searching for information on a web site, students should consider who owns the site: a university, business, or a private or nonprofit organization. *ISTE 6. b. & d.*

For example, if a breast cancer cure sponsors a web site, and the content is women's health, the web site will concentrate upon how good the company's treatment is and not present side effects of that company's treatments. It might not display other useful treatments by other companies.

Teachers Need to Use Technology to Let Students Learn Outside of the Classroom

If teachers cannot provide information in some subject area, then technology could help them offer additional resources or classes in that subject. These could include on-line classes or courses. *ISTE 2. c.* Teachers should know how to use technology so they can help students learn independently. Student projects could include extra credit, visits to other schools to see how they use technology, and use of CDs and multimedia programs. *ISTE 3. d.*

What the Students Didn't Say...

What the 8th graders didn't say is revealing too. Not a word was mentioned about "assessment and evaluation." *ISTE 4.* It is perhaps not surprising that students might not think of this area, since "grades" and "doing homework" belongs to "school work" and so much learning with technology does not, as yet. I wonder if that might not be a good thing. However, there is one thing I regret. I feel badly that students do not work every day in an environment where high quality feedback gives them more ideas, helps them improve their work to very high levels, and teaches them concepts and techniques "just in time" to use them effectively in a real context. If they did work in such a setting, I bet that they would ask for more feedback. Assessment and evaluation would not go unmentioned if it were helping them to learn, achieve and maintain a high level of interest and motivation.

The 8th graders also didn't mention several aspects of "productivity and professional practice." *ISTE 5.* They expect a basic level of productivity, but do not expect or perhaps know about the teacher as a lifelong learner. This too, I feel, is a shame. What would their perceptions be if they had many teachers who were actively learning and growing in front of them, so they could see what an adult learner looks like? I'm afraid that more often, what they see is an adult who is controlling the flow of events, saying what can and can't happen, talking most of the time except when asking a direct question, then responding to the student who answers before any other student can.

There are notable exceptions. When I interviewed the students during a long car ride on our way to a statewide conference on technology, all of their examples kept coming back to essentially two teachers in the school. I pointed this out, saying, "Has anyone else during your three years at the middle school used technology to teach? Let's see. You've had about six to eight teachers each year, about 24 teachers. Are there just 2 who are teaching with technology? They replied, "That's about it." The two notable exceptions used outstanding approaches and gave multiple opportunities for students to learn with and use technology in expression and exploration. Most important, these were "core academic" teachers of history, science and language arts in their small school where teachers often do double and triple duty. But clearly, we need to find a way to raise the expectations that all teaching must follow their example, or else our students will not be as prepared as they need and want to be.

Conclusion

What do we wish our teachers knew? That technology is vitally important to our future and our world. That working with technology is fun and helps us learn. We wish they knew that we students are highly motivated to learn with technology. We wish they understood that we like to be stretched to our highest skills and that by letting us show what we can do, we feel good about our academic achievements.

References

ISTE (2000) National educational technology standards for teachers. International Society for Technology in Education: Author.

Implementation of an Electronic Tutorship Support System in a School of Business Administration: a Case Study

Oscar M. González
School of Business Administration
University of Valladolid
Spain
oscarg@emp.uva.es

David Pérez
School of Business Administration
University of Valladolid
Spain
david@emp.uva.es

Victoria Cánovas
School of Business Administration
University of Valladolid
Spain
vicky@emp.uva.es

Abstract: This paper analyses and describes the implementation of a tutorship system based on a telecommunication network that pays attention to the different interests and requirements of students and teachers of the School of Business Administration (University of Valladolid – Spain). The system has been designed to modify and improve the traditional tutorship system by the use of Internet. In this way, the system supports the "learning process" without the necessity of physical presence of the different agents implied. Using the electronic tutorship support system it is possible to solve problems and queries related to academic subjects of the Business Administration Degree. Actually, we are evaluating and analyzing the impact and acceptance of the system for both, students and teachers. Besides, we are attempting to involve as professors as possible in the test and evaluation phase, as well as in the redesign and implementation of other telematic services applied to education in a collaborative form.

Introduction

At the end of 1998, the Spanish Government offered the possibility to provide economic support to those investigation projects related to the design of educational systems as support and improvement of teaching skills.

Many professors of the School of Business Administration (University of Valladolid – Spain) were aware that two of the main problems of their students were the overcrowding in classrooms and the high number of students that could not attend class (they are usually full-time workers). A good solution could be the implementation of a tutorship support system using a telecommunication network as well as the design of complementary didactical hypermedia material, which could facilitate not only the learning process of different disciplines, but the potential use of Internet as well (Bouras, 1998, Davies, 1997).

Besides, students could use the system in order to get access to all general and academic information that is normally displayed on a notice-board.

Identifying the Problem

The School of Business Administration of the University of Valladolid has just ended an auto-evaluation process made by some university specialists, professors and Business Administration students (assisted by an extern-committee of evaluation).

One of the conclusions obtained by all agents implied was the conviction that the traditional tutorship system was inefficient, hardly used and almost exclusive for the query of doubts or concrete questions just before the exams. Two important drawbacks were found.

On the one hand, the fact that an elevated number of enrolled students for this degree (in comparison with other degrees of our University) are full-time workers, makes that they have a lot of difficulties attending lessons and asking for help in the resolution of questions related to their studies.

On the other hand, the possibility to maintain a close interaction between professor and students without dependence on time and physical presence could facilitate a more flexible communication and, therefore, improve the promotion of equal opportunities (Verdú, 1998a).

Fortunately, an element which could help to introduce, innovate and, by the way, stimulate the professor's work, is the introduction of computers in the teaching process and, of course, the possibility of access to Internet in the sense not only of information transmission and retrieval but also as a communication channel (Penfield, 1996, Verdú, 1998b).

So, the School of Business Administration has made a great effort in order to implement the electronic tutorship support system described in this paper as part of the teaching process.

We hope that students use the system (Fig. 1) and improve the situations or processes they consider not sufficiently developed in the classroom. We believe that this system can become a great help in the sense of getting new habits in the teaching skills. Moreover, students can obtain a better quality of learning than the one that professors can offer right now with only traditional teaching methods (Flur, 1996, González, 1998).

The complete analysis of the system will be carried out on May 2001.

Objectives and Contents

The developed project can decrease some of the deficiencies found in the report about the quality of the Business Administration degree. In this sense, we could enumerate the following general objectives:

- **Create a new professor role**, not only as source and transmitter of knowledge to the students but also as a collaborator and guide.
  Students, with the guidance of professors and the interactions with the rest of the group, can develop a new "active role", which additionally provides a better adaptation to the professional world (very important in future) (Dix, 1997).
- **Integrate several activities of the current classes**, where the traditional explanations, the resolution of problems on the blackboard and the exercises based on the use of the computer in the laboratory are clearly separate issues.
  As last objective, we could consider an electronic classroom where it were possible to integrate different issues such as information search, queries, collaboration ways, theoretical and practical contents, design of study alternatives, etc., (using the telematic infrastructure of the open system) (Khasnabish, 1997).
- **Extract the common characteristics of several subjects** in order to design a generic system applicable not only to subjects imparted by the participants in this project, but also to the whole Business Administration degree.
  So, we are attempting to involve as professors as possible in the research, design and implementation of telematic systems applied to education in a collaborative form (Boutaba, 1997).

Using the general objectives described before we can conclude the following concrete objectives of the project:

- **Elaborate didactic hypermedia material** that includes practical examples and theoretical help to the classroom knowledge. This material must be designed in two ways:
  - first, as a complement to the traditional lessons (it will allow students to apply classroom knowledge to real-world situations) and,
  - second, as a support that facilitates a close interaction with faculty and classmates.
- **Implement a mechanism of electronic tutorship,** looking for:
  - support, guide and evaluation of the learning process;
  - a flexible way to suggest new academic activities, and;
  - feedback to the learning process regarding the starting level of knowledge, the results of the evaluation and the acquired information by the tutorship action (Abdulla, 1997, 1998).
- **Maintain and create an efficient Web environment** where students can access to sources of information referring to the different courses: programs, examination dates, qualifications, activities to develop at the School, didactic material, etc.

If we are able to complete these objectives, we will motivate students, implying them in the development and resolution of the proposed tasks. Besides, it will permit a better assimilation of the theoretical concepts explained in the classrooms.

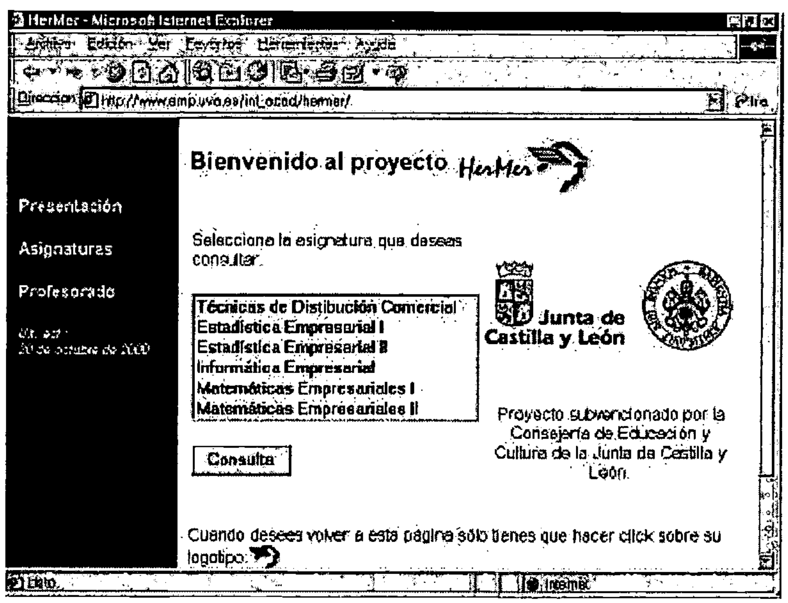


Figure 1:*Homepage (in Spanish) of the tutorship system (http://www.emp.uva.es/herner/)*

Methodology

During the implementation phase the next six points were considered in an integrated way:

- **The technology** used for the development of the system.
- **The selection of appropriate contents of the main courses** that were included in the proposed material.

  For doing this, it was considered the experience of both, professors and specialists in distance learning.

- **Task postings.** The experimental character of some subjects included in the project forced to design new exercises that could be included in the system in an easy way.
- **Supervision of the academic tasks** through the network. Professors should response at most 48 hours later the student request.
- **Encourage of the use of Internet**
- **Resolution of the proposed exercises.** Students must be able to reach the solutions and/or get support in order to resolve the proposal activities. The interaction mechanism should be easy and, if possible, just in time.

Implementation Phases

It is very important to describe the different phases followed in the implementation of our system. In fact, this sequence could be used for the elaboration of other similar electronic tutorship systems.

Analysis of the professor's requirements

In a first phase, it must be analysed the learning requirements to be covered by the system. The perspectives and necessities can be studied through the academic programs.

In this sense, it is necessary to carry out meetings with professors and specialists in distance learning in order to study problems and solutions. The study would be the base to future enlargements (other courses or other University degrees).

Design of the electronic tutorship support

With the conclusions of the previous phase, next step would be the translation of the learning requirements to the telematic system. This is a design phase of functional characteristics and learning contents.

It is very important to specify the concrete subjects, the kind of questions to request and the type of tasks to include. It must be specially considered the use of the metaphor that we call *"the integrated classroom"*, which permits the integration of the different modules of the system.

Design and development of the hypermedia didactic material support

In this kind of systems it is very important to develop didactic material as support to the learning process. It should consist of a set of theoretical aspects and/or practical habits but focused in order to be used easily through the system.

One of the most important objectives is that students can feel more motivated by the high interaction grade, guide and supervision implemented. This would solve one of the typical problems of the traditional tutorship system because it offers an easy way to communicate alumni with faculty and classmates.

Development and implementation of the proposed system

The system must be able to give access to all students' requests. Also, the interaction with the professor should take place in an efficient and easy way, avoiding a complex interface. In our case study, a good solution was the use of the Windows environment because students are familiarised with this interaction mode.

Evaluation of the system

In a last phase, the system should be evaluated based on the observations and conclusions derived of its use. Profiting this accumulated experience in the design, development and application of the system, it could proceed in two directions: correcting the errors detected and studying its applicability in the total subjects involved in the University degree.

In this sense, we have designed a survey to be done at the end of the academic calendar by more than 1000 students. This survey has been designed by specialists, and the objective is to detect the problems with the use of the system and the validation of the contents provided as complement to the classroom knowledge.

Conclusions

This paper discusses the design, development and implementation of a new electronic tutorship support system, based on the use of Internet as help to the traditional learning process in the University of Valladolid. The system is being used at the School of Business Administration to solve the problem of overcrowding.

Based on our experience, it has been presented the characteristics of this kind of systems, the most important objectives, the proposed methodology and the different phases involved in the implementation.

Acknowledgements

The work presented in this paper would have been impossible without the close collaboration of Ana Bedate, Justina Casado, Beatriz Fernández, Jesús González, Fco. Javier Galán, Manuel de Prada, Mª Arantzazu Rivas, Chantaly S.Phabmixay, Angel Sanz, and Felicidad Viejo, professors and researchers of the University of Valladolid, Spain.

References

Abdulla, G. Abrams, M. and Fox, E. A. (1996). *Scaling the World Wide Web.* Department of Computer Science. Virginia Polytechnic Institute and State University. Blacksburg. USA. http://ei.cs.vt.edu/~succeed/96ieeeAAF/. 1998.

Abdulla, G. Fox and, E. A.Abrams, M. (1997). *Shared User Behaviour on the World Wide Web.* Association for the Advancement of Computing in Education (AACE). USA. http://ei.cs.vt.edu/~chitra/docs/97webnet/.

Bouras, Ch. Gkamas, A. Kapoulas, V. Lampsas, P. and Tsiatsos, Th. (1998). A Platform for the Implementation of the Services of an Educational Network. *IFIP World Computer Congress. Teleteaching'98: Distance Learning, Training and Education.* Part III. Short Papers XV. Vienna. 159-168.

Boutaba, R. El Guemhioui, K.and Dini, P. (1997). An Outlook on Intranet Management, *IEEE Communications,* 35 (10), 92-99.

Davies, G. (1998). *Teleteaching'98: Distance Learning, Training and Education.* Part I. Part II and Part III (short papers). XV. IFIP World Computer Congress. Austrian Computer Society (OCG). Vienna.

Dix., F. (1996). Challenges and Perspectives for Cooperative Work on the Web. *ERCIM workshop on CSCW and the Web.* http://orgwis.gmd.de/W4G/proceedings/challenges.html.

Flur, P. W. Lockhart, J.B. and Yalamanchili, S. (1996). Integrating Academic Services in a Modern Networked Environment. *IEEE Transactions on Education,* 39 (3), 409-414.

González , O.M.et al. (1998). Integrating Cooperative Learning in a Virtual Class: A case Study. *IFIP World Computer Congress. Teleteaching'98: Distance Learning, Training and Education.* Part III (short papers). Vienna. 373-383.

Khasnabish, B.and Saracco, R. (1997). Intranets: Technologies, Services, and Management. *IEEE Communications,* 35 (10), 84-91.

Penfield Jr, P. and Larson, R.C. (1996). Education Via Advanced Technologies. *IEEE Transactions on Education,* 39 (3), 436-443.

Verdú, Mª.J. et al. (1998a). Internet for Schools: a New Way of Learning and Working. In *Proceedings of the 10th World Conference on Educational Multimedia and Hypermedia,* 2. Freiburg, Germany. 1859-1860.

Verdú, Mª. J. et al. (1998b). Internet for Schools. *IFIP World Computer Congress. Teleteaching'98: Distance Learning, Training and Education.* Part III (short papers). Vienna. 131.

Activities for Integrating the Internet in Teacher Education Classes

Marie Hegwer-DiVita
College of Education
Education Specialist Program Area
California State University, Long Beach
United States
mhegwer@csulb.edu

Abstract: A taxonomy of Internet activities may be useful for teacher educators who are new to using the Internet in instruction. In this paper, three categories of Internet activities are outlined: Direct, WebQuests, and Complex. Tasks, examples, and resources representing each of the categories are presented; examples from special education teacher education courses are emphasized. Instructors may begin with simpler activities and add more complex assignments as skills develop. Using different types of tasks increases student motivation and demonstrates variety in instructional planning. This taxonomy and the examples are being developed for use by a faculty "tech buddy" to aide in supporting colleagues participating in a PT3 Implementation Grant.

Activities for K-12 students utilizing the Internet are featured in many journal articles and teacher resources, websites, and books. These activities range from very simple to very complex and with descriptive titles from "Internet Fieldtrip" to "WebQuest." Teacher education classes also increasingly use the Internet and can benefit from utilizing the same sort of activities. A list and description of a range of Internet activities may be useful for teacher educators who are new to using the Internet as an instructional tool. Instructors may begin with simpler activities and add more complex assignments as their skills and students' skills develop. Using a variety of types of tasks both increases motivation through variety and demonstrates variety in instructional planning for teachers.

Three categories of Internet activities are outlined here: direct, WebQuests, and complex. Tasks representing each category will be discussed, including examples and resources. Examples from special education teacher education courses are emphasized. Unless otherwise stated, "student" refers to university students in pre-service or inservice teacher education classes. This taxonomy and the examples are being developed for use by a faculty "tech buddy" to aide in supporting colleagues participating in a Preparing Tomorrow's Teachers to Use Technology (PT3) Implementation Grant.

Direct Internet Activities

These activities are generally relatively simple and direct tasks: multi-media or integrative project products are not involved. They seldom require skills beyond knowledge or comprehension and seldom more than one skill at a time. Sample activities in ten subcategories include:

Site evaluation

Students are given a specific URL and complete a description and evaluation worksheet, which may include downloading a part of the site. An introductory example that could be investigated in less than 30 minutes is http://www.penafriend.com/, the site for Pen-A-Friend which facilitates penpals between people with and without developmental disabilities. (However, one hopes that reviewers might use it and establish a penpal relationship!) This type of evaluation task becomes more complex when websites with multiple components, menus, and links are the target. An involved example is the award winning mega-site www.ldonline.org, a service of The Learning Project at WETA (Washington Educational Television Association) in Washington, D.C., in association with The Coordinated Campaign for Learning Disabilities. It would require weeks to fully investigate and read all the documents and resources materials available. It would probably be a more realistic, yet still involved task, to require students to review specific parts of LDonline, such as "ABCs of LD and ADD" at http://www.ldonline.org/abcs_info/articles-info.html.

Required reading

Many valid and accurate sites exist which can be used as required reading. Such material is often very timely and less costly than textbooks. For example, in a class on classroom management with a component on legal aspects of suspension and expulsion, http://www.cde.ca.gov/spbranch/sed/susex.pdf has "Suspension/Expulsion Handbook," an excellent 60-page document describing best practices in California with narrative, education code, and suggested forms for the process.

Find a site and summarize it

Search skills are involved when students are given a specific topic or theorist related to course content and asked to find one or more pertinent websites. Brief summaries verifying pertinence may be required by the instructor.

Site worksheet

The instructor makes a worksheet of questions (multiple choice, T/F, fill-in, or short answer) pertaining to a specific website related to the course. There are several K-12 teacher resource books of such activities (Burgstahler & Utterback, 2000; Sherwood, 1998). For example, one blackline master by Burgstahler & Utterback, entitled "NetWork: The Ghost Train Letter," lists a website URL, directs students to a specific part of the site, and then has room with lines for primary students to write two words from a specific sentence having a silent letter "h." Such books are useful for K-12 teachers and can be used as a source of activities in teacher education classes to teach Internet skills while modeling K-12 activities and resources (Hegwer-DiVita, 2000).

Scavenger hunts

This activity is very similar to a site worksheet. Usually a list of related sites is specified by the instructor. The student is given a number of short answer or fill-in questions to complete using information from the site list (Rekrut, 1999). Questions tend to be factual in nature. Milwaukee High School has developed an excellent example of a well-developed scavenger hunt at http://www.teleport.com/~billf/Internet_Lesson_Plans/Navigating.the.Internet/Internet.in.the.Library.html for basic Internet skills. In a slightly different format, Tammy Worchester has developed a number of Internet activities, including a structured scavenger hunt useful in self concept and community building: http://www.essdack.org/tips/allaboutme.htm.

Online quizzes

While there are software products for creating paper- or disk-based test banks, there are also some sites with templates for online tests and quizzes. Quiz Center, originally developed by the University of Hawaii, is now housed at http://school.discovery.com/quizcenter/. Instructors and teacher education students can use this site to easily build online quizzes. The Hawaii site still lists other links to quiz programs at http://motted.hawaii.edu/et_tools/quizcenter/otherquiz.html. Instructors can make quizzes covering course material or ask students to make and share quizzes for each other or for K-12 students. Sites, such as http://www.myschoolonline.com/golocal/, will host online quizzes (and school web pages) in a commercial venue. Peirce (2000) has a brief overview of online tests in relation to critical thinking. The conclusions are appropriate for K-12 and teacher education classes.

WebBytes

Brief, specific tasks supporting course content may be assigned to document students' visits to a given site or pair of sites (http://www.learningspace.org/webbyte/). The assignments should be short and specific and cover only one or two closely related sites. An example from an assistive technology course is:

> a. Read "Section Two: NIDDR Research Agenda--Chapter 5: Technology For Access And Function" at http://www.ncddr.org/rpp/techaf/lrp_ov.html
> b. Read "A Call to Action" by Dave Edyburn at http://www.pappanikou.uconn.edu/edyburn2.html
> c. Select 3 of their research purposes &/or priorities and explain how they might guide the development of your course contract for this class.

Topic packets

Each student poses a question or topic pertaining to the teacher education course content. Then, each student finds 3-5 websites which, taken as a whole, respond to the question/topic. The student writes an integrated (not website by website) response/discussion, referencing the sites. To document the extent of their searching, students may also be required to list at least 5 sites which they encountered in their search and the reason they rejected each site. Students may be required to electronically share their packet with classmates and the instructor. For example, in a class on positive behavior support, an Adaptive PE student chose to investigate her rights as a teacher in a school with regard to violent and "acting out" behaviors. She used the following sites in writing and sharing an excellent paper: http://www.rppi.org/ps234.html, http://www.colorado.edu/cspv, http://eric-web.tc.columbia.edu/monographs/uds107/preventing_contents.html, and http://www.ideapractices.org/lawandregs.htm. She also briefly described why she had discarded 5 other sites, principally for being off topic and non-specific.

Internet fieldtrips

As discussed at http://teacher.scholastic.com/fieldtrp/tguide.htm, these assignments require K-12 students only to read brief descriptions or related sites and to use the links to visit the sites. Field trips at Scholastic's Field Trip site are in categories such as Children's Literature, Language Arts, K-2, Math, Science, and Social Studies. These field trips could be used as written in introductory teacher education courses or perhaps easily modified by adding requirements for student output.

Group bookmark set

Students could contribute website bookmarks and comment on such listings by using http://www.backflip.com, a free but commercial site that lets users setup a bookmark file that can be accessed or amended from different computers. A university instructor could easily setup a file, for example, on the topic of depression and suicide in children and adolescents. Students, from home, work, or lab, could access the bookmark file of sites listed by peers, add to the listing, and comment on the relative merits of sites, how they compare to course texts, or other summarizing or evaluative tasks. This site also has benefit to anyone trying to coordinate bookmark files between home and work!

WebQuests

The term "WebQuest" was coined in 1995 by Bernie Dodge. Since then, what appears to be an entire subculture has developed. (See the appendix for a list of select WebQuest Internet resources.) WebQuests may be characterized in their own 12 subcategories (Dodge, 1999): retelling, compilation, mystery, journalistic, design, creative products, consensus building, persuasion, self-knowledge, analytical, judgment, and scientific. WebQuests involve a practical task and, often, a complex product. Inquiry, application and synthesis skills are always involved. The instructor describes a task or gives a problem scenario along with a number of select Internet sites that will be useful in completing the project. Students are not limited to the sites given and non-Internet tools may also be used. Sharing the results, often through technology, is required. While WebQuests for K-12 students may take anywhere from a class period to a month to complete, teacher education student products qualifying as true WebQuests are more likely to be culminating course assignments or even sole course assignments because of the concept and resource integration required for completion. The apparent complexity of WebQuests does not prevent their use in special education (Kelly, 2000). A good place to begin understanding WebQuests is http://edweb.sdsu.edu/webquest/overview.htm.

Overall, WebQuests are better seen than described. An example of a short WebQuest on Positive Discipline is at http://www.guilford.k12.nc.us/webquests/pd/pd.htm. This activity is appropriate for any teacher education course related to classroom management and was developed by staff at Guilford County Schools in North Carolina. The Kentucky Department of Education and SERC at the University of Kentucky sponsor a much more complex example investigating interventions for an elementary student with behavior problems at http://ebd.coe.uky.edu/webquest/webquest.html.

Complex Internet Activities

This category is evolving as more creative ideas and integrations are fashioned. For instance, Teachers College, Columbia University, at http://www.ilt.columbia.edu/k12/livetext/curricula/general/webcurr.html, has many links and discussion of complex web design from a constructionist view. It is likely that any of the previous categories and examples could be made into complex tasks. Complex tasks are closely integrated with multimedia technology in presentation by the instructor or in the student's product. Synthesis, analysis, and evaluation skills will be evident in every complex activity.

HyperTasks

These project assignments make use of HyperStudio or other such commercial products for teachers or students to use as a vehicle for their presentation or for ultimate use by their own K-12 students. Plano Independent School district in Texas provides a site with tutorial information, resources, and links highlighting HyperStudio tasks: http://k-12.pisd.edu/HyperStudio/HyperInternet.html.

Web activity templates

Perhaps the best known of the easy-to-use website templates is TrackStar from the South Central Regional Technology in Education Consortium at http://trackstar.hprtec.org/. This site, in addition to having a step-by-step template for developing online lessons integrating websites, also has a library of such lessons developed by other teachers. Filamentality, at http://www.kn.pacbell.com/wired/fil/, is another excellent template for web-based activities and also includes tutorials and libraries of lessons.

Website publishing

Without getting into HTML programming, software products such as "HyperStudio" and "SiteCentral," make producing web pages fairly easy even for novice and intermediate users.

Interactive PowerPoint presentations

A brief article (Tomei & Balmert, 2000) outlines the use of PowerPoint for branching, interactive lesson development reminiscent of old Apple // software such as "Story Tree" by Scholastic. Basically, students are given information and a related question or choice. The choice they make takes them to the response slide and so on, branching depending on student responses. Such techniques may also be used by IHE instructors and K-12 teachers. The main advantage of this technique is that PowerPoint is commonly available in universities and schools and is increasingly being used for presentations in both environments. Consequently, many users already have familiarity with the software. Tomei and Balmert refer to an example from biology available at http://www.duq.edu/~tomei/skeleton. Such a technique could be an especially effective use of SmartBoard technology.

Conclusion

It is easy to say that these activities are nothing new and the computer is just being used as a fancy tool to complete good, old library research projects. While these activities all have their origins in such tasks as paper& pencil worksheets, library research, and drama, they do have some unique advantages. They utilize computer technology that is still new to some learners and rapidly developing or changing for all of us: novelty and motivation are valuable instructional variables! Internet material needs to be carefully evaluated, but can be more current than that in a textbook. Also, as more preservice and inservice teachers have computers and Internet access at home, they are able to use and develop such activities at home at a time that best fits their personal schedules. For many of our students, the best time for their personal study, research, or production time is late at night after traditional libraries have closed or are too far away.

This list of Internet activities is a work in progress. There are certainly variations and combinations of each of these activities and no doubt many other such activities. Perhaps by viewing simple Internet activities as part of a continuum of options, faculty who are just developing their own skills at incorporating technology in course requirements will be more encouraged to begin some activities to their courses.

References

Burgstahler, S., & Utterback, L. (2000). New kids on the net: Internet activities in elementary language arts. Boston: Allyn & Bacon.

Dodge, B. (1999). WebQuest taskonomy: A taxonomy of tasks. Available: http://edweb.sdsu.edu/webquest/taskonomy.html

Hegwer-DiVita, M. (2000). Modeling technology use in special education teacher training. In Willis, D., Price, J., & Willis, J. (Eds.), Proceedings of SITE 2000 (pp. 657-660). Charlottesville, VA: Association for the Advancement of Computing in Education.

Kelly, R. (2000). Working with WebQuests: Making the web accessible to students with disabilities. Teaching Exceptional Children, 32(6), 4-13.

Peirce, W. (2000). Online strategies for teaching thinking. Syllabus, 14(2), 21 & 24.

Rekrut, M. (1999). Using the Internet is classroom instruction: A primer for teachers. Journal of Adolescent & Adult Literacy, 42, 546-557.

Sherwood, W. (1998). Internet activities for math: Challenging. Westminster, CA: Teacher Created Materials.

Tomei, L., & Balmert, L. (2000). Creating an interactive PowerPoint lesson for the classroom. THE Journal, 28 (1), 69-71.

Appendix – WebQuest Internet Sites

http://edweb.sdsu.edu/webquest/webquest.html
Entry link to "The WebQuest Page;" still maintained by Bernie Dodge, San Diego State University

http://www.ozline.com/webquests/intro.html
Leads to more explanation and resources by Bernie Dodge and Tom March

http://faculty.nl.edu/mhan/NECC99Web/sdwebquest.htm
Sample of a WebQuest for practicing staff development skills and techniques

http://www.trumbull.k12.oh.us/resources/onproj.html
WebQuests of a global nature from Trumbull County Educational Service Center in Ohio; many links

http://www.guilford.k12.nc.us/webquests/UltimateWebSites.html
Nearly 100 WebQuests developed by staff at Guilford County Schools in North Carolina; they include resources for others building their own WebQuests.

http://curry.edschool.virginia.edu/curry/dept/cise/read/resources/webquests/hype/index.htm
An explanatory slide show about WebQuests by Raymond Jones of the University of Virginia; links to samples from U of V

http://www.teleport.com/~billf/Internet_Lesson_Plans/Hobbit.web/Hobbit.html
Lovely and complex site by Rob Aaldijk all about Middle Earth; probably not truly a WebQuest, but it could be very useful as an example of a complex web-based literature project. Asldijk used Vistapro 4.0, Paint Shop Pro 4, and Terrain Maker 1.1.

http://njnie.dl.stevens-tech.edu/currichome.html
Stevens Institute of Technology's Center for Improved Engineering and Science Education has primarily science projects utilizing real-time Internet data; perhaps some of the best projects making the most of the Internet's advantages and that could not be done otherwise!

Results of a learning software design competition

Brad Hokanson, Simon Hooper, and Paul Bernhardt
College of Education and Human Development, University of Minnesota
bhokanson@che.umn.edu

Abstract: This paper presents the results of the first Learning Software Design Competition sponsored by the University of Minnesota. Results and observations from the process of the competition are included.

We established the University of Minnesota Learning Software Awards as a mechanism to identify and promote exemplary and innovative educational software. Our long-term goal is to establish an electronic forum featuring best practices in the field. We want to influence educational design by providing access to samples of work judged to be exceptional, and to create a form of eJournal that publishes active samples of exemplary practice-in-action, not simply written articles.

One criticism of our field is that we have not identified what we consider to be exemplary projects. Although many design professions have well established and easily accessible archives of their best work (e.g. art galleries, buildings, and books), the field of Instructional Technology has done little to establish resources where students or practicing designers can examine the best and most inspirational works.

During the fall of 1999 and spring of 2000, we solicited and received approximately 65 entries from across the United States. Judging involved a two-phase process. First, a pool of 35 judges screened entries. Twenty entries were forwarded for further consideration. Three expert judges conducted final judging: Tom Duffy (UNext), Lloyd Rieber (University of Georgia), and Stan Trollip (Capella University). The judges selected the following award winners and honorable mentions.

First place awards
The Writing Trek by Sunburst Communications
Math Problem Solving by Plato Education
Psychology Experiments by Kenneth McGraw, University of Mississippi
Off the Wall by Michael Gardner, University of Georgia

Runners-up
Research Assistant by Dan Schuch, Florida State University
Tuberculosis Case Management by University Research Co.

Honorable mentions
Claymation by Mary Beth Kiser, Edina Public Schools, MN
Probability Explorer by Hollylynne Stohl Drier, University of Virginia
Bohr's Atomic Model by Jeff Wilden, Weber State University

Although it was beyond the scope of the competition to provide full-access to the projects, all the winners provided resources that can be accessed and examined. Samples representing their projects are available at the competition website: http://design.umn.edu/learningcompetition In addition, each of the winners has submitted an article for a special issue of Tech Trends outlining the problems they addressed in their projects and commenting on how they designed their solutions.

Innovation:

Our primary goal was to support the development of innovative uses of technology. We focused on three dimensions of innovation for this competition. The first dimension involves using new capabilities of technology for educational advantage. For example, the very scale and accessibility of the Internet is used to the advantage of researchers and students alike through Psychology Experiments by Kenneth McGraw. There, the power of the Internet connects researchers and research subjects, and provides educational examples for study. Off the Wall by Michael Gardner uses the interactive capabilities of multimedia to investigate the artist Chuck Close. Users explore the work of the artist, interacting with elements of scale, brush stroke and subject. Jeff Wilden describes an interactive multimedia program titled Bohr's Atomic Model. This web-based interactive simulation allows students to build an atom using an atomic construction set.

The second dimension involves solving existing problems in a new or unusual way. Plato's Math Problem Solver and Sunburst's Writing Trek use unique capabilities of the computer and the Internet to assist learners while providing diverse and challenging learning environments. Plato's Math Problem Solving software uses real-world math problems and employs three levels of scaffolded support to guide the user through the solution process. Writing Trek includes a great variety of writing activities and provides the opportunity to publish student work on an Internet site. In contrast to these commercially developed products, Dan Schuch created Research Assistant, a database, to support the complex cognitive demands of graduate education. Not all winners were fully computer-based. Mary Beth Kiser's fifth grade class completed a learning activity involving clay, video, and the World Wide Web.

The third dimension includes new, under-addressed, or under-served problems. Tuberculosis Case Management by Elisa Knebel and Probability Explorer by Hollylynne Drier use the capabilities of the computer in this manner. Tuberculosis Case Management helps medical workers in the Third World, far from Silicon Valley, diagnose and treat a deadly disease. Probability Explorer is oriented to younger students. It engages children though probability experiments and exploration, and allows them to construct a more accurate understanding of the nature of chance.

Observations:

Our observations from the competition provide insight into the development of educational software. First, it is clear from the descriptions presented by the award winners that the design processes employed varied greatly across the projects. Some groups followed formal methodologies, and in some cases, the strategies employed are the result of a formal design process. In other cases, however, the innovation appears centered on the overlap between expertise in the subject matter and a use or interest in a technology. Often, creative inspiration appears to occur as sudden insight.

Second, access to development funds did not limit creativity. As noted above, three winners were graduate students. Apparently, innovation does not require large teams or budgets. Third, comments from the competition judges about the value of the judging process were overwhelmingly positive. Many people commented that the process of reviewing competition entries was enlightening and worthwhile.

The competition was funded by the Design Institute at the University of Minnesota. The second round of the competition is currently being planned. Information about the competition, including a video and samples of this year's winning entries, can be accessed at the competition website.

Interactivity: The Key to Successful Web-Based Learning Environments

Mary Ann Kolloff
Curriculum and Instruction
Eastern Kentucky University
United States
maryann.kolloff@eku.edu

Abstract: The creation of online courses demand more attention to the paradigm of learner-focused instruction with high levels of interactivity. As a result, it is becoming increasingly important to suggest more precise methods of design and analysis of web-based instructional activities. This paper suggests criteria for designing interactive web-based student activities and gives examples used with pre-service and in-service teachers.

There is no question as to the value of interaction in the classroom. Students interact for understanding and faculty depend upon the interaction for feedback from students to determine success in achieving objectives. Interactivity in the online course becomes more critical as it is often the "life line" or connection between the distant student and instructor and the student and classmates. Currently, many faculty members have to transform their courses from the traditional on-site model to the web or web-enhanced model. In order to accomplish the transformation, faculty must often participate in a variety of professional development sessions. The immediate challenge for faculty is to become familiar with the mechanics of the computer delivery tools being used. However, in doing so, all too often the focus is on the technology itself rather than its effective use.

After the faculty has mastered the delivery tool, a critical problem becomes the effective use of online interactivity, especially in the area of high-level critical thinking. In order to have successful interactions in any course, requirements include physical and cognitive processing. And, successful interactions are often mediated by quantity and quality of effort (Hannafin, Hannafin, Hooper, Rieber, & Kini, 1996). What techniques can instructors use to be confident that interaction is required for the discussion of concepts, principles, and assignments? How can the instructor design the course so effective interaction occurs in web-based learning environments? Ensuring active, attending behavior in web-based learning environments is challenging for many instructors. Interactivity should engage the learner with the material, the ideas of fellow students, and the ideas of the instructor. The end result is to build a community of learners based on learning requirements that include the exploration and development of ideas, application of principles, refinement of interpersonal skills, and modification of attitudes.

It is the intent of the presentation to share techniques for designing web-based or web-enhanced learning environments that include a high level of interactivity that lead to successful learning communities. Examples of practical applications with undergraduate, pre-service teachers and graduate library science students in activities such as preliminary interest inventories, role playing, author visits, and debates will be presented and discussed. Examples will be categorized according to the learning requirement.

Interactivity as a Concept

The classic instructional theory definition of interactivity has its bases in behavioral theory. Basically, the meaning of interaction is that it provides a way for learners to receive feedback. One means of providing feedback, in the classical sense, is error correction. Identifying errors engages the learner in recognizing inadequacies in their mental models and motivates the learner for a deeper understanding of the concept, skill, or attitude. Errors that remain undetected are repeated and reinforced since there isn't any feedback. (Hannafin, Hannafin, Hooper, Rieber, & Kini, 1996). Giving the corrective feedback concerning the adequacy of the statement is often not enough information for the learner. Additional information or elaboration is needed for effectiveness and for the changing of mental models of concepts.

In Michael Moores' concept of "transactional distance", he discusses three types of interaction essential for any distance learning environment. These are learner-instructor, learner-content, and learner-learner interaction. Learner-instructor interaction is defined as the components of motivation, communication, and feedback between the instructor and student. Learner-content interaction is defined as methods by which the learners obtains cognitive information from texts, and other resource materials such as web pages, videos, or journal articles Finally, learner-learner interaction is defined as the communication and exchange among students about information, course content, assignments, and attitudes (McIssac & Gunawardena, 1996).

Muirhead defines interactivity as that which involves "participation by the learner in on-line communication between learners and their class tutors" (p. 1, 2000). Murihead further defines interactivity as having three components: communication, participation, and feedback.

Interaction is a complex variable that includes many different aspects and issues. These elements provide a fundamental for involving interaction in the design of the course. Variables to consider include the amount of interaction, type, methods (viz., asynchronously or synchronously), spontaneity, quality, and timeliness of the interaction.

Interactive Strategies in Online Learning communities

In order to create well-structured and meaningful interactive activities, several criteria for designing the learning environment must be considered. In other words, what the teacher must provide and the student must do. Reigeluth & Moore's (1999) comparison points for analyzing instructional theories are useful as a basis for the planning or analysis of an interactive class activity. Specifically, these criteria are: types of learning, control of learning, focus of learning, grouping for learning, interaction for learning, support for learning. An additional category, the online discussion technique, is added to clarify the computer conferencing tool implemented.

Several examples of interactive activities used in pre-service and in-service education online classes are analyzed below using the criteria suggested.

Activity One: Copyright

The goal for activity one is to gain a knowledge base of the copyright law and applications of the law for school library media centers. Students were given a list of questions about copyright. The number of questions equaled the number of students. Each student was randomly assigned one question. After a period of two weeks, each student was required to post an appropriate answer to the question and lead an online discussion on the issue. Each student was also responsible for responding to three additional postings. An analysis of this activity is outlined below:

- Types of learning:
  The type of learning involves building and application of knowledge

- Control of learning:
  The teacher controls the learning since the education goal is directed by standardized testing for the certification area. The teacher selects the content, selects the resources, decides the activity, how it will be accomplished, and in what order. In this particular case, students are to find appropriate answers, by visiting web sites and referring to their text, to copyright questions prepared by the instructor.

- Focus of learning:
  The focus of learning is centered on a particular topic, copyright.

- Grouping for learning:
  The grouping for learning is individual with small group interaction. The assignment reads that each student is responsible for leading the discussion of one question. Three additional students are to extend and elaborate to the initial posting of the question.

- Interactions for learning:
  The interactions needed for this activity is student with material and student with student. Students respond to guided questions and react to the posted response. Team membership is built since the whole class is responsible for building the database for the knowledge needed for the topic. Ownership of the information is vital since questions concerning the topic appear on the standardized test. Issues often arise in the discussions concerning fair use and the violation of copyright laws and as the law is implemented in schools. This provides students with real-life examples of application of knowledge to real life experiences.

- Support for learning:
  The instructor provides cognitive support for the activity by providing appropriate textbook and web sites for the students to use in order to find appropriate responses to the guided questions. The teacher is also responsible for providing feedback to the whole group based on the accuracy of the responses. Emotional support is also provided for the standardized test since the students have access to a document that is easily reviewed prior to taking the standardized test.

- On line discussion technique:
  Discussion forum is used in order for students to complete the assignment over a two-week time period.

Activity Two: Interviews with Authors

The goal for activity two was to gain an understanding of authors as individuals and the influences of their lives on their writings. An interview can occur with a live author or deceased author role-played by an expert. Either a guest or a student may be the expert and role-play a particular author.

- Types of learning:
  The type of learning involves the understanding of authors and their ideas. In addition, conducting an interview strengthens interpersonal skills.

- Control of learning:
  The teacher selects the content, decides the activity, and how it will be accomplished. In this example, students were to find an informational or biographical book focusing on Shakespeare. They were to develop questions they would like to ask him based on their readings of the book.

- Focus of learning:
  The focus of learning is centered on a particular topic, Shakespeare.

- Grouping for learning:
  The grouping for learning is individual with whole group interaction. The assignment reads that each student is responsible for reading one book and posting questions to a discussion forum in order that the whole group may review the questions. The whole group then participates in a chat session in order to conduct an interview with Shakespeare.

- Interactions for learning:
  The interactions needed for this activity are student with material and student with teacher (viz., the expert). Students were to read a book and prepare questions they found important to further their

understanding of the author. Questions were shared so the students could review the types of questions prepared prior to the interview. A Shakespearean expert role-played the playwright. This provided students with a real-life experience in order to gain understanding of the author's life and works.

- Support for learning:
  The instructor provided cognitive support for the activity by stating the reasoning behind interviewing an author and choosing an appropriate book to read. Shakespeare was chosen for this activity since class discussions often focus on appropriate authors to read and study in the middle grades. Emotional, or attitudinal, support is also provided since most students recall reading Shakespeare only in high school and having little understanding of the language used in his works. The instructor also provides debriefing activities focusing on the meaningfulness of the experience and using similar activities in middle grade classrooms.

- On line discussion technique:
  Discussion forums were used to post questions and a chat session for the interview.

Activity Three: Debate

The goal for activity three is to gain an understanding of controversial topics. Applying an understanding of the topic is crucial since controversial issues, such as child abuse, AIDS, school violence, or drugs, are often at the height of discussion in educational settings.

- Types of learning:
  The type of learning involves the knowledge and understanding of controversial ideas and issues. Furthermore, in real-life situations, students need to be prepared to engage in a high-level of thinking as ill-structured problems arise in schools.

- Control of learning:
  The teacher selects the content and decides the issue. For this activity, students were placed in either a pro or con group. Learners have control over preparing the arguments, designing the environment, and determining how their argument will be presented.

- Focus of learning:
  The focus of learning is centered on a particular topic, challenging and censoring books.

- Grouping for learning:
  The groups were composed of seven or eight members. Each group worked independently in order to prepare their argument.

- Interactions for learning:
  The interactions needed for this activity are student with material and student with student. Working in small groups students were to prepare arguments for the debate.

- Support for learning:
  Supplying a list of web sites and appropriate textual materials for both sides provided cognitive support for the activity. The instructor also furnished cognitive support if students requested additional information. Cognitive and emotional support was provided in debriefing sessions as the arguments were reviewed and the energy necessary to implement a debate was reinforced.

- On line discussion technique:
  To prepare arguments, students used discussion forums and chat sessions. A chat session was used to conduct the debate.

Summary

Instructors can conduct an analysis of the activities in their courses using the criteria provided by Reigeluth & Moore (1999) to ensure confidence that interaction is embedded in the discussion of concepts, principles, and assignments. The criteria also provide a means for the instructor to reflect on the design of the learning environment in order that it may be learner-focused. In addition, the criteria enable the instructor to give appropriate support to their students in a web-based environment.

References

Hannafin, M. J., Hannafin, K.M., Hooper, S. R., Rieber, L.P., & Kini, A. S. (1996). Research on and research with emerging technologies. In D H. Jonassen (Ed.) Handbook of Research for Educational Communications and Technology (pp. 378 –402). New York: Simon & Schuster Macmillan.

Kearsley, G. (May, 1995). The Nature and Value of Interaction in Distance Learning. George Washington University, Washington, DC. Paper prepared for the Third Distance Education Research Symposium, May 18-21, 1995.] http://www.hfni.gsehd.gwu.edu/~etl/interact.html [November 1, 2000]

McIssac, M.S., & Gunawardena, C. N. (1996). Distance Education. In D H. Jonassen (Ed.) Handbook of Research for Educational Communications and Technology (pp. 403-437). New York: Simon & Schuster Macmillan.

Muirhead, B. (2000). Interactivity in a Graduate Distance Education School
Educational Technology & Society 3(1) 2000.
http://ifets.ieee.org/periodical/vol_1_2000/muirhead.html {November 1, 2000]

Reigeluth, C.M., & Moore, J. (1999). Cognitive education and the cognitive domain. In C. M. Reigeluth (Ed.), Instructional design-theories and models: a new paradigm of instructional theory, volume II (pp. 51-68). Mahwah, NJ: Lawrence Erlbaum Associates.

SCRIPTING A LESSON: A METHOD TO ASSIST THE DESIGNING OF PERSONALIZED LEARNING ENVIRONMENTS

Dr. Michel Labour,
Laurent Verclytte
Nicolas Vieville
Prof. Sylvie Leleu-Merviel

Laboratoire des Sciences de la Communication
Université de Valenciennes et du Hainaut Cambrésis
B.P. 313, 59304 Valenciennes Cedex 9
France
michel.labour@univ-valenciennes.fr

1. INTRODUCTION

One of the challenges of teaching is to ensure the learning content is not only meaningful to learners, but also has the desired educational impact on the quality of their learning. All too often, however, carefully crafted teaching/learning materials tend to be presented in such a way that they have limited impact on learners. One explanation for this, is that many teachers feel unable to convert their expert knowledge to the needs of different learners because they do not have the appropriate preparation in integrating teaching tools into their lessons.

This paper describes a method to guide the designing of learning environments, based on the work of an interdisciplinary team of researchers and teachers at the *Université de Valenciennes* (France). The first part of the paper discusses research conducted at the University using Kolb's Learning Style Inventory (1984) to establish the perceived learning styles of 179 adult learners (Study 1). This is followed by giving the results of a study into learners' self-observation of their dominant learning style (Style 2). The second part of the paper outlines the historical legacy of different pedagogic models *via* six educational paradigms, cross-referenced to nine operational aspects of teaching. To put this analysis in perspective, a study was conducted into the expressed learning modes of 575 adults learning English as a Foreign Language (EFL) (Study 3). This is followed by a comparison of two dominant educational schools of thought, drawn from the work of Piaget and Vygotsky. The third part of the paper explains step by step how to draw up a scripted lesson *via* a series of interconnected pedagogic fragments. To do this we define key concepts such as: lesson, document, hyperdocument, lesson script, diagese, script, scenation, scenic, and setting up the situation. This process is called the scenistic approach to lesson planning. Finally, the paper proposes different personalized learning tracks based on two broad types of lesson scripts with their respective advantages and disadvantages in the classroom.

2. FOUR BASIC LEARNING STYLES

There is consensus about the idea that a lesson based essentially on the apparent convenience or fascination for teaching tools is doomed to failure. From an educational point of view, teaching tools are not neutral, if nothing else by the fact, for example, that they depend on the teacher's perceptions of learning styles and what s/he expects of learners in terms of the tools' capabilities. In this light, David Kolb's (1984) inventory of learning styles (viz. *Reflector*, *Theorizer*, *Pragmatic* and *Activist*, see Table 1 below) can help us to help understand what may be going on in the learning process. The advantage of using Kolb's inventory is its widespread use and cross-curricula application. In practical terms, a dominant learning style represents the likely starting point of how an individual marshals his/her resources. If this initial approach should fail, the learner might then turn to other learning modes.

To put Kolb's inventory into the context of continuing education, a study of 179 learners (Study 1) of EFL (September – October 2000) filled in a close-ended questionnaire at the *Université de Valenciennes* to establish a four-facetted profile of learners, with each one of the four facets representing a maximum score of 100% each. In this context, of the learners questioned: 70.8% describe themselves as *Reflective*; 67.2% see themselves as *Theorizers*; 66.1 % consider themselves as *Pragmatic*; and 58% perceive themselves as being *Activist*. In short, more than two thirds of the French adult learners asked for a pedagogic structure that allows them time to carefully weigh up the different sides of the question (*Reflective*), followed by their need to adopt the *Theoriser* (questioning) and *Pragmatic* ("get the instructions-then-do it on your own") learning modes (see Table 1 below).

After having filled in the initial questionnaire, 42 adult EFL learners (TOEIC average score of about 405 points) were personally explained what each of the four learning styles were and then asked to identify explicitly which particular style best described their approach (Study 2). The direct self report of perceived dominant learning style shows that: 40.5% of learners describe themselves as *Reflective*; 33.5% of learners see themselves as *Pragmatic*; 19% of learners see themselves as *Theorizes*; and 7% of learners see themselves as *Activist*. This study contrasts sharply to the results of the more indirect survey of perceived learning styles of their co-learners (Study 1). The impact of a directive (*jacobine*) and "rationalist" French culture on adult learners' perceived learning style could be an important factor in explaining the apparent gap between indirect (Study 1) and the more direct self-reports (Study 2).

Given that self-observation reflects learners' image of themselves and that of the social process (e.g. the educational/cultural system), several implications can be drawn from the studies into learner self-reports. First, teachers in (French) adult education need to take into account the needs of *Reflective* learners who tend to focus on, for example, gathering (consuming) information, rather than creating (producing) information (contrary to the *Pragmatist* and *Activist* modes). Second, how can the planning of lessons cater for other types of learning styles, notably that of *Theorizers* and *Pragmatists*. Finally, when compared to the results of the 179 learners polled (Study 1) a significant amount of learners seem not to be aware of their own probable "learning style" when directly questioned about the subject (Study 2). Failing to understand one's learning style, may explain, in part, some of learners' difficulties in attaining their learning objectives due to not being able to assimilate the data in an "appropriate" way in terms of their cognitive processes. How can they be made aware of their likely learning style?

3. SIX EDUCATIONAL PARADIGMS

For teaching to be effective as an act of mediation between what learners know and what they want to know, it is useful to have an overview of the achievements of previous generations of pedagogic style that inevitably influence current teaching practice. From the adult learner's point of view, this approach could explain, in part, their expectations and needs when (unconsciously) referring back to the educational experiences of their youth. For teachers, highlighting this legacy may bring out ideological self-interest, rarely made explicit, forming part of what Thomas Khun (1962) calls a "paradigm" or unquestioned theory or set of beliefs within a given scientific community.

Based on the initial work of Puren (2000), it is possible to expand his initial analysis into a broader nine-facetted table (Table 2 below) to present a mosaic (a series of non-related elements linked more for historical reasons rather than for any intrinsic causes) of various features of the teaching and learning approaches of the last few decades.

Paradigm	1. Reception	2. Impregnation	3. Action	4. Reaction	5. Construction	8. Interaction
Significant learning happens by	direct assimilation of knowledge transmitted by the teacher	intensive exposure to the source of knowledge	completing pedagogic tasks	reacting to pedagogic prompts of the teacher/ teaching tool	building up a personal system of knowledge	meaningful exchanges
Guiding model of mediation	teacher-centered	individual's needs & wants	physically active learners	linear & highly structured teaching content	self-awareness ("learning how to learn")	negotiation among learners & with the teacher
Preferred pedagogic mode	lectures	self-discovery, workshop activities	"laboratory" work	programmed teaching, e.g. drill work	self-monitoring activities	discussion groups, collaborative activities
Dominant pedagogic type of tool	teacher-led tools e.g. talk & chalk, commenting on written texts	"real- life" tools used in a personal context	real-life tools adapted to a pedagogic context[1]	machine-driven "teaching machines"	learner-driven pedagogic tools e.g. personal computer[2]	network-linked tools e.g. Internet
Dominant sensorial modes	aural[3]	visual[4], tactile[5]	aural, kinaesthetic[6]	visual, tactile, kinaesthetic	visual, tactile	aural, tactile
Dominant symbolic perceptual modes	verbal[7], sequential[8]	verbal, non-verbal[9], non-sequential[10]	non-verbal, sequential	non-verbal, sequential	verbal, non-verbal, sequential	verbal, non-verbal, non-sequential
Learners are primarily expected	to be attentive to the teacher	to maximize learning opportunities	to participate in class	to react in a set way	to produce verifiable statements in terms of their needs & wants	to balance out their needs & wants with the socio-cognitive demands of the learning task
Preferred learning style (cf. Kolb 1984)	reflective	activist	pragmatist	(reflective)	theoriser	reflective

Table 2. Mosaic of educational paradigms

To put this analysis of educational paradigms into the classroom context, a one-year study (September 1999 – October 2000) of the sensorial modes of 575 adult EFL learners, at the University (Study 3), reveals that of those who filled in the questionnaire: 67.3% feel they are teacher-dependant; 60.2% see themselves as needing to be physically active (*Kinaesthetic*); and 60.3% say they are able to learn by listening (*Aural*). It seems then that more than two thirds of adult learners expect explicit guidance from the teacher and 60 % of the learners want to be given an opportunity to be physically active and to learn by listening. In other words, even if being physically active and listening to what the expert says are important to learners, they expect even more to have the guiding hand of the teacher present. Given this need for pedagogic guidance, the work of Grangeat (1998:183) allows us

[1] Wiburg, K.M. (1995) An Historical Perspective on Instructional Design: Is it Time to Exchange Skinner's Teaching Machine for Dewey's Toolbox? http://www-cscl95.indiana.edu/cscl95/wiburg.html (consulted 28.10.2000)

[2] see: Edgar, R. (1995) PC is to Piaget as WWW is to Vygotsky at http://www.iconceptual.com/Siggraph.html (28.10.2000)

[3] Definition: Learners favouring the *aural mode* are specially sensitive to human values, like human warmth and a convivial environment. They tend to focus on communication, teamwork and respect for others in the group (Labour 1998:107). Aural learners represent around 30% of the population cf. http://www.demon.co.uk/mindtool/mnemlsty.html (consulted 27.10.2000), this reference is also used concerning *visual* and *kinaesthetic* oriented learners (see below).

[4] Definition: In learning by observing, a *visually oriented person* focuses on the details, and the applications of what is being observed. Visual learners make up about 65% of the population (see above). For McLuhan (1964:291) the visually-dominant mode tends to see all things as continuous and connected. This is done by nurturing a fixed point of view, an attitude of detachment & non-involvement, and in separating functions/stages/tasks in time and space (McLuhan 1964:217, 247, 291).

[5] Definition: *Tactile oriented learners* need to be in "direct" contact (*e.g.* the television, see McLuhan 1964: 233,290,292,295) with elements of the object of knowledge. Tactility is "the interplay of the sense, rather than the isolated contact of skin and objects" (McLuhan 1964:273). The related area of haptic technology, has become increasingly important in the development of the new technologies of information and communication (e.g. force feedback applications).

[6] Definition: *Kinaesthetic oriented learners* prefer learning according to how they perceive physical performance (e.g. paralinguistic communication involving body language, eye contact, hands and gestures in a given language-culture) in terms of effort, self-image, efficacy, etc. Kinaesthetic learners make up around 5% of the population (see above). This mode is not situated in any one particular part of the body, as those of seeing and hearing, and involves a nonlinear perceptual process.

[7] Definition: The *verbal mode* implies a system of communication that consists of statements with a syntax.

[8] Definition: *Sequentiality* implies a process that has a pre-set beginning, middle, and end.

[9] Definition: The *non-verbal mode* consists of statements with no obvious syntax (e.g. images, gestures, tones of voice, use of space, clothing cues, colours, taste) and assumes a high level of literacy. Studies show that nonverbal cues are 50% effective, while words are only 7% effective cf. http://www.trnty.edu/depts/education/teach/communication/nonverbal.htm ; http://mhhe.com/socscience/speech/commcentral/ mgnonverbal.html (consulted 27.10.2000)

[10] Definition: *Non-sequentiality* has no pre-set order, the person chooses how to organise the available segments of data

to look at how two dominant educational approaches, inspired by the works of Jean Piaget and Lev Vygotsky respectively, tackle the issues of how people acquire knowledge in terms of external teaching agents.

Jean Piaget : self-structuration	**Lev Vygotsky** : (guided) co-selfstructuration
a) biological view of learning where the individual first needs to have a certain level of mental development before being able to have meaningful contact with the social context - structuralist view of learning	social view of learning where it is the concepts from others in society that stimulate the individual's internal mental development - functionalist view of learning
b) discovering things by oneself and dialoguing with "objects" of learning	stress on social interactions and on the ability to get help from others
c) skeptical about the efficacy of (explicit) mediation ("Each time one explains something to a child, one stops him/her from inventing it.")	mediation is decisive ("If the child makes one step in learning, he advances two steps in his development.")
d) role of the specialist is to provide a rich environment and to facilitate cognitive conflicts that are the driving force of mental development	role of the specialist is to identify when the learner is in a *Zone of Proximal Development* and to help him/her complete a task first by being helped and then by him/herself
e) especially useful for error analysis and to plan how to overcome a learner's difficulties	especially useful for gradually building up (scaffolding) challenging teaching/learning units

Table 3. Brief comparison of some of Piaget's and Vygotsky's contribution to educational theory

4. THE CONCEPT OF SCRIPT CREATION APPLIED TO THE DESIGN OF A LESSON

It is not sufficient, however, just to know what information content is suited for learners. It is equally necessary to know how to present this information in an "appropriate" way. To do this the preparation of information content involves selecting and organizing data, in other words defining a planned structure consisting of sub-sections, itself able to be broken down to its most basic level. The term "document" designates this organized structure.

Definition: A *document* is an organized structure of lower level elements of information. A document is thus information content that can be applied to a given medium/tool. Hence, a computer screen, a cassette audio, a book, a piece of canvas, etc. is not in itself a document but only the material base/tool of the document.

Definition: "A *hyperdocument* is a content of information made up of a nebulosity of fragments, whose sense is constructed by each of the given reading routes" (Balpe 1990). This definition does not make any reference to a corresponding physical medium. It is linked to the concept of "document" mentioned above, but adds the dimension of the multiplicity of (reading) routes, presupposing the possibility for users to intervene in the distribution of the contents, in particular in the means of selection or in the numerous choices (interactivity).

Definition: A *lesson* is a hyperdocument with pedagogic or cultural aims. A lesson consists of having access to objects of knowledge available *via* the various teaching media as well as their technical variants (hyperdocuments, hypermedia, and more traditional tools like chalkboards, books, etc.). In short, the term "lesson" refers to the structure that controls the organization of the constituent pedagogic sub-elements while being totally independent of the physical object ultimately constructed.

When designing a lesson, it is often useful for the teacher to have a way to make explicit the intended structure of the lesson. This can be done by creating a mental/conceptual model of the lesson. Traditionally, teachers design a lesson plan based on a "document" structured into different interconnecting parts. The lesson plan can then be given to the learner by way of a "summary". With the summary, learners can then look up any section of the document wherever it be on the chosen medium/teaching tool. In this way, a distinction is established between the actual physical putting into practice of the (teaching) content, and the various aids used to look up the different parts of the lesson. Though a sequential style of reading is still the most common, with this technique different types of reading routes now become possible even in the case of a linear approach. For example, widely diffused written culture, i.e. the press, has diversified the ways of having access to knowledge in introducing parallel procedures of looking for data. Newspaper and magazine pages present with the body of the main article, clearly visible footnotes, cross-references, sub-titles, condensed margin texts, illustrations, boxes of information, etc. In this vein, when one wants to really use the possibilities of sound documents and moving pictures one may need to go even further than the written medium.

In the audiovisual world, the "script" is the working model of creation. The concept of script is complex, and yet has not been the object of much in-depth, critical reflection. The numerous specialized guides that do exist on how authors can improve their script writing techniques (e.g. Seger 1998) give the illusion that the notion of *script* is self-evident and thus does not need any further discussion. Yet, this is far from being the case today when the script can no longer remain at the level of lock-step linearity, inherited from the centuries-old written culture aided and abetted by a traditional audiovision approach in education which has remained the dominant model in the minds of many.

In the case of the cinematographic document, the script is a tool that aids the creation process from the initial idea to the continuity of dialogues. The extended script is able to integrate the different functions of interactivity and allows a break with linearity. In this context, the "lesson script" is not a physical model of data to be put on a given medium nor is it a model of interaction with the learner. The script is a way of *accompanying* the creation of the lesson from the initial idea to its finished state. It serves as a concrete translation of a teacher's mental representation of a given lesson. This type of script can thus evolve dynamically during the creation process. Between defining the lesson content and creating a complete lesson there is, however, a series of intermediary phases. Previous studies (Leleu-Merviel 1996) have introduced concepts that take into account the evolutive dimension of the script in the progression of the dynamics of the lesson creation process. The first phase, linked to the definition of the lesson content, corresponds to the concept of *diagese*.

Definition: The *diagese* includes everything that belongs to the imagined/proposed setting of the document as expressed through the *lesson content*.

Definition: The *script* refers to a structured content that progresses through a series of events. While the script develops the *logic of the different pedagogic events*, the *scenation* organizes these events together as interacting elements. It can be equated as the "route" (or path) that the learner takes within the structure defined by the script. The scenation is associated with the surface structure as opposed to the *deep structure of the script*. In particular, the impact of the interactivity modes is transformed by a scenation that, though predetermined, develops itself during the interactive session. It is in this sense that a teacher can interrupt the linearity of a prepared lesson to "spontaneously" present a part of the lesson, which should have been dealt with at a later time, in order to instantly and directly respond to a question.

Definition: The *scenation* (Colin 1992) implies the *organized structure of events* and/or states with which the learner actually interacts. It is made up of a body of fragments taken from the script to determine how the physical data is linked to the actual production of the script. When the creation of the script and the scenation's outline has been done, the lesson exists in an "abstract" way. It is, for example, the text of a play, or the musical partition. It is neither the play itself (the theatrical performance), nor the concert (the musical performance). The performance transposes the abstract document into a reality perceivable to the physical senses.

Definition: The *scenic*, or the concrete presentation, refers to the process that allows the transposition of the text into a *concrete reality*. It is the result of aesthetic choices, practical or financial constraints, conditions of usage, etc. The scenic deals with the choice of the medium for a given fragment taken from the scenation's structure: text, sound, or both together, etc. Similarly for the data of the document, the scenic affects the precise translation of fragments extracted from the script, given that one should carefully consider how the learner's interaction with the environment of the document will be translated in concrete, hands-on terms.

Definition: *Setting up the situation* defines the modes of the *concrete facilitative links between the user and the data* of the document. In the multimedia world, it is on the level of setting up the situation, and only on this level, that the creation of user functions will be linked to a button, an icon, a joystick, a click, a captor, a data glove, a virtual reality immersion headset, etc. In this way, we see how setting up the situation deals with the way that concrete means of action allows the user to navigate in an environment presented by the scenic in order to facilitate the acquisition of knowledge in a given context.

In short, our approach to facilitate the creation of a lesson implies: constructing the *diagese* linked to the description of the content ; constructing the *script* (architecture) in which the acquisition of knowledge progresses sequence by sequence though a series of organized events ; creating the *scenation*, as a constituted structure of fragments from a script with which a user is potentially placed in a real context of interaction ; choosing the *scenic*, which translates the text into a body of physical data, that the user's senses can perceive ; defining the degree of setting up the situation to establish concrete modes of relations between the user and the data of the document. The term "scenistic approach" of lesson planing thus designates using this approach in presenting of teaching content. Its novelty rests in distinguishing five levels of script writing (described above) which, in practice, are far too often misunderstood at the expense of the efficiency of the outcome for the learner.

5. DEVELOPING PERSONALIZED LEARNING TRACKS

Guided by the various educational paradigms (Table 2) and the insights of Piaget and Vygotsky (Table 3), two broad types of lesson scripts can be proposed. First, there is a lesson script based on *optional tasks* to ensure that learners who have had access to the same core data can, at various moments, supplement or refresh the input of data according to their personal preferences. This approach is particularly useful when dealing with areas of teaching/learning which are likely to cause difficulties (*learning black spots*). A practical example, of such a lesson script is that of proposing various pedagogic activities to be done in a *pluri-media resource center*. Using books, video tapes, audio-tapes, computer programs and network connections, a custom-made "database" can guide learners to appropriate sections of encyclopaedias, pre-recorded demonstrations, lesson summaries, exercises, etc. The danger with this type of script, however, is that it may ghettoize learners, or reinforce preferences and tastes which may not always facilitate a broadening of the learner's mind.

The second type of lesson script is that based on a *"tunnel" of multimodal activities* to get students to explore different ways of appropriating data. To do this, activities are proposed for learners to enter a pedagogic "tunnel" to try out, for example, different learning styles through a series of activities in order to complete the lesson. This approach implies that learners need to explore different ways of tackling a given subject. In this way learners are likely to do better in some activities, while in others they may need help. Such an approach can prove particularly useful in guided *project work* (*e.g.* case studies, simulations, co-operative activities), *evaluation activities* (e.g. France's innovative *Diplôme de Compétence en Langue* based on a standardised script to validate language abilities[11]) and with *innovative subjects* that demand a significant change in the habits of learners.

A well-laid out lesson scripts can thus: help those with apparent learning difficulties based on their cognitive and perceptual preferences (accessibility); encourage learners to make choices and/or to explore alternative ways of learning to surpass themselves (self-discovery); orchestrate different teaching/learning resources e.g. email, newspaper articles, videos, sound recordings (co-ordination); be adopted based on feedback from learners and acquisition of new resources (updating); demonstrate how financial investments are being used (accountability).

6. CONCLUSION

The underlying idea of our script-based tutoring system is that there is no ready-made recipe for successful learning. Any attempt at increasing the efficiency of a teaching/learning system ultimately depends on matching learner needs and expectations to the cognitive demands of the learning task and to the constraints of the teaching/learning context. But, before tackling the inevitable questions of logistics and costs in setting up such a tutoring system, it is vital to have in place a system of objective measures to evaluate the efficiency of the different types of tutoring schemes in terms of what learners do, what they feel they have learnt, and how feedback facilitates planning and decision-making. This preoccupation in establishing reliable measures linked to a quality assurance approach is the driving force of our ongoing research in this domain.

ABSTRACT
The audiovisual approach in pedagogics, so closely associated with a lock-step view of teaching in the seventies, has undergone a revolution in recent years. By way of examining how teachers can script a body of pedagogic sequences, or lesson, we look at the different phases of the lesson planning process and how a more innovative audiovisual approach can facilitate this process. First, we outline different learning styles as perceived by learners themselves. Second, we propose an overview of the different pedagogic approaches available to teachers. Third, the different phases of creating a lesson script are described based on a scenistic approach. Finally, we suggest two broad types of lesson scripts for the development of personalized learning tracks to demonstrate some of the advantages of having a common platform for apparently contradictory teaching methods, namely linking a narrowly sequential to a broader non-sequential style of teaching.

REFERENCES

Balpe J.P. (1990) Hyperdocuments, hypertextes, hypermedia, Paris: Eyrolles
Colin M. (1992) Cinéma, télévision, cognition. in Processus discursifs, langage et cognition, Nancy: Presses Universitaires
Grangeat, M. (1998) Lev S. Vygotsky (1896-1934): L'apprentissage par le groupe. in Ruano-Borbalan, J-C. (ed.) Eduquer et former. Auxerre: Sciences Humaines Editions, pp.177-183
Kolb, D. (1984) Learning Style Inventory Technical Manual, Boston, MA: McBer
Labour, M. (1998) Que pense l'apprenant de l'apprentissage guidé de l'anglais ? Panorama des représentations des adultes en formation continue, unpublished doctorate thesis. Université de Technologie de Compiègne, France
Leleu-Merviel S. (1996) La scénistique : méthodologie pour la conception de documents en media multiples suivant une approche qualité, unpublished post-doctorate thesis, Université de Paris 8, France
McLuhan, M. (1964) Understanding Media. The Extensions of Man. Mentor Book: New York
Puren, C. 2000. La didactique des langues face à l'innovation. 3rd Conference on the Use of New Technologies in Foreign Language Teaching, Virtual Environments and Language Learning, 23-25 March, Université de Compiègne, France
Seger L. (1998) Faire d'un bon scénario un scénario formidable, Paris: Editions Dixit

[11] http://www.education.gouv.fr/fp/dcl.htm (consulted 11.10.2000)

Analysis of Large Web-Based Courses at the University of Central Florida

Kevin A. Lenhart
klenhart@mail.ucf.edu

J. Stephen Lytle
slytle@mail.ucf.edu

Carol Cross
cacross@cfl.rr.com

University of Central Florida
Department of Health Professions
United States

Distance education, as once described by a colleague, is sitting in the back row of a three hundred-seat auditorium. It has traditionally been thought that to successfully teach a large class, you needed to herd students into an auditorium, and proceed to lecture them for several hours. This provides the students with very little opportunity to interact with fellow students or the instructor.

Over the past few years we have discovered that, with the advent of the Internet, large classes (one hundred to one hundred and sixty students) can be successfully taught at a distance. Over the past several semesters we have collected data regarding student perceptions of these courses and the instructor, as well as demographic information. Our results show that not only do the students enjoy taking these courses, but that they are as, if not more, successful in them then in traditional large classes.

At the University of Central Florida, distance education was embraced in 1996 almost as a necessity. With 33,000 students in the fall of 2000, and 52,000 expected by 2010, UCF is growing faster than brick and mortar buildings can be constructed. Until recently, class space was rented during the day at a movie theater nearby.

Distance education provides some relief to this problem. UCF had divided its courses that have a web presence into three categories, enhanced (E), media enhanced (M), and web-based (W). The E courses provide the instructor with the ability to use the web without reduced seat time. The M courses use the web as an integral part of the course and reduce the seat time by 1/3, 1/2, or 2/3. The W courses have no regular class meetings. Some do however have an optional orientation and/or proctored examinations. These course designations are designed, in part, to inform students of the modality of the course. The designations and explanations are listed with the course, as well as instructor contact information, in the course schedule.

Survey Results

Our survey (UCF, 1999) looked at student demographics and perceptions of entirely web-based courses. Three courses were examined over two semesters. Two under graduate courses, with between 110 and 125 students, and one graduate course with 35 students.

The demographics determined from the survey responses indicated a higher percentage of female students then males compared to university norms. 77.6 percent female compared to overall University norms of 54.9 percent female. 49.3 percent of the respondents were employed full time and 37.3 were employed part-time.

The students were asked of their overall satisfaction with the course, from very satisfied to very unsatisfied. 87.8 were satisfied with the course and only 12.2 percent were neutral or un-satisfied with the course. When asked of their likelihood of taking another on-line course, 65.9 percent indicated that they definitely would, 26.5 percent said they probably would, and only 7.6 percent were unsure, or did not wish to take another web-based courses.

Students were also asked to assess the amount and quality of their interaction with other students compared to similar face-to-face courses. 64.7 of the respondents found no difference, or an increase in the amount of interaction. 71.8 of the students found no difference or an increase in the quality of interaction with other students.

Similarly, students were asked to assess the quantity and quality of interaction with the instructor. 67.9 percent of the respondents found no difference, or an increase in the amount of interaction. 77.2 percent of the respondents found no difference or an increase in the quality of the interaction with the instructor.

Methodology

Teaching a large web based course takes quite a different approach then teaching the traditional class. It becomes very much a team effort. The support of all levels of administration, colleagues and teaching assistances is iatrical to the success of the course. The University of Central Florida has put their full weight behind this endeavor. Several new non-academic departments have been developed to support faculty in the creation and development of their courses. Course Development and Web Services provide training and resources for faculty in the form of classes, instructional designers, graphic artists and web programmers. The Center for Distributed Learning oversees the administration and planning of on-line courses as well as other modalities, such as video and interactive television. The Research Institute for Teaching Effectiveness (RITE) was created to lend support to faculty who wish to do research regarding distance education. (Sorg, et. al., 1999).

In addition to support, a better understanding of the learner is needed. Where does learning occur? Does it occur during the lecture, the reading of course text, or in the research of a term paper? How about the library, in study groups or even last minute cramming for an exam? Learning occurs with all of those activities, and more. Learning does not necessarily occur in any one of those activities more then another. Technology's role in the learning process is to enhance the instructor's ability to convey the subject matter to the learner. Distance learning can be used to supplement the traditional course or, in many instances, replace it completely. (Lytle, et. al., 1999)

Learning Tools

The software we use to deliver course content, WebCT, allows the instructor to choose from list of available learning tools. We have found that the use of five to seven of these or other tools is ideal for teaching a totally web based course. The ones we have chosen are all asynchronous, never requiring students to meet or work at the same time as one another. Some of the most successful of these are E-mail, forums (discussions), electronic grade book, calendar, quizzes, drop-box, On-line glossaries and a simulated hospital.

While the Asynchronous Learning Network we have developed allows the learner the freedom to work at his or her own pace, the course is still highly structured. Course materials are divided in to "themes". Each theme has reading materials, an activity, homework assignment and quiz. Each theme activity, homework assignment and quiz has a due date during the semester. The student is given between one and two weeks to complete the assignments and take the required quiz. The student also communicates via e-mail and the forums with other students and the instructor. The created illusion of autonomy gives the students confidence. The instructor trusts them enough to work at their "own pace" yet they have other students and the instructor available to support them.

This structure is not only important on the student side, but necessary on the instructor side as well: We have developed a set of standard operating procedure (SOP) for dealing with each of these courses. We know what we need to do and when, to stay on schedule. The students also know from this, what to expect from us.

Ralph Waldo Emerson once said "the years teach much which the days never knew." Time has taught us, through trial and error and trial again, what works for the courses we teach, and what doesn't. What may work for one discipline, may not work for another. What works for us today, may not work tomorrow. It is only through trial and error, and an understanding of the learning process that education may grow with students.

References

J. S. Lytle, B. Lytle, K. Lenhart, L. Skrotsky. (1999). Large-Scale Deployment of Technology-Enhanced Courses. Syllabus, 13 (4), 57-59.

Sorg, S., Truman-Davis, B., Dziuban, C., Moskal, P., Hartman, J., & Juge, F. (1999). Faculty Development, Learner Support, and Evaluation in Web-based Programs. Journal of Interactive Learning Environments, 7(2-3), 137-155.

UCF Distributed Learning Initiative Student Survey. (1999). Orlando, FL: University of Central Florida, Research Initiative for Teaching Effectiveness.

Perceived Difference Between Classroom and Distance Instruction

Doo Hun Lim
Human Resource Development
University of Tennessee
United States
dhlim@utk.edu

Abstract: In an effort to compare the perceived degree of learning and application between different groups of students in terms of gender, instructional delivery formats, length of study time, and learner motivation level, an HRD course of a university was studied. Data analysis was conducted to compare the learning and application difference and the reasons for high or low learning and application were identified and categorized. From the findings, issues in distance learner, instructor, and instructional design to enhance learning and application were discussed.

Introduction

In comparing the learning difference between classroom instruction and distance education method, several studies have revealed that there is no significant difference between the two (Relan, A. & Gillani, 1997: Russell, 1999; Wentling & Johnson, 1999). Even though comparing the learning difference between different delivery formats has been a major research focus in distance education, seldom has been conducted to identify the difference in learning application between classroom and distance instruction (Ravitz, 1997; Wentling & Johnson, 1999). One problematic situation in higher education is that most classroom and distance instructions have focused not on the application of learned subject content but on the conceptual understanding of the subject content. From several research studies, it was identified that a high degree of learning does not always result in a high degree of application because there are many factors inhibiting application of the learning during and after the instruction (Foxon, 1997; Lim, 1999).

Along with this learning application issue, promoting a high degree of learning and learning application in virtual environment has become another important issue in higher education as more universities and colleges try to develop and deliver quality distance instruction. While we can apply many of the learning application strategies for classroom instruction to designing an applicable distance instruction, it is still a fact that distance instruction requires unique strategies to meet the needs of distance learners' learning and application of their learning in virtual environment. Different delivery formats such as satellite-based and web-based instruction within distance education even may have to adopt different instructional strategies to satisfy unique learning needs of each delivery format.

Methodology

To address the issues of learning and application in classroom and distance instruction, finding the reasons why certain delivery formats (i.e. web-based, satellite-based system) incur a high or low learning and learning application and deploying appropriate instructional strategies to enhance students' learning and application seem critical to assure high quality distance learning. In order to identify these instructional needs, the purpose of this study is to compare the perceived degree of learning and application of learning made by different groups of students in terms of gender, delivery format, study time, and motivation level and identify instructional strategies and design factors promoting higher learning and application.

The subjects for the study included nineteen undergraduate HRD (Human Resource Development) major students who took an instructional systems design course through the three different delivery formats (web-based instruction, classroom, satellite-based instruction) respectively at a mid-western university. Among the students, eight students had taken the course through web-based instruction, six students through satellite-based instruction, and five students through classroom instruction respectively. All students were given an option to select one of the three delivery formats voluntarily during the course registration period.

The instructional systems design course was designed for the three delivery formats and delivered by an instructor. The classroom instruction was delivered in a multimedia classroom equipped with satellite-based delivery capability where the classroom and the satellite-based instructions were implemented simultaneously. The satellite-based system utilized one-way video and two-way audio communication system for instruction.

An online questionnaire was developed to obtain the students' perceived degree of learning and application for the thirty-four learning objectives extracted from the instructor's lesson plans that were used during the semester. The questionnaire also asked reasons for high or low learning and learning application made by the students during the class. The question items used a five point Likert-type scale to measure the perceived degree of learning and application. Students were asked to complete this online survey at the end of the semester. The study times spent by the students who took the web-based instruction were assessed by asking each student's study time for one learning module in a logout form at the end of each learning module.

The data analysis of the study utilized both quantitative and qualitative analysis. The differences in the degree of learning and application were analyzed using Kruskal-Wallis Test for the three student groups of different delivery formats. Mann-Whitney Test was used for other comparison groups such as gender, motivation, study time since the mean scores of the perceived degree of learning and application for the comparison groups did not show normal distribution. The reasons for high or low learning and application were identified and classified into categories.

Findings

Learning and Application

In order to identify what was learned or not learned from the course, the students were asked to rate their perceived degree of learning for each of the 34 learning objectives of the course. As a group, the nineteen students indicated a fairly high perceived degree of learning. The population mean score for the perceived degree of learning was 4.04 on a 5 point scale (scale range was 1 to 5), which indicates "mostly understood" in the rating scale of the questionnaire. Further analysis was conducted to examine the differences in the degree of perceived learning between the different student groups in terms of gender, delivery format, study time, and learner motivation. In general, it was found that there were no significant differences in the perceived learning between the groups as shown in Table 1. As a whole group (8 students in the web-based instruction), the average time to study a learning module (one learning module was equivalent to one week's study load) was 83.2 minutes.

The mean scores of all students' perceived degree of learning application was 3.89, which can be interpreted as "frequently applied". Regarding the perceived learning application differences between the groups, it was found that there was no significant difference. In comparing the perceived degree of learning and learning application made by the students, there was a high relationship between the two. The Pearson's correlation between the mean scores of learning and learning application showed a high degree of relationship (.896) at the 0.01 level (2-tailed).

	N	Mean	SD	p^b
Male	10	4.11/4.05[c]	0.76/0.70	.968/.604
Female	9	4.05/3.80	0.74/0.91	
Internet	8	4.07/3.97	0.60/0.58	.995/.828
Classroom	5	4.01/4.06	0.91/0.92	
Satellite	6	4.16/3.80	0.85/1.09	

Shorter	4[a]	3.75/3.64	0.60/0.42	.343/.114
Longer	4[a]	4.40/4.30	0.46/0.56	
Higher motivation	11	4.32/4.04	0.64/0.85	.152/.351
Lower motivation	8	3.76/3.79	0.77/0.80	

[a] The number of students who took the web-based instruction.
[b] Exact significant value (1-tailed significance).
[c] Left and right values indicate the mean scores for learning and learning application respectively.

Table 1: Perceived learning and learning application differences

From the qualitative analysis, several reasons have been identified as the factors to promote high learning. Among them, instructional effectiveness, instructor effectiveness, and learner motivation were found as the major categories for the reasons to enhance students' learning (accounted for 70% of the reasons for high learning). Some example reasons of the instructional effectiveness are: instructional design, interactive interface, and learning activities. According to the different delivery formats, certain reasons were more frequently replied from a certain group. For example, reasons in instructional effectiveness were mostly replied from the web-base instruction group while reasons in instructor effectiveness were mostly replied from the satellite-based instruction group. Several reasons were found to inhibit the student learning. Some instructional design factors (unclear content, not applicable content, too much information for a class), personal reasons (miss the classes, lack of interest, short of time to study, short attention span), and lack of opportunity use the learning are those reason categories that negatively influence the student learning.

The reasons for high application of the learned content varied. First, the most frequently replied reason was that the learning content was constructed in such a way that it could be applied to students' studies and current job tasks. Opportunity to use the learning on the jobs and during the instruction was another major category of reasons for high application. High understanding and interest toward the learning content were also found as another category of reasons promoting high application of the learning. Regarding the reasons to negatively affect the application of student learning found, those were low degree of learning, not applicable to the students' jobs and tasks, lack of opportunity to use, and lack of interest.

Instructional Design Issues

When the students were asked to provide their specific learning experience from the instruction, diverse opinions and feelings could be collected and categorized. The first category was the interaction and interface design of the instruction. Some representative comments made by the students were:

- need to reflect students' dominant learning style to designing the instruction,
- appropriate grouping of student work groups,
- more time to practice the learning during instruction,
- alternate way to complete group project in case a group work didn't work well,
- more instructor/student and student/student interaction, and
- weekly chat session to promote more interaction between students.

The second category of the students' responses was issues in delivery and student support. Some expressed concerns were:

- fast feedback of the assignment and questions raised during self study,
- fast technical assistance,
- timely announcements of class activity on the web page, and
- providing basic computer skills class before the class starts.

For asking the general quality of web and content design of the instruction, most students replied that the web design was good and constructed in a user friendly manner so they could move around the learning module web pages easily. Regarding the content design, several students indicated that the text was designed clearly so they can find the main points at a glance. The layout of the text content was said to provide clear instructional cues for student's learning process. Other comments were also added that the text layout was structured to display plenty of information into meaningful chunks and units. The graphics used in the instruction were said to be very attractive and represent appropriate information for the instruction. Multimedia components of the instruction were indicated to be effective since they were used only when the multimedia content was needed for students' learning.

Discussion

Learning and Application

From the data analysis, it was identified that there was not a significant difference in the perceived degree of learning between the groups. This finding supports Russell's (1999) research study claiming there is "no significant difference" in learning between the classroom and distance instruction in general. One valuable finding from this study is the fact that the "no significance" symptom occurs even in the application of learning for the comparison groups. From this finding, it can be argued that attaining certain level of learning and application of learning from a course may not be severely influenced by the different types of delivery formats. Rather, it may be influenced more frequently by instructional design factors and strategies that decide the quality of the instruction.

One major benefit of using web-based instruction in higher education was found to exist from this study. The finding of no significant learning and application difference between the shorter and longer study time groups may be interpreted as an evidence that each student could study the lessons by their own pace and competency level, which resulted in different study times between the students while attaining the same level of learning and application. This finding provides a rationale to use self-paced and individualized learning method for web-based instruction. The no significant difference between the higher and lower motivation groups, however, seemed contrary to the general notion that higher motivators learn and apply better. One possible reason for this finding might be because the small sample size does not have enough power to detect the difference between the higher and lower motivation groups.

Instructor Effectiveness in Satellite-based Instructional System

Instructor effectiveness was identified as one of the major factors affecting student learning and learning application for the satellite-based instruction group. Nine out of the eleven responses regarding the reasons for high learning were replied from the students in satellite-based instruction group. This finding seems natural since the instructor of any satellite-based system, as a subject matter expert and facilitator of the learning, becomes the major conduit to deliver learning content to the students. Among the several factors in instructor effectiveness, clear presentation is the most frequently replied response. This finding leads to a recommendation to provide appropriate training of presentation skills for the instructors using satellite-based system. Other competencies required for the instructors might include instructor's command of the subject matter, use of class time, way of summarizing or emphasizing important ideas in class, use of examples and illustrations, use of challenging questions, and listening skills.

Instructional Design Issues

The study findings also raise several issues and problems related to web-based instruction. When delivering instructional content through web-based delivery method, the quality of instructional design factors seems to be critical for student learning and application. Among the reasons for high or low learning, reasons in instructional design factors were ranked as the top reason category for making student learning successful or unsuccessful in web-based instruction group. A recommended instructional strategy to promote high learning and application for web-based instruction is adopting diverse learning activities such as case studies, scenario analysis, simulations, individual and group project, and frequent short quizzes checking students' learning progress to retain student motivation throughout the course.

Applicability of learning content is another instructional design issue found from the study.

Applicability of learning content was indicated as one major reason category for both high and low application of learning. To make a learning experience meaningful for students in higher education, the learning content needs to be "applicable." Several recommendations are advised to enhance learning application. First, instructional content need to be constructed plain and simple enough to be applied to students' studies and current tasks involved. In many cases, heavy use of text presentation to explain theories, principles, and concepts in web-based instruction is not effective for student's application of learned content. The learning activities to solve this problem are case studies, short fill-in question items asking application examples of the learning content, scenario analysis, peer evaluation of class assignments, web searches for application examples, and group and individual projects. Second, as Baldwin and Ford (1988) recommend, the learning content needs to be identical or at least similar to the actual application settings. Developing class assignments that have similar construct and procedure with the learning content is one effective way. Providing individual practice followed by a step-by-step guided practice after a segment of instruction is another strategy to promote application of the learned content not only to similar but even to different context.

Conclusion

This study has identified several facts about college students' learning and application experience occurred in an HRD course from a mid-western university. Even though the size of the population limits the generalization of the study results, several issues in instructional design were stemming from the study findings and possible solutions and recommendations were seek to enhance student learning and learning application. One major contribution of this study to the related study fields is that the symptom of no significant difference between face to face and distance instruction is found not only from the learning but also from the learning application. The generalization of this finding, however, may need another set of studies using a broader population in national level.

One distinct benefit acquired from this study is that the findings provide basis to choose various instructional strategies to improve the technology-based instructional delivery methods. As instructors or instructional designers, our major concern is then to test and wisely apply these instructional strategies to design an effective instruction. The effectiveness of the instruction, however, will be dominantly affected by the level of our experience and insight toward these instructional strategies and concerns for more meaningful application of these strategies in our instruction.

References

Baldwin, T. T., & Ford, J. K. (1988). Transfer of training: A review and directions for future research. *Personnel Psychology,* 4(1), 63-105.

Foxon, M. J. (1997). The influence of motivation to transfer, action planning, and manager support on the transfer process. *Performance Improvement Quarterly,* 10(2), 42-63.

Hagman, J. D., & Rose, A. M. (1983). Retention of military tasks: A review. *Human Factors,* 25(2), 199-213.

Huczynski, A. A. (1989). Training designs for organizational change. *Management Decision,* 27(4), 27-35.

Lim, D. H. (1999). Organizational and Cultural Factors Affecting International Transfer of Training. *Performance Improvement,* 38(3), 30-36.

Ravitz, J. (1997). Evaluating learning networks: A special challenge for web-based instruction. In B. H. Khan (Ed.), *Web-based instruction* (pp. 361-368). Englewood Cliffs, JN: Educational Technology Publications.

Relan, A. & Gillani, B. (1997). Web-based instruction and the traditional classroom: Similarities and differences. In B. Khan (Ed.), *Web-based instruction.* Englewood Cliffs, JN: Educational Technology Publications.

Romiszowski, A. (1997). Web-based distance learning and teaching. In B. Khan (Ed.), *Web-based instruction.* Englewood Cliffs, JN: Educational Technology Publications.

Russell, T. L. (1999, September 15). No Significant Difference Phenomenon [WWW document]. URL http://cuda.teleeducation.nb.ca/nosignificantdifference

Wexley, K. N., & Nemeroff, W. (1975). Effectiveness of positive reinforcement and goal setting as methods of management development. *Journal of Applied Psychology,* 64, 239-246.

Wentling, T., & Johnson, S. (1999). The design and development of an evaluation system for online instruction. In P. Kuchinke (Ed.), *Academy of Human Resource Development Annual Conference, 1999,* Academy of Human Resource Development, Washington, D.C. 548-553.

Yamninll, S., & McLean, G. (1999). Theories supporting transfer of training. In P. Kuchinke (Ed.), *Academy of Human Resource Development Annual Conference, 1999,* Academy of Human Resource Development. Washington, D.C. 1116-1123.

On-Line Delivery of Multimedia Courseware

Leping Liu, Ph.D.
Assistant Professor of Instructional Technology
Towson University, U.S.A.
Email: **lliu@towson.edu**

Abstract: This paper introduced some methods of using the Web as a template to deliver multimedia courseware, including CBI (computer-based-instruction) applications created with multimedia authoring tools and tutorials accompanied with the applications. The author converted CBI applications created with *ToolBook, HyperStudio,* and *Director* into the Web version and then delivered them on the Web as an on-line courseware package. From the perspective of instruction, this project extended the concept of computer-based-instruction to a Web environment. From the perspective of technology integration, this project increased the uses of technology in school classrooms and, meanwhile, it reduced the equipment requirements to schools. From the perspective of information delivery, it used the Web as the template or organizer to deliver the courseware, instead of using certain particular software environment.

Introduction

Multimedia learning environment has been found effective to stimulate students' thinking and memorizing process, and to enhance learning (Wadsworth, 1992; & Alessi, & Trollop, 2001). In the field of education, the term "multimedia" indicates computer-controlled interactions of information from different media—text, sounds, images, graphics, video, and recently, Web resources; and computers control the multimedia via authoring tools (Simkins, 1999; & Grabe & Grabe, 2000). Computer-based-instruction (CBI) refers to the use of multimedia authoring tools such as *ToolBook, HyperStudio, or Director* to develop a lesson, drill, or test for the purposes of presenting information, reinforcing or assessing instruction and learning, which are implemented in that particular authoring environment (Criswell, 1989; & Gibbons & Fairweather, 1998). When we talk about multimedia courseware, it refers to a package consisted of CBI components, the use of other media, or paper-print of course documentations/materials (Ivers & Barron, 1998; Elin, 2001; & Lockard & Abrams, 2001). Originally, courseware—that appeared as educational software—was designed and implemented by computer software experts. Teachers could only use the existing products. One common issue was that teachers had difficulty in finding appropriate existing software that could fit the particular learning/teaching purposes, no matter how well developed the software was (Tiene & Albert, 2001). Therefore, a practical idea was that teachers develop their CBI programs themselves to achieve specific goals/objectives of learning/teaching. This became possible while more and more multimedia authoring tools were available (Zahn, Azhn, Rajkuma, & Duricy, 1999; & Alessi, & Trollop, 2001).

Using self-developed CBI programs brought out many critical issues to teachers and students, among which courseware delivery was a major one that we need to deal with. After the CBI program was completed, how can our students access them (Tiene, & Albert, 2001)?

The author taught three graduate level multimedia design courses offered by the Instructional Technology Master program. In these courses, students learned three authoring tools (*ToolBook, HyperStudio,* and *Director*) and developed courseware packages. Most students in these classes were school teachers. They hoped they could use their courseware for their classroom teaching. However, their schools did not have the software for their classrooms, and most public schools were lack of budget to purchase these expensive multimedia authoring-tools for students' use. Therefore, the author started the current project trying to convert the courseware packages into Web version, and put them on the Web. The purposes of this project were to (1) explore the effective and convenient methods to do so, and (2) develop instruction modules for students/school teachers to learn the methods.

Products from Three Instructional Technology Courses

The first course was titled "Computer Assisted Instruction." The purpose of this course was to apply the principles of instructional systems development to the design of instruction and training to be delivered via a computer-based model. The computer laboratory tasks focused on the construction of a lesson using an authoring tool—*ToolBook*. In Figure 1, "The Types of Graphs" is one "page" from a lesson unit "Construct Graphics" developed by student.

"Theory and Design of Computer Based Instruction" was an advanced course that investigated several theoretical strategies appropriate to development of computer-based instruction (CBI). Principles and methodologies of information systems development were applied in the context of instructional systems design process. Computer laboratory tasks enabled students to use the more complex functions of authoring tools and Web based applications in constructing a CBI lesson. *Director* was the major tool for the CBI project. In Figure 1, "Charting a Filling" is one "stage" of a training unit (*Director* program) "Dental Charting" developed as a team project.

The third course was "Technologies in Reading" -- A course designed to help teachers develop technology-based reading instruction. Emphasis was on integrating current computer technologies and software applications into reading curriculum design. Course content included designing reading segments on phonemic awareness, vocabulary development, comprehension, and writing, using presentation, graphics, and multimedia authoring software *HyperStudio*. In Figure 1, "Can You Identify a Setting?" is one "card" of a lesson unit (*HyperStudio* program) "Read a Good Book and Write a Good Story" developed to assist children's reading and writing.

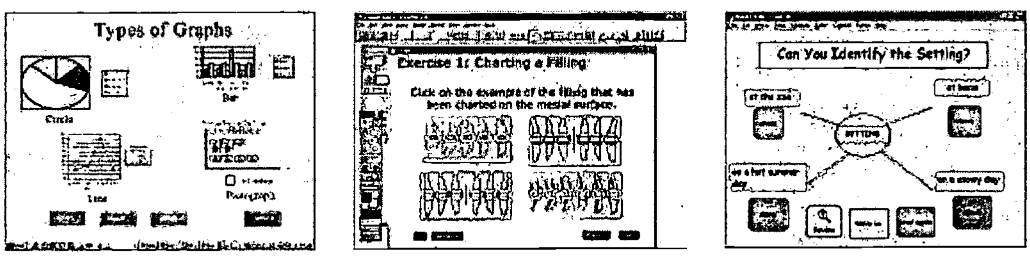


Figure 1. Sample CBI Projects Developed with Authoring Tools

In the three courses, at the phase of project planning, students had the options, and were encouraged, to choose the topics that they could use in their real life teaching or work. At the point they completed this course, some of them implemented a complete short program; some of them well developed a structure of a huge program and completed one or two sections as the lesson units. They were anxious to test the programs in a real life setting, rather than the final project presentation, and to examine students' learning effect. Then, came the problem to deliver the program to the classrooms.

Issues of Courseware Delivery

Traditionally, these CBI programs only can run in the same environment in which they were developed. That is, for example, as in the above sample projects, the "Construct Graphics" only can run in the *ToolBook* environment, the "Dental Charting" only in *Director,* and the "Read a Good Book and Write a Good Story" only in *HyperStudio*. In order for students to use the CBI programs or the courseware packages in classrooms, they must have the particular authoring software installed in their computers. Therefore, the issue is whether or not our schools can afford to purchase enough copies to support each classroom. The educational site license price of *ToolBook* is around $300 per copy, around $240 per copy for *Director*, and around $90 per copy for *HyperStudio.* There is no statistics that shows the distribution of software in schools. But, the interesting situation was: there were around 48 students in the three classes; none of them had the authoring software available in classroom or at work.

Some other issues, such as hardware capacities and Mac-PC compatibilities, are also need to be considered. Are the hardware capacities powerful enough to support the software? Can we use the programs across different platform?...

So, what is the point if our students worked through the courses and learned to develop course packages but there is no environment for them to use their knowledge, skills or products? The search for a technique solution led us to the Web; with the rapid development of World Wide Web, Web applications have been available in almost all the areas (Khan, 1997; Niederst, 1999; & McCormack & Jones, 1998). Online courseware delivery may provide a new or different conceptual framework for "computer-based instruction."

Online Courseware Delivery

There are four major steps to deliver the courseware on the Web:

1. Converting CBI program into HTML files
2. Editing HTML files
3. Uploading the courseware HTML files on the Web
4. Downloading, installing, and setting the properties of multimedia Plug-Ins

In each step, some technique problems need to be considered and dealt with carefully. The procedures were written into several lab modules that can help our further students, or school teachers, learn the techniques of online courseware delivery. From the experience of converting project files created with the three authoring program, the author found that the following tips were very useful and sometimes were very easy to be ignored.

Converting HTML Files

First step is to convert the CBI programs into Web version--HTML files. Programs developed with the three authoring tools require different conversion procedures. To convert *HyperStudio* stack to HTML, from Extras menu, choose Export Webpage, and in the Save Web page dialogue box, save the file as HTML file.

Converting *Director* programs (movies) is called "making movies for the Web." Before you convert the movie, make a back copy of it. Because after you convert it, there is no way to decompress it and recover the original file. Next, set up the movie playback properties (See Figure 2). Then save the file as *ShockWave*

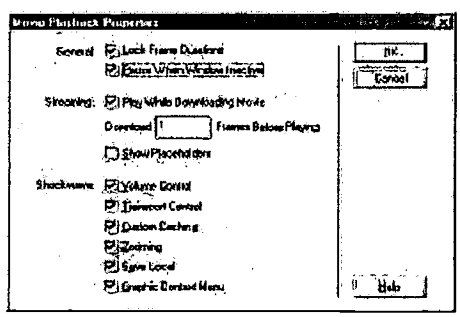


Figure 2. Set Movie Playback Properties to Convert Director Movies into HTML

file, as well as generate it into HTML. You should have one *ShockWave* file and one HTML file.

To convert *ToolBook* files (books), the complex procedure is to set up the HTML Export properties. Different from Director movie conversion, each page in the "book" is saved as one HTML file. That is, if we have 30 pages in the program, we will have 30 HTML files—similar as the conversion of *PowerPoint* presentation slides.

Editing HTML Files

After the program is converted into HTML file, some editing work is necessary before uploading them on the Web. For example, the title appears on the first page of the converted *Director* movie is automatically converted using the original file name. As in Figure 3, the title is "web-standardtest.dcr" that is the original file name of the CBI program. We need to edit this HTML file changing it an appropriate title. Also, we need to develop a Web page as the organizer to navigate the *HyperStudio, ToolBook* and *Director* CBI applications and necessary course materials.

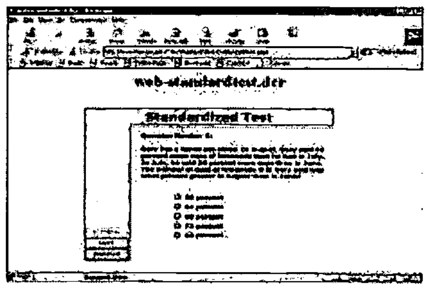


Figure 3. Director CBI Web Version

Uploading HTML Files onto the Web

We can use FTP to upload the HTML files on the Web. One thing different form uploading common Web pages is that both the HTML files and original files (*HyperStudio, ToolBook* and *Director* CBI files) should be uploaded onto the Web and in the same folder. For Director, all HTML file, ShockWave file, and the original movie file should be uploaded.

Working with Multimedia Players—PlugIns

The last step is to download and install PlugIns. To obtain the multimedia interactive effects, we need multimedia players in the computers that the users/students worked on. Even though all the necessary files are on the Web, the online programs won't work without the required PlugIns installed in the computer. In Table 1, listed are the URLs for free downloading all the PlugIns for running *HyperStudio, ToolBook* and *Director* CBI courseware on the Web.

Table 1. Multimedia Players—Plug-Ins for Running Online CBI Programs

Plug-Ins	**Download Site URLs**
Neuron-for *ToolBook*	http://home.click2learn.com/products/neuron.html
For *ToolBook 7.2*	ftp://ftp.asymetrix.com/pub/tb2/neuron/72/neuron.exe
For *ToolBook 6.5*	ftp://ftp.asymetrix.com/pub/tb2/neuron/6x/cbtsystems/neuron65.exe
For *HyperStudio*	http://www.hyperstudio.com/resource/hsplugin/plugin.html
Shockwave and *Flash 5* Player—for *Director*	http://sdc.shockwave.com/shockwave/download/triggerpages_mmcom/default.html
Quicktime 4.1.2	http://www.apple.com/quicktime/download/

It seemed, to the author, that the most complex portion of this project was to deal with plug-ins. Each program required different plug-ins to run it. The latest versions of browsers have the built-in plug-ins for most multimedia programs. But, the users/learners' computers may run different versions of the browser. Therefore, downloading the multimedia players from the web sites of each software company was the important step before the courseware could run on the Web.

Figure 4 shows some examples of the online CBI projects developed by students from the three classes:

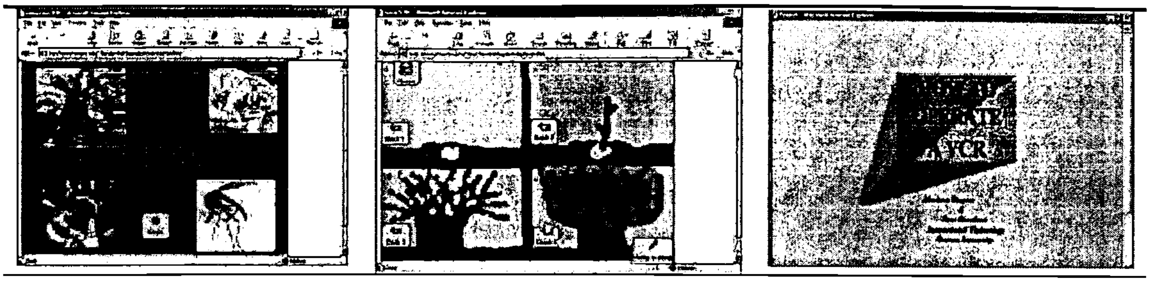


Figure 4. Examples of Online CBI Projects

Outcomes

Because contents and schedules of the three courses did not allow enough time to add one more project like this, the author provided students the modules to the classes as an optional project. Some students tried it and students tried their online programs: one did with her third grade class; the other one shared with her colleagues. Some feedbacks indicated that students showed more interests in learning with the on-line courseware, they were motivated to spend more time on the learning topic/concepts through the courseware than they did in traditional learning, and their interaction with the program provided them more opportunities to rehearsal what they learned. Also, some other schoolteachers felt that this was convenient, and especially those non-technology teachers felt that using technology in classroom was not something in the air.

This project also resulted in the revision of the three instructional technology courses and advanced the technology levels of the three courses to keep up with the contemporary technologies. The author revised the course syllabus adding the online delivery contents into course work.

Summary

Overall, this project was implemented in two dimensions: (1) technically, the author explored the necessary techniques of designing a multimedia courseware package in the Web environment, develop a technical model of implementing such courseware, and design a sample interactive on-line lesson including CBI designs (using authoring tools) and course materials, and (2) instructionally, the author developed instructional modules for students to learn the techniques to create such on-line courseware.

This project went beyond the normal scope of courseware design in three ways. First, from the perspective of instruction, it extended the concept of computer-based-instruction into a Web environment.

Second, from the perspective of technology integration, it increased the uses of technology in school classrooms for more students and in a wider range and, meanwhile, it reduced the equipment requirements to schools.

Third, from the perspective of information delivery, it used the Web as the template or organizer to deliver the courseware, instead of using certain particular software environment.

Further experimental study would be conducted to examine the learning effect of on-line courseware. Also, we are expected to explore or deal with more technique issues that might occur because of the continuous development of new technologies.

References

Alessi, A. M., & Trollop, S. R. (2001). Multimedia for leaning: Methods and development. Boston: Allyn and Bacon.

Elin, L. (2001). Designing and developing multimedia. Boston: Allyn and Bacon.

Grabe, M., & Grabe, C. (2000). Integrating the Internet for meaningful learning. New York: Houghton Mifflin.

Criswell, E.L. (1989). The design of computer-based instruction. New York: Macmillan.

Gibbons, A. S., & Fairweather, P. G. (!998). Computer based instruction. Englewood, Cliffs., NJ: Educational Technology Publications.

Khan, B. H. (1997). Web-Based instruction. Englewood, Cliffs., NJ: Educational Technology Publications.

Ivers, K. S., & Barron, A. E. (1998). Multimedia projects in education: Designing, producing, and assessing. Ehglewood, CO: Libraries Unlimited.

Lockard, J. , & Abrams, P. D. (2001). Computers for twenty-first century educators. New York: Longman.

McCormack, C., & Jones, D. (1998). Web-based education system. New York: Wiley Computer Publishing.

Niederst, J. (1999). Web design in a Nutshell: A desktop quick reference. Paris: O'Reilly.

Simkins, M. (1999). Project-based learning with multimedia. *Thrust for Educational Leadership, 28*(4), 10-14.

Tiene, D., & Albert, I. (2001). Exploring current issues in educational technology. Boston: McGraw-Hill.

Wadsworth, B. J. (1992). Piaget's theory of cognitive and affective development. New York: Longman.

Zahn, S. B., Azhn, C. J., Rajkuma, T. M., Duricy, M. D. (1999). Using multimedia as a communication tool. *International Journal of Instructional Media, 26*(2), 221-229.

Teaching with Geographic Information Technology

Amy K. Lobben
Department of Geography
Central Michigan University
USA
Amy.Lobben@cmich.edu

Abstract: This paper highlights curriculum designed to train pre-service and in-service teachers to teach with geography technology. Because geography, like many disciplines, has evolved into a field that implements technology into many areas of research, teacher educators must incorporate the teaching of geographic technology into their education curriculum. One particular area of geography, which has developed over the past decade is known as Geographic Information Science (GISci) and involves the gathering, manipulation, analysis, and display of spatial information. The burgeoning of this new science presents geography educators with several challenges: how do we teach pre- and in-service teachers to implement the new technologies in their classrooms, can in-service teachers use the new technologies to help create educational materials for the changing geography curriculum, can new geography technologies help present and future educators better understand the field of geography, and can we help educators to use the technologies to build geographic resources for their classrooms.

Introduction

All disciplines are part of the information age; the extent to which information technology is adopted varies from field to field. Geography is the study of the surface of the earth and includes the study of people, the environment and their interaction; it "combines a description of places with the formulation of principles and concepts [and] it promotes an understanding of patterns, processes, and the resultant landscapes on the planet (Hardwick and Holtgrieve, 1996 p.6). As a result, the focus of the discipline is volatile; we witness in the evening news everyday the massive changes occurring around the earth, from natural events, such as hurricanes, floods, volcanoes, or earthquakes to cultural events, such as political coups, massive immigration, or medical disasters. Because of the volatility of what geographers study, the field itself has seen major theoretical and philosophical shifts throughout its academic history. The most recent shift is occurring today, as society moves even further into the information age. Geography is at the forefront of technological development and implementation and has developed the new sub-field of GISci. The development affects the way geographers view geography and, therefore, the way geographers are teaching geography.

GISci Defined

GISci is the study of spatial information, utilizing various technologies. In its most simplistic definition, this area of study includes three components: remote sensing (the data gathering component), Geographic Information Systems (GIS) (the data manipulation and analysis component), and cartography (the data display component); each is defined below.

Remote Sensing

Remote sensing may be defined as reconnaissance from a distance; what makes the data collection intrinsically remote sensing is that the instrument used to gather the data is not in contact with the object of study. Several instruments may be used in the process of remote sensing, but the two most common platforms are aerial photography and satellite sensors. The sensors compile images in two primary ways, by either actively sending signals or by passively receiving light (Lillesand and Kiefer 1994). First, some sensors transmit radar signals, which hit an object on the earth and return to the instrument, providing a visual image of the objects on the surface. Second, sensors can detect the length as well as amount of electromagnetic radiation emitted or reflected from objects on the earth. The EMR received by the sensor forms a photograph of sort of the objects on the surface. Scientists identify various features based on the varying amounts of EMR they emit or reflect. All of these images allow for geographic studies including analyzing the changes in areas of ecological concern such as the Brazilian rainforest or the polar ice caps. Time series images captured in these areas allow scientists to ascertain the land use or land cover changes in the rainforest or the change in area of the ice caps.

Data gathering is also accomplished with Global Positioning Systems (GPS) and remote sensors to aid in data gathering. GPS allows geographers to record with accuracy within centimeters the absolute and relative position as well as attribute data of spatial objects. GPS units, which may be small hand-held units up to large field-grade units receive time signals transmitted by a constellation of about 24 satellites maintaining separate orbits, each approximately 11,000 nautical miles above the surface of the earth (Campbell 2001). Each satellite signals at the speed of light in all directions; the signals include the time the signal was sent (measured on highly accurate atomic clocks) as well as the exact location of the satellite in its orbit. The GPS unit receives signals from multiple satellites (ideally from at least 4) and determines the unit position based on the linear distance calculated between the unit and each satellite from which signals were received.

GIS

Through computer software specifically designed for GIS, scientists use spatial data to solve geographic problems. A spatial database includes objects' x,y locations and attributes (qualitative and quantitative). A GIS program provides an organizational framework in which links between the attributes and locations allow the GIS user to conduct spatial analyses. Organizational structures include attribute tables that store data for points, lines and polygons, a map area that allows the user to see a graphic depiction of the data, identifier tables that reveal the results of a query, and layered data that may be analyzed independently (per layer) or wholly (per project). Environmental data such as soil type, ground cover, and water table data entered into a GIS program could help scientists determine the best location for a landfill, an animal refuge, or a commercial development.

Cartography

Cartography is the art and science of mapping and provides a data display method that allows all geographers to represent their spatial information using continually advancing mapping technologies. As a separate discipline, cartography has a rich and long history (over 2000 years) and many researchers conduct cartographic research completely outside the domain of GIS and remote sensing. However, most applied cartographic work is now conducted with GIS software and in conjunction with GIS or remote sensing research or projects.

Educational Applications of GISci

While GISci is a burgeoning sub-field within geography, much of the focus of GISci instruction and research reveals the building blocks of the entire discipline of geography, in general. Pre- and in-service teachers, in particular, would benefit from additional instruction in GISci. Traditionally, the geographic education or teachers was conducted in a classroom over the course of a term. However, because of the nature of GISci, the discipline is well-suited for teaching and learning in the format of a workshop or seminar series. Presented below are four ways in which pre- and in-service teachers may be trained in the area of spatial information technology.

1. Teach pre-service and in-service teachers how to incorporate geographic information technology into their curriculum.

Global Positioning Systems (GPS) may be used to help teachers enforce basic geographic concepts. World coordinate systems, such as latitude and longitude, as well as mapping are part of the geography curriculum as early as the third grade. Teachers can use GPS units with students on the school grounds to illustrate coordinate systems. With units set to a navigate position, students can walk north, east, south, and west routes and observe how the direction, distance, and latitude/longitude coordinates change as they walk. Also, GPS units can record coordinates for points (fire hydrant, mailbox, or lamppost), lines (sidewalk, slide, or path), and areas (pond, sandbox, or parking lot). The recorded points, which are stored in the unit, may be downloaded easily into any geographic information systems program. With the GIS program, the teacher and students can color-code each attribute to create a GIS database of the school. Students can also enter spatial attribute information on the school community available from sources such as local governments or the US census bureau (the bureau provides community level socio-economic data throughout the US in digital format called TIGER files) to create a database for the entire school district. These data can be used to solve hypothetical geographic problems, such as where to locate new schools, fire stations, or soccer fields. In addition, the data in the student-created community GIS database may be used to design thematic printable maps of the community.

Remotely sensed satellite images are publicly available from a variety of sources. Agencies such as NASA or SPOT (a private French company) provide images for purchase or free. The quality and resolution vary by price, but high-resolution images of many areas are available for nominal charge or free through the US government. In fact, NASA maintains a link on their web-site designed to provide materials specifically for educators and includes a table of contents of images, instructions for downloading, and suggestions for classroom use (see Figure 1).

Teachers can use these images in many areas of the geography curriculum. For example, remotely sensed images taken throughout the year show the browning and greening process of deciduous vegetation. They can also show the land use patterns of local communities and land cover changes, such as deforestation or desertification. Figure 2 contains images gathered in 1984 and 1990 by the NOAA satellite. These images illustrate the reduction the Sahara Desert experienced after four years of steady and significant expansion. Also, thematic maps created from the geographic information systems technology can be overlaid on remotely sensed images of the same area to create orthophotographs, which help students understand the concept of spatial distribution and mapping (Figure 3).

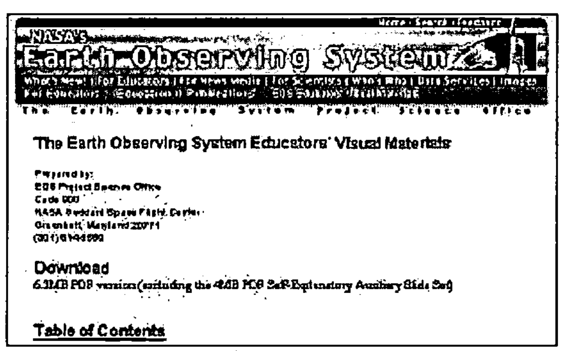


Figure1: NASA educational materials
(http://eospso.gsfc.nasa.gov/eos_edu.pack/toc.html)

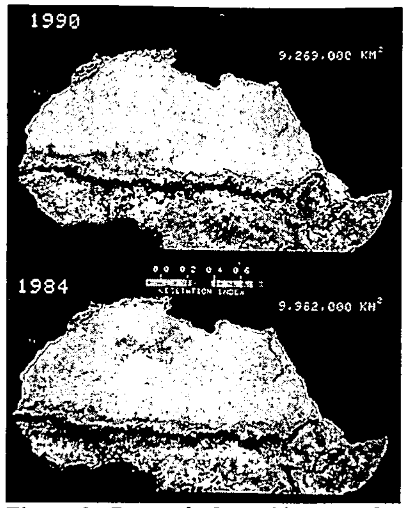


Figure 2: Remotely Sensed images of Sahara Desert Reduction

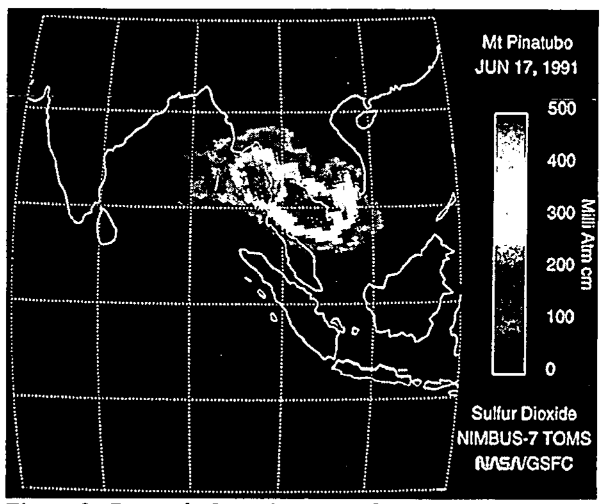


Figure 3: Remotely Sensed Images of
Sulphur Dioxide Released from the Eruption of Mt. Pinatubo

2. Teach present and future teachers to use spatial information technology to create educational materials for their classrooms.

   GIS software, such as ESRI's ArcView can be used quickly and easily to create many types of maps for use as supporting educational materials. These GIS programs make available a plethora of empty basemaps (counties, states, countries...) that can be printed and used for geography projects such a map development or place-name exercises where students can draw their own map symbols and include missing data (drawing in missing rivers, streams, or lakes for example).

   In addition, GIS programs allow for easy incorporation of thematic data, which may be used to create thematic maps showing specific socioeconomic or physical data distribution. These maps provide an invaluable resource for teaching human, cultural, or physical geography. A linguistic map can accompany a lesson on cultures; a population distribution map can provide graphic display for a lesson on US migration; or, a map representing the flow of goods can help students better understand the topic of world trade.

The thematic data are widely available from national sites such as the USGS (www.usgs.gov), the census (www.census.gov) as well a local or state sites such as state DNRs. Also, the data are often accessible in a format that can be opened directly in a GIS program. Acquiring ready-made data sets significantly streamlines the task of creating maps. With a reasonable working knowledge of ArcView, the thematic map in Figure 4 is very quickly created, from beginning (locating the data) through the creation (opening in ArcView and highlighting the desired theme) to printing the final map.

3. Use GISci technology to help teachers better understand geography.

   Geographers in all areas amass and analyze a great deal of information. Throughout the discipline, scientists are turning to GISci as a method of data collection, analysis, and display. The basic principles of GISci are geographically universal and an understanding of these principles provides the foundation for basic geographic theory. Geography is necessarily the study of all things spatial and GISci provides the theories and methods behind the gathering, analysis, and display of spatial information. An understanding of the application of spatial information technology provides a basic understanding of geography, itself. As a result, introductory level courses in GISci are required in most teacher preparatory programs. These courses introduce teachers to basic concepts such as data gathering methods, data measurement, data manipulation, data visualization, analyses, mapping, and distinguishing between the concepts of location and attribute. Geographic technology is employed in the teaching of these concepts in a variety of ways. For example, while discussing data gathering methods, teachers gather data using GPS units, which require distinguishing between location (UTM or latitude/longitude coordinates, for example) and attributes (point, line, or area features, such as trees, roads, or lakes, respectively). The data gathered are down-loaded into a computer and a GIS program allows the teacher to explore the data and apply geographic theory from nearly any area of the discipline (landuse planning, cultural, economic, medical or physical geography) while conducting geographic analysis. In addition, the program allows the teacher to map the data.

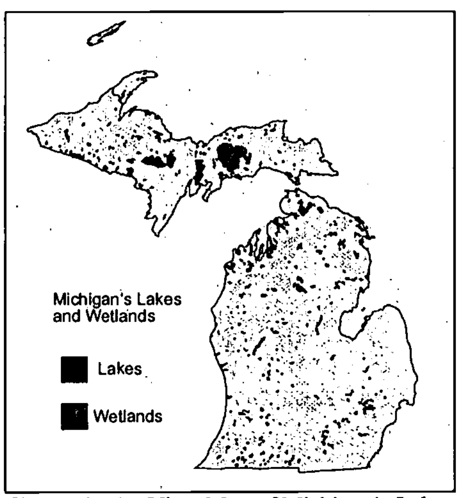


Figure 4: ArcView Map of Michigan's Lakes and Wetlands

4. Build geographic resources for classrooms using information technology.

   GIS programs such as ArcView provide a platform for easy storage and retrieval of geographic information gathered by the teacher for instruction or gathered by the students in learning activities. A classroom database can be created, maintained, and queried by students and teachers. By maintaining a robust set of geographic data, including maps, location, and attribute data, the classroom may be a stage of geographic exploration.

Also, because many geographic data are available from government web-sites, the classroom computers provide an ideal storage device for such information. The World Wide Web is arguably the largest and most accessible source of information, today. Hundreds of quality geography sites are available. Many of these sites not only provide geographic information, but also provide activities that may be completed at home or in the classroom. Information provided at the sites includes quality maps, aerial photographs, and environmental and cultural data. Teachers and students can create a valuable classroom resource simply by creating a class web page containing categorized links to useful geography web-sites. In effect, they can compile an interactive annotated bibliography of geographic references.

Conclusions

While the benefits of the new spatial information technology provided by GISci have been enjoyed by geographers over the past several years, geographers instilled with the responsibility of educating tomorrows teachers should begin to incorporate the new technology into the teacher education curriculum. This incorporation has been slow, as GISci is itself, struggling to define its position in the field. In addition, and probably the most important factor of the slow merger of GISci into teacher education is the lack of academic geographers trained in the new area. Finally, those academics who are trained devote much of their time and research to furthering the new area through theoretical and applied research.

But, the spatial information technology utilized in the study of geographic information science can be a valuable resource for the in-service geography teacher. Not only does the understanding of the new field in geography improve the teacher's understanding of the entire discipline, but the technology may also be used to help teachers improve and expand their existing curriculum by applying it to develop student projects, to provide classroom resources, and to create educational materials for classroom use.

The suggestions outlined in this paper provide a starting point for GISci teacher education instruction. But, teacher educators need to design a geography curriculum that incorporates geographic information technology and, unfortunately, often the most useful courses are not within the list of "required" courses in a teacher education program. Due to the changing nature of this as well as other information technology based disciplines, the curriculum should advance and morph to mirror changes in the field, itself.

References

Campbell, J. (2001). *Map Use & Analysis*. Boston: McGraw-Hill Higher Education.

Hardwick, S. & Holtgrieve, D. (1996). *Geography for Educators: Standards, Themes and Concepts*. Upper Saddle River, NJ: Prentice Hall.

Lillesand, T., & Kiefer, R. (1994). *Remote Sensing and Image Interpretation*. New York: John Wiley & Sons, Inc.

Developing Web Pages to Supplement Courses in Higher Education

Cleborne D. Maddux
Department of Counseling and Educational Psychology
University of Nevada, Reno
United States
maddux@unr.edu

Marlowe H. Smaby
Department of Counseling and Educational Psychology
University of Nevada, Reno
United States
smaby@unr.edu

Abstract: This paper presents some issues in the use of web pages as supplements to traditional, on-campus courses. It also presents some technical and design problems currently found in such pages, as well as some suggested solutions. Some of these problems can be rectified by better use of hypertext markup language (HTML), while others are more pedagogical in nature. Attention is given to ensuring that pages are accessible to individuals with disabilities.

Introduction

The World Wide Web is in the process of revolutionizing almost every element of worldwide culture, and, because of the incredible speed of its growth in size and popularity, it began to do so before most of us had an inkling of its true importance. An index of the unprecedented growth of the web is the fact that there were fewer than 50 web pages in existence when President Clinton took office. Today, in the last few weeks of the Clinton presidency, there are over 1 billion web pages, and, according to a joint study published by Inktomi and NEC Research, at least 67,000 new sites are added each day (Sullivan, 2000).

Growth in access and popularity have also been phenomenal as measured by the number of people who use the Internet and the Web. The Computer Industry Almanac (Juliussen & Petska-Juliussen, 2000) estimates that in 1999, there were nearly 260 million users, 110 million of them in the United States. The Almanac goes on to note that by 1999, there were 25 countries where over 10 percent of the population were Internet users. The Almanac predicts that there will be 490 million worldwide users by the year 2002 (79.4 per 1,000 people) and 765 million users by year-end 2005 (118 per 1,000 people worldwide). In such a rapidly changing environment, up-to-date figures are impossible to obtain. NUA Limited (2000), in a slightly more recent study, estimates that by September of 2000, there were at least 377.65 million Internet users in the world, with over 161 million located in the U.S. and Canada. By the year 2000, 50% of U.S. homes had a computer (UCLA Center for Communication Policy, 2000), nearly 50% used the Internet, and 700 new households were being connected to the Internet each hour (Office of the White House Press Secretary, 2000).

With so many people using the Internet and the Web, and with such incredible growth in size and popularity, it was inevitable that the influence of the web would begin to expand exponentially. In fact, the growth and popularization of the Internet and the Web has been, and will continue to be so important, that this phenomenon may be remembered as the single most influential development of the second half of the Twentieth Century (Maddux, Johnson, and Willis, in press).

Because changes in education typically take place only after changes in the culture at large, education in general was slow to respond, and computers began appearing in K-12 schools only after they were firmly entrenched in businesses, in homes, and in most other walks of life. Access to the Internet and the Web was even slower to reach public schools, and remains spotty to this day. Nevertheless, schools continue to acquire technology at a rapid pace. In 1999, the most recent year for which reliable statistics are available, over 870,000 additional instructional computers were installed in U.S. schools and the ratio of students to school computers improved to 5.7 to 1. Furthermore, 90% of schools gained Internet access, and of those, 71% had access within instructional classrooms (Market Data Retrieval, 1999).

Higher education has been even slower than K-12 education to make use of the Internet and the Web in teaching and learning. Although most professors now have computers and Internet access in their offices, higher education classroom use of technology in general and the Internet and the Web in particular is not common. However, within the last few years, educational administrators at all levels, particularly those in higher education, have begun to show greatly increased interest in the Internet and the Web for use in distance education. This interest has been motivated by greatly increasing competition for students by private entrepreneurs, especially those known in academic circles as "diploma mills." These organizations are mounting massive commercial distance education programs in diverse fields of study that are beginning to erode the dominance of traditional colleges and universities in attracting students, especially non-traditional students who continue to make up increasing proportions of the U.S. higher education student body. This widespread entry of the private sector into higher education has taken place because the business world has suddenly become aware of the potential educational power of the Internet and the Web, the increasing cost-effectiveness of related technology to carry out distance education, and the potential student demand.

> (Business leaders) are licking their entrepreneurial chops in ravenous expectation of the profit-taking gorge to come. Everywhere one turns, they are waxing eloquent about the new opportunities, and making estimates of the profit potential in terms of not millions, but billions of dollars per year. (Maddux, in press)

Given the huge profits now being realized, and the even greater ones being predicted, it is not surprising that the private sector wants into the act. Last year, private, online learning companies took in about $500 million dollars. More importantly, Merrill Lynch estimates that by 2003, online higher education will gross 7 billion dollars a year and will then grow at the rate of 55 percent a year (McGinn, 2000). Other estimates are even more extravagant, with some running as high as 9 or 10 billion dollars a year by 2003. In any case, the U.S. is now spending a total of 810 billion dollars a year on education, and the business community is gambling that the portion devoted to distance education, both public and private, will continue to increase rapidly. That seems a safe bet, as students are signing up in record numbers for courses delivered completely online, and even for completely online degree programs offered by a variety of public and private institutions and organizations.

I cannot help but believe that the current rush to completely online distance education will, in the long run, harm higher education. Quality control problems are obvious, and the temptation to sell courses and degrees with little if any rigor or respectability has already proved irresistible to many providers. Ironically, some of these providers are colleges and universities themselves, many of which are now maintaining completely online courses and programs in direct competition with their own on-campus offerings.

Part of the problem, it seems to me, is a failure on the part of many students, professors, businessmen, and administrators to distinguish between *information* and *education*. The web is a fantastic resource for information location and retrieval, but education, although it includes information, requires much more than hardware, software, and a medium. Nevertheless, as web-based, multimedia technologies evolve, improve, and become even more cost effective; distance education is sure to expand its involvement with completely web-based courses and programs.

Although it appears that the marriage of the web and distance education may be largely unfortunate and ill-conceived in its completely online incarnation, I believe the web has considerable potential to improve on-campus offerings. Since the web is a highly efficient and incredibly vast repository of information, its potential is considerable as a supplement to, rather than a replacement for, traditional on-campus courses.

Unfortunately, many colleges and universities are not building an infrastructure or support system to encourage web sites as supplements to on-campus offerings. Instead, web consultants and other campus technical support personnel are often assigned to help develop completely online courses while professors who want to provide supplementary websites for their courses are left to teach themselves how to design and maintain web pages. Many have done so, but most do not have the time, the motivation, or the ability to become proficient webmasters. Partly because of this, and partly because the web is so new that widely accepted style and design standards have not evolved, many supplementary pages are not as effective as they could be, and some are so poor that they are worthless.

The purpose of the present paper is to present a variety of aids and cautions for developers of web pages that are intended to be supplementary to traditional courses.

HTML and HTML Editors

Web pages are written in a simple markup language that evolved from the editorial marks placed on pages before they were sent to the printer for typesetting. The language is called HTML (hypertext markup language). Although HTML is easy to learn, there are a variety of editors and translators on the market, and these are widely used. HTML editors and translators are intended to make it possible to produce web pages without the need for learning HTML. Instead, the user enters text in more or less traditional format, and the software converts it to HTML.

There are many problems with HTML editors. One of the most serious is that there is no such thing as a WHAT YOU SEE IS WHAT YOU GET (WYSIWYG) editor, and consequently, it is almost always necessary to make modifications to the code produced by editors. However, those who have not learned any HTML are unable to do this. Consequently, they often end up with a page that is not really what they wanted, or a page with many technical problems. Another problem is that the code produced by editors is typically highly compressed, lacking in sensible line spacing and white space, and without comment code to clarify difficult sections. Therefore, it is difficult for anyone, even experts in HTML, to edit code produced by such software, thus making even simple and minor modifications almost impossible to accomplish quickly and easily, if at all. A third problem is that the complexity of many editors is such that it is as difficult and time-consuming to learn to use it as it would be to learn HTML in the first place. Finally, those who rely on editors can work only if the computer they are using has the editor installed, while those who learn HTML itself can work on any computer that has a word processor.

Web Accessibility

Another common problem with many web pages is lack of accessibility for individuals with disabilities. The scope of the problem can be appreciated in light of the fact that there are 35 million people with disabilities in the U.S. and around 740 million people worldwide (Lazarro, 1998). Accessibility is an issue, because many people with disabilities must use adaptive aids in order to use the Internet and the Web. The World Wide Web Consortium has recently published a document entitled Web Content Accessibility Guidelines 1.0 (1999). The document presents an excellent explanation of the need for special consideration of web access for individuals with disabilities:

> For those unfamiliar with accessibility issues pertaining to Web page design, consider that many users may be operating in contexts very different from your own:
>
> They may not be able to see, hear, move, or may not be able to process some types of information easily or at all.
>
> They may have difficulty reading or comprehending text.
>
> They may not have or be able to use a keyboard or mouse.
>
> They may have a text-only screen, a small screen, or a slow Internet connection.
>
> They may not speak or understand fluently the language in which the document is written.
>
> They may be in a situation where their eyes, ears, or hands are busy or interfered with (e.g., driving to work, working in a loud environment, etc.).
>
> They may have an early version of a browser, a different browser entirely, a voice browser, or a different operating system.
>
> Content developers must consider these different situations during page design. While there are several situations to consider, each accessible design choice generally benefits several disability groups at once and the Web community as a whole.

The document goes on to describe specific methods for web page design that will maximize access for individuals with disabilities.

There is an excellent web site that should be used by all web page developers. The site, entitled Bobby (http://www.cast.org/bobby/), will check web pages for disability access and provide a comprehensive report of any problems found as well as suggestions for solutions to these problems.

Problems and Solutions

HTML codes are called "tags" and are located between "greater than" and "less than" brackets. Many HTML codes are "containers," requiring one tag to activate a function and one to terminate it.

The TITLE tag is such a tag, and many web pages written by novices lack a good, descriptive title. The web page title should be placed between <TITLE> and </TITLE> tags. Omitting an HTML title causes search engines and directories to list these pages as "UNTITLED" or with titles that are incorrect or misleading.

Another problem is that beginners often omit META tags (tags containing a brief narrative description and list of keywords for use by search engines and directories). This may cause search engines and directories to list such pages in the wrong categories, or to provide descriptions that are not accurate. Two excellent web pages that will write the HTML for good META tags is (a) The Meta Tag Generator (http://www.web-source.net/meta.html) and (b) The META Tag Builder (http://vancouver-webpages.com/META/mk-metas.html). These sites present a form for users to fill out in which they specify keywords, descriptions, and other information about their page. The site then writes the HTML for good META tags and presents the code so that it can be copied and pasted into the user's HTML.

Many pages do not optimize their use of graphics. One the most common problems is the tendency to use too many graphics. Graphics take time to load, and the more graphics in a page, the longer it will take to load fully. Web users are notoriously impatient, and pages that take more than half a minute or so to load will often be abandoned before they are even viewed. There are a number of HTML verifier pages on the web. These sites will prompt for a URL, then examine the underlying HTML and provide a report of any problems found. Some of these sites will provide an estimate of the number of seconds a page will require to load given a connection of a specific speed. An excellent example of such a page is Dr. HTML (http://www2.imagiware.com/RxHTML/).

Whenever possible, web designers should re-use graphics rather than making use of many different graphics. Such a technique is practical for graphics such as line dividers, and is good practice because once a graphic has been loaded into a user's browser, it can be used again on that page without reloading time.

Other good practices with regard to graphics include the following:

1. Always include a text description for any information communicated with a graphic (for users with adaptive aids and for users with browsers that cannot display graphics),.

2. Always specify height and width of all graphics (in order to permit a browser to display text while the graphics are loading),

3. Always use the ALT= attribute to specify a description of the graphic. (Any elementary HTML manual will explain exactly how to do these things, or interested individuals may consult the author's website at http://unr.edu/homepage/maddux/prog/sylcp411.html.)

A sample of the HTML code for displaying a graphic of an elephant in a file called "elephant.gif" that is 75 pixels in width and 100 pixels in height is:

```
<IMG SRC="elephant.gif" WIDTH=75 HEIGHT=100 ALT="Picture of an elephant">
```

4. For large images, provide small, "thumbnail" images that are links to the full-size image. Since large images require longer to load, the long wait will result only for those users who wish to view the large version of the graphic.

5. Developers should never make use of an image that is stored only on another server. Instead, developers should copy the image into their own accounts and display it from there. Displaying images on someone else's server slows down loading and places a load on the other server. (Of course, no image should be used in any fashion unless it is in the public domain, or the owner has granted written permission for its use on another's site.)

6. The use of "image maps" should be avoided. These are graphics with special areas that function as links) Many web users may not realize that areas of graphics can be made to function as links, and, at the present time, adaptive aids cannot cope with image maps.

7. Refrain from using "frames." (an HTML strategy for dividing the browser window into separate displays or windows.) Bookmarking a page with frames is problematic, adaptive aids have difficulty with them, and some individuals dislike them so much that they will not visit pages that employ them.

8. Every page should contain a link to the e-mail address of the developer. The link should display the full e-mail address.

9. All pages should contain a link at the bottom of the page to permit a quick return to the top of the page.

10. All pages should contain a link back to the home page. This is essential because most users find pages through a search engine. If there is no link back to the home page, such users may be unable to find that home page, since they cannot simply click on the browser "back" button, as they could if they had found the page by "surfing" to the home page and then choosing a relevant link.

11. Content of the page should be current, and there should be a line at the top or bottom of the page giving the date the page was last modified. It is especially important that links presented on the page be tested often to be sure they still function. Users who discover that many links on a page no longer work will leave the page and never return.

12. Limit the length of pages to two or three screens at the most. Long sections should be broken into "chunks" and placed in separate files that can be reached through links.

13. Develop a color scheme for each course for which there are supplementary sites. That way, students will always be aware of which supplementary page they are viewing.

14. For lecture courses, lecture notes should be included, and should be posted as quickly as possible after each class. My experience and the result of several informal surveys shows that students view lecture notes as the single most useful part of a web page.

15. Do not promise to post specific information and then neglect to do so.

16. Include a page of links to other pages on the web that deal with course-related topics. However, be sure to carefully preview all such sites to be sure the content is accurate and otherwise appropriate. Links that lead to irrelevant or improperly described pages will soon be ignored by students.

17. Include links for downloading all class handouts. This is viewed by students as next in importance only to lecture notes. Then too, such links will relieve the instructor of the tedious chore of locating handouts and arranging copies to be made for students who were not in class or who have lost important handouts. Handouts can be placed on one's server in word processing format, and students can choose a link to the file, save it on their own computers, or print it out.

18. Include a full syllabus that includes all grading policies and criteria.

19. Ensure that all pages employ correct mechanics of writing including spelling, punctuation, grammar, etc.

20. Ensure that all information is correct and presented in understandable ways.

21. Do not expect that supplementary web pages will result in instructor time savings. Web pages are time consuming to construct and maintain properly. Although some time will be saved by avoiding the need to search paper files for handouts that students have lost, giving "private lectures" to students who were ill, etc., the time required for web maintenance will more than make up for time saved. The purpose of a supplementary page should be to improve teaching and learning, not to save time.

22. Be prepared for students to quickly come to expect and to depend upon supplementary web pages. It is amazing how quickly many students progress from gratitude about access to a supplementary page to an attitude of entitlement.

Conclusions

Web pages that are supplementary to traditional, on-campus courses can be highly beneficial to students and professors. However, there are many common problems that can limit the usefulness of such pages. This paper has presented a few of these problems as well as some simple solutions. For a complete discussion of these and other recommendations, readers are referred to Maddux (2000), Maddux and Cummings (2000), and Maddux and Johnson (1997). Interested readers are also encouraged to visit the first authors' supplementary web site for his course on web site design and maintenance. The home page can be found at http://unr.edu/homepage/maddux/prog/sylcp411.html, and HTML instructional pages can be accessed from links at http://unr.edu/homepage/maddux/prog/demo.html.

References

Juliussen, E. & Petska-Juliussen, K. (2000). *U.S. tops 100 million Internet users according to Computer Industry Almanac.* Arlington Heights, IL: The Computer Industry Almanac, Inc. Retrieved March 20, 2000 from the World Wide Web: http://www.c-i-a.com/199911iu.htm

Lazarro, J. (1998). *Web accessibility: Making the Internet accessible for persons of all abilities.* Retrieved February 1, 2000 from the World Wide Web: http://webreview.com/wr/pub/98/09/04/feature/index.html

McGinn, D. (2000, October). Biz men on campus. Grok, 76-84.

Maddux, C.D. (in press). The Web in education: Asset or liability? *Computers in the Schools.*

Maddux, C.D. (in press). Solving accessibility and other problems in school and classroom web sites. *Rural Special Education Quarterly.*

Maddux, C. D., & Cummings, R. (2000). Developing web pages as supplements to traditional courses. In B. Abbey (Ed.), *Instructional and cognitive impacts of web-based education*, pp. 147-155 . Hershey, PA: Idea Group Publishing.

Maddux, C.D. & Johnson, D.L. (1997). The World Wide Web: History, cultural context, and a manual for developers of education information-based web sites. *Educational Technology*, 37 (5), 5-12.

Maddux, C.D., Johnson, D.L., and Willis, J.W. (in press). *Educational computing: Learning with tomorrow's technologies* (3rd ed.). Boston, MA: Allyn & Bacon.

Market Data Retrieval (1999). *Technology in education 1999.* Shelton, CT: Author.

Masotto, T. (1995). *CommerceNet/Neilsen Internet demographics survey executive summary* [Web document]. URL http://www.commerce.net/work/pilot/nielsen_96/exec_95.html.

NUA Limited (2000). *How many online?* Retrieved November 28, 2000 from the World Wide Web: http://www.nua.ie/surveys/how_many_online/index.html

Office of the White House Press Secretary (21 January, 2000). *Information technology research and development: Information technology for the 21st Century.* Retrieved March 23, 2000 from the World Wide Web: http://www.whitehouse.gov/WH/New/html/20000121_2.html

Sullivan, D. (2000). *Search engine sizes.* Retrieved March 20, 2000 from the World Wide Web: http://searchenginewatch.internet.com/reports/sizes.html

UCLA Center for Communications Policy (2000). Landmark UCLA study will explore the evolution and impact of personal computers and the Internet. Los Angeles, CA: Author. Retrieved March 22, 2000 from the World Wide Web: http://www.ccp.ucla.edu/press_release.htm

World Wide Web Consortium (1999). *Web Content Accessibility Guidelines 1.0.* Author. Retrieved November 30, 2000 from the World Wide Web: http://www.w3.org/TR/WCAG10/

Toward an Adaptive e-Framework for Teacher Education

M. Adamo[1], M.G. Dutto[2], I. Gatti[2], M. Lancia[3], G.F. Mascari[1] , M. Vitale[4], S. Vigiani[1]

[1]Istituto per le Applicazioni del Calcolo "M.Picone" (IAC) - Italian National Research Council (CNR),
[2]Coordinamento Formazione Insegnanti (CFI)– Italian Ministry of Education
3 Centro Elaborazione Dati (CED) - Italian National Research Council
[4]Servizio Reti di Comunicazione (SRC) - Italian National Research Council .

adamo@iac.rm.cnr.it, mgdutto@istruzione.it, igatti@istruzione.it,
lancia@cedrc.cnr.it, mascari@src.cnr.it, vitale@src.cnr.it, vighouse@mail.lina.it

Abstract

The Italian Ministry of Education in collaboration of the Italian National Research Council are engaged in joint activities concerning the modeling, design and prototype implementation of an adaptive e-framework supporting the interactions of various actors of the national teacher training system. The framework includes patterns of static and adaptive versions for resources-services allocation and management.

Introduction

In the knowledge society, knowledge is a primary resource at various levels including: the know what, the know how and the know why. The processes acting on knowledge: creation, acquisition, processing, evaluation, storing and transmission, and their interrelationships contribute to determine a new social dynamics. The education systems are complex organizations in the knowledge society: they offer services based on the exchange of knowledge between "knowledge providers" (research centers, universities, laboratories, museums, etc…) and "knowledge clients" (school students, enterprise employees,) by means of "knowledge intermediaries" (teachers, pedagogical resources, etc…). Teacher training can be considered as the interaction between providers and intermediaries in education systems.

The information and communication technologies are enabling factors for the development of the knowledge society and hence of the education systems. In particular teacher training is becoming a strategic issue that requires new advanced web based solutions.

The Italian Ministry of Education and the Italian National Research Council are engaged in joint activities concerning the modeling, design and prototype implementation of an adaptive e-framework supporting the interactions of various actors of the national teacher training system.

The e-framework includes patterns of static and adaptive versions for resources-services allocation and management: a teacher training system can be modeled by composing patterns, according to its complexity: In particular:

- the static resources-services allocation: services are provided by teaching agencies to the teachers;
- the adaptive resources-services allocation: the system takes care of the teachers and training agencies profiles for matching their respective needs and supply;
- the static management of the system behavior according to the cycle: planning, monitoring, evaluation, change management and planning
- the adaptive management of the system dynamically coordinates the planning, monitoring, evaluation and change management subsystems.

Up to now a prototype of information dissemination of teacher training services, called SIF and based on the static resources-services allocation pattern, has been realized with a high degree of scalability scalabilty: (around 25.000 teachers and 250 training agencies). Design and implementations of advanced teacher training systems, based on more complex patterns, are in progress.

1. Resources-Services Patterns

1.1 Static Resources-Services Pattern

Training agencies and teachers interact trough the matching between training resources offering and training services request. The matching is realized according to a matching schema associated to a kernel component which is specified once for all w.r.t the evolution of the overall system (i.e. "statically").

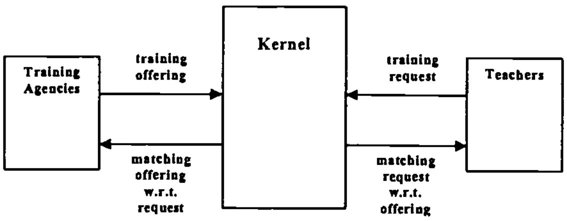
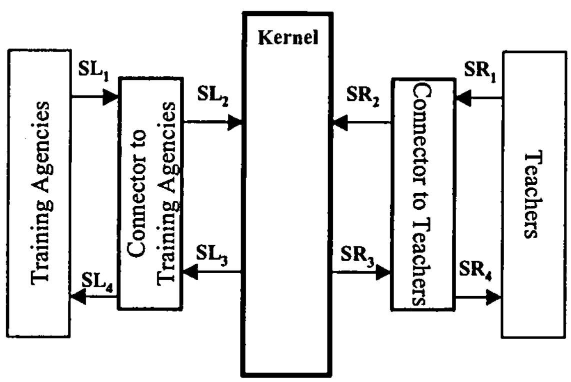


Figure 1: ***Static Resources-Services*** **Pattern**

1.2 Adaptive Resources-Services Pattern

Training agencies and teachers interact trough the matching between training resources offering and training services request. The matching is realized according to matching schemas chosen by the connectors among those available from the kernel component (i.e. "dynamically"), as specified in the following figure.



L-labels	Flows	Flows	R-labels
SL_1	training offering	training request	SR_1
SL_2	available training offering	available training request	SR_2
SL_3	matching offering-request availability	matching request-offering availability	SR_3
SL_4	matching offering-request	matching request-offering	SR_4

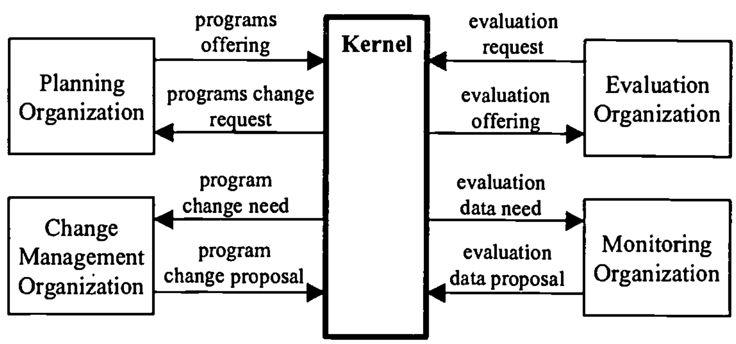
Figure 2: ***Adaptive Ressource-Services*** **Pattern**

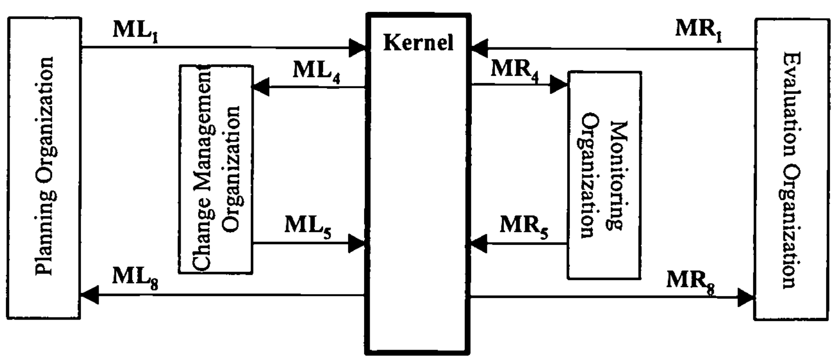
BEST COPY AVAILABLE

2. Management Patterns

2.1 Static Management Pattern

The global management of a teacher training system is obtained by composing local interactions of four organisms (planning, monitoring, evaluation and change management) with the kernel component. The interactions rules are specified once for all w.r.t the evolution of the overall system (i.e. "statically").



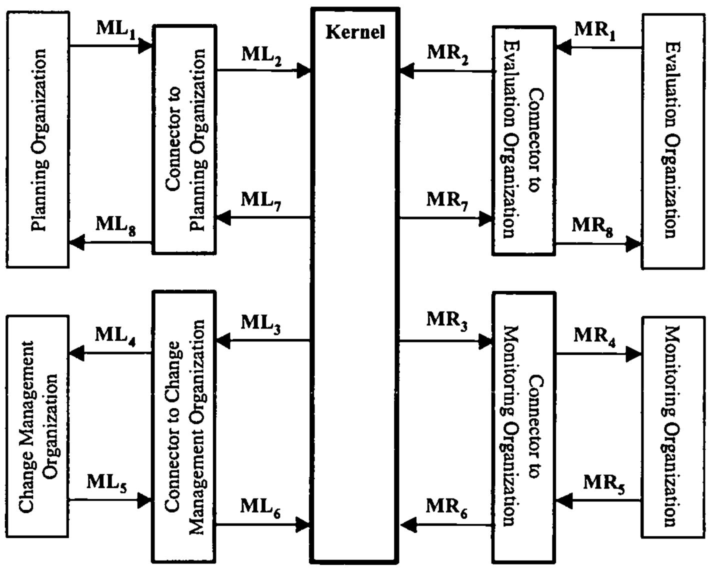


L-labels	Flows	Flows	R-labels
ML_1	programs offering	evaluations request	MR_1
ML_4	program change need	evaluation data need	MR_4
ML_5	program change proposal	evaluation data proposal	MR_5
ML_8	program change request	evaluation offering	MR_8

Figure 3: *Static Management* Pattern

2.2 Adaptive management Pattern

The global management of a teacher training system is obtained by composing local interactions of four organisms (planning, monitoring, evaluation and change management) with the kernel component. The interactions follow rules chosen by the connectors according to the availability for interaction from the kernel. (i.e. "dynamically").



L-labels	Flows	Flows	R-labels
ML_1	programs offering	evaluations request	MR_1
ML_2	actions offering	indicators request	MR_2
ML_3	matching actions-indicators availability	matching indicators-actions availability	MR_3
ML_4	program change need	evaluation data need	MR_4
ML_5	program change proposal	evaluation data proposal	MR_5
ML_6	actions change proposal	indicators data proposal	MR_6
ML_7	actions change request	indicators data offering	MR_7
ML_8	program change request	evaluation offering	MR_8

Figure 4: ***Adaptive Management*** **Pattern**

3. Patterns-based Teacher Education Systems

Teacher education systems can be modeled by composing the previous patterns: the more complex model is obtained by composing the adaptive resources-services pattern with the adaptive management pattern, as illustrated in the following diagram.

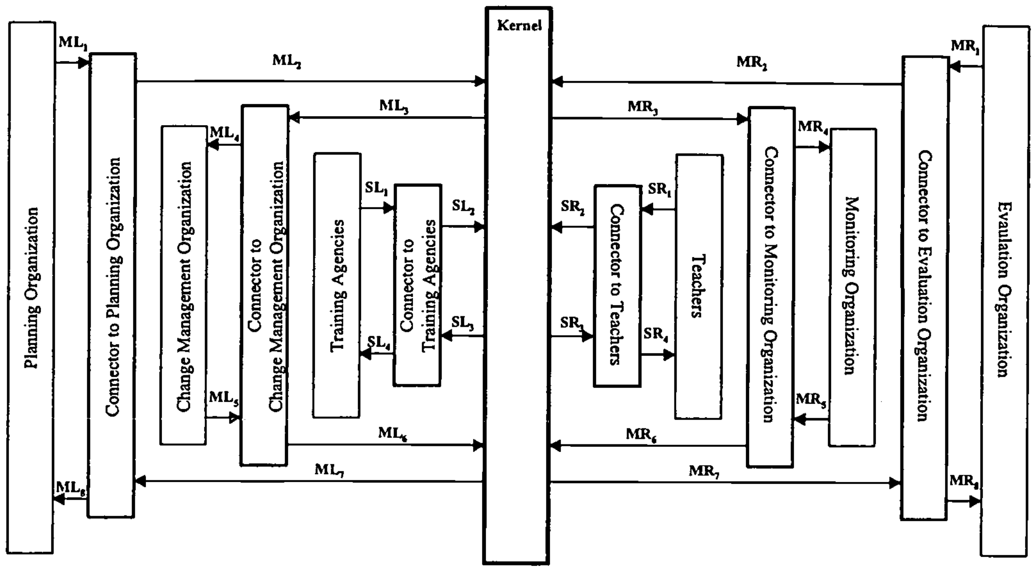


Figure 5: ***Adaptive Resources-Services and Management*** **System**

The design of such kind of complex system requires a rigorous modeling methodology. A long way in front of us !

References:

[1] IEEE 1999: LTSA Specification - Learning Technology Systems Architecture (http://edutool.com/ltsa/)

[2] Association for the Advancement of Computing in Education (www.aace.org)

[3] University of Massachusetts - Center for Computer-Based Instructional Technology (http://ccbit.cs.umass.edu/ccbit/)

[4] B.P. Woolf, V. Lesser, C. Eliot, Z. Eyler-Walker, M. Klein: "A Digital Market Place for Education", SSGRR 2000, L'Aquila (Italy) 2000

[5] G.F. Mascari: Frameworks for Complex Adaptive Systems, in preparation

Acknowledgments:

to Gianni di Fiandra (ITIS Fermi), Daniela Merella (CED CNR), Paolo Sartorelli (CED CNR), Gianfranco Timpano (CED-CNR), Giovanni Guerrieri (CED-CNR), Silvio Scipioni (CED-CNR) for their contribution to the SIF project.

Problem-Based Learning Using Web-Based Group Discussions: A Positive Learning Experience for Undergraduate Students.

Joanne Y. Pelletier
School of Education
Acadia University
Canada
joanne.pelletier@acadiau.ca

Gary W. Ness
School of Recreation Management and Kinesiology
Acadia University
Canada
gary.ness@acadiau.ca

René J.L. Murphy
School of Recreation Management and Kinesiology
Acadia University
Canada
rene.murphy@acadiau.ca

Abstract: The purposes of this study were to incorporate computer technology into parts of an undergraduate exercise physiology course, to motivate students, to get them actively involved in the learning process and to enhance learning. Two classes of third year students were studied; the first was taught using problem-based learning (PBL) activities with on-line discussions on a course web page while the second was taught using traditional lectures. Student perceptions about the use of technology and PBL were collected. Data related to student knowledge, comprehension, and application of course material were collected. The teaching methods resulted in similar grades on exam questions and final course marks with only one significant difference, that being a higher score (15%) in the PBL and technology group's answer to a question of "application of knowledge" ($p=0.02$). Lastly, this project verified the viability of these teaching methods and demonstrated their acceptance by undergraduate students.

Introduction

Many believe that the use of computer technology to support teaching activities in university settings contributes significantly to student learning (Blumberg and Sparks, 1999; Levine et al., 1999; Carroll, 1998; Todd, 1998; Wiemer, 1998; Davis et al., 1997; Dwyer et al., 1997; Richardson, 1997). Acadia University provides unique opportunities for faculty to incorporate computer technology into their teaching. Since the implementation of the Acadia Advantage program in 1996, all Acadia University students have received an IBM laptop computer with rental cost included in tuition fees. Faculty members are encouraged to use the computer and associated features to provide learning opportunities, which integrate the technology into their courses. The Acadia Institute for Teaching and Technology (AITT) is a new unit, which has as its purpose to provide technical support to Faculty at Acadia University. The AITT has developed a web-based Automated Courseware Management Environment (ACME) program, which is heavily used by faculty. Each course has a web-site with numerous features including course information, class email, access control, notes, discussions and tests. Students have unlimited access to their course pages.

Attempts have been made to integrate problem-based learning (PBL) into traditional lecture-based undergraduate courses (Béliveau and Martel, 1995; Edwards et al., 1999; Finch, 1999; Lim and Chen, 1999; Niederman and Badovinac, 1999; Purdy et al., 1999; Sullivan et al., 1999; Barrows, 1998;

McInerney, 1998; Huang and Carroll, 1997; Stern, 1997; Cliff and Wright, 1996). It has been suggested that regular use of PBL is a valuable addition to traditional methods of lectures, textbook readings, and laboratory exercises for the teaching and learning of physiology (Des Marchais, 1999; Galey, 1998; Stern, 1997; Cliff and Wright, 1996). Problem-based learning in undergraduate courses is student-centred rather than faculty-centred (Saarinen-Rahiika and Binkley, 1998), thus supporting the cognitive learning theory (Svinicki, 1998). Furthermore, problem-based learning is believed to develop problem solving skills in undergraduate courses (Dalton, 1999; Lim and Chen, 1999).

Purpose

The goals of this study were to incorporate the technology available to parts of an undergraduate exercise physiology course, to motivate students, to get them actively involved in the learning process and to enhance learning. The aims of this initial research project were to compare students' knowledge and retention of course material taught using traditional methods and taught using problem-based learning (PBL) activities utilizing computer technology, to evaluate students perceptions of the two teaching methods and learning activities and to identify teacher actions and/or learning activities that help or motivate kinesiology students to learn exercise physiology. Finally, this project could provide pilot data on the usefulness of these strategies in teaching a variety of similar undergraduate courses.

Methods

All procedures were approved by the institution's research ethics review process. Two classes of third year students were studied; course material was taught using lectures and laboratory exercises, however one section of the course was taught using supplemental problem-based learning (PBL) activities with on-line discussions on a course web page while the other section was taught using only traditional lectures. Both groups received identical laboratory experiences. Students randomly selected one of the course sections and lab sections during the registration period and were not aware of the instruction methods to be used.

At the beginning of the semester, the study was outlined to all prospective participants. All students agreed to participate (ie. allow use of GPA, course/ exam marks in reporting group data, course evaluations, etc). To ensure that groups were similar, grades in the prerequisite courses, as well as overall GPA, were compared and no significant differences were found between the group taught with technology and PBL and the group taught with lectures (see Table 1).

A subgroup of students from each class also volunteered to participate in other parts of the study. Student perceptions about the use of technology and PBL were collected using the Nominal Group Technique (Delbeck et al., 1975) and the Evaluation by Group Animation Technique (Talbot and Bordage, 1985). These students were subsequently compensated financially for their participation. Data related to student knowledge, comprehension, and application of course material, were collected using identical exam questions in both course sections at the end of the semester. Retention over time will be assessed using the same exam questions administered one year after the end of the courses. The questions used to evaluate knowledge and comprehension of key concepts as well as ability to apply course material to specific situations were "Name and describe the different methods by which body heat is lost during exercise in a hot environment. Identify the major heat loss mechanism and the physiological problems that the prolonged use of this mechanism imposes." and "Your grandparents are leaving for the hot and humid climate of the Caribbean islands for the Christmas break. They would like to exercise during their trip and ask you, an expert in exercise physiology, what they should do before, during and after the exercise sessions in warm environment. Explain why you recommend these procedures." respectively.

A one-way analysis of variance was used to compare group means. Significant differences were accepted at the 0.05 level of probability. All data are expressed as group means and standard deviations.

Results

Random selection of course and lab sections by students during the registration period prevented bias from the researchers. However, to ensure that the groups were similar, grades in prerequisite courses (2nd year Anatomy and Physiology) were compared for each group. Group average GPAs at the end of second year also were compared. There were no significant differences between the two groups on any of the variables (Table 1).

Table 1. Groups

	Number of Students	Grades in prerequisite courses (mean ± SD)		GPA after 2nd year (mean ± SD)
		Course #1	Course #2	
PBL and technology	26	2.45±1.03	2.37±1.10	2.63±0.64
Lectures	34	2.56±0.89	2.44±0.90	2.82±0.54

The two teaching methods resulted in similar grades on exam questions and final course marks with only one significant difference, that being a higher score (15%) in the technology and PBL group's answer to a question of "application" of knowledge (p=0.02, PBL vs lectures). This was not surprising as the problems were developed to encourage students to apply the basic exercise physiology concepts to real life situations. The PBL and technology group also performed slightly better in the exercise physiology course (Table 2) although this did not reach significance. These preliminary findings suggest that students may benefit from the use of technology and PBL in exercise physiology.

The result of this first experience, using a web-based program to teach exercise physiology employing PBL and technology, was overwhelmingly positive. Student comments included: "Not only does the incorporation [of technology and PBL] help to add to my learning, I feel like without it I am being cheated". Students also indicated that this teaching method "allowed the use of the computer" and "online discussions are more effective". The majority of students who participated in the PBL problems suggested that it made the material "more relevant and meaningful". It appears that the majority of students enjoyed and appreciated this teaching style and were positive about its use in undergraduate curriculum.

Table 2. Effects of the teaching methods on grades.

	Knowledge/ understanding question (/10)	Application question (/10)	Final grade in course (%)
PBL and technology	6.19±3.12	6.43±2.07*	73.3±13.1
Lectures	6.71±2.63	5.43±1.55*	70.0±15.5

Data are reported as means and standard deviations. * indicates significant difference between groups.

Discussion

The most important findings of the present study are that students who were involved in the PBL and technology course responded very positively to the method and that this teaching style was similar to the traditional style (ie. lectures and laboratory exercises) in teaching effectiveness as assessed by exam answers and grades. Technology education has been designed to reduce the number of formal lecture hours, to enhance student enthusiasm and to assist learning (Abdulla et al., 1983; Levine et al., 1999; Carroll, 1998; Davis et al., 1997; Dwyer et al., 1997; Richardson, 1997). In fact, computer-assisted education is now considered a useful resource to teach physiology to undergraduate and medical students (Blumberg and Sparks, 1999; Levine et al., 1999; Carroll, 1998; Todd, 1998; Wiemer, 1998; Davis et al., 1997; Dwyer et al., 1997; Richardson, 1997) and to teach health education to physical education students (Béliveau and Martel, 1995). The present study provides support for the use of these teaching strategies in undergraduate exercise physiology.

Currently available research supporting technology education suggests that in general, the incorporation of technology into higher education has not proven detrimental. On the contrary, some studies have reported that the introduction of technology is beneficial to undergraduates' learning (Blumberg and Sparks, 1999; Devitt and Palmer, 1998; Levine et al., 1999; Davis et al., 1997; Richardson, 1997). One might assume that kinesiology students also could benefit from the contact with this technology in the classroom. Moreover, according to a recent report prepared for the American Federation of Teacher and the National Education Association (Phipps and Merisotis, 1999), most studies supporting the use of technology done to date, have been descriptive and few had control groups to compare teaching methods. This study is the first to control for teaching method and suggests that technology and PBL can contribute to learning in an undergraduate exercise physiology course. Also, there is little information available on the long-term impact of technology in teaching of exercise physiology. The students involved in this study will be recruited and tested again to determine the degree to which information was retained in both teaching styles. Furthermore, few studies have addressed undergraduates' perceptions of technology education in the instruction and learning of exercise physiology (Davis et al., 1997; Richardson, 1997). In the present study, student perceptions were sought. Overall, students indicated that this teaching method was interesting, effective and appreciated. Students commented that the use of technology with PBL was more effective because some of the learning could take place without the need to get together as a group.

Bloom's (1956) taxonomy of educational objectives domain identifies six aspects of learning, the first three being knowledge, comprehension and application. Because application requires the use of general principles to solve a problem, technology and problem-based learning exercises can help students to apply their understanding (comprehension) to new situations (Carroll, 1998). The students who participated in the PBL and technology class were, overall, better at answering an exam question which was designed to evaluate their ability to apply their new knowledge to a specific situation. There is evidence that knowledge acquisition and reasoning skills are greater for students taught using PBL than students taught using conventional methods (Finch, 1999; White et al., 1999; Doucet et al., 1998; Kaufman and Mann, 1998). Students commented that PBL problems made the information more pertinent. This may be a reason why students believed this approach to teaching was more relevant to their needs.

Anecdotally, the use of computer technology and problem-based learning exercises was adopted by another faculty member teaching in the same Kinesiology program. In another undergraduate course (growth and motor development), second year students also commented positively on course evaluations about the use of PBL and technology, suggesting that this method could be used more extensively in undergraduate kinesiology curriculum delivery. Also, recent studies have indicated that students find problem-based learning beneficial (Béliveau and Martel, 1995; Kuhnigk and Schauenburg, 1999; White et al., 1999; Birgegard and Lindquist, 1998; Doucet et al., 1998; Lancaster et al., 1997; Stern, 1997; Cliff and Wright, 1996). Specifically, students explain that such an experience enhances reasoning, integration of content and professional behaviours (Stern, 1997). Students did feel however, that problem-based learning was not effective if they did not feel confident that they were learning the content their instructor had intended them to learn (Huang and Carroll, 1997). The use of the web-site discussion provided the instructor/ tutors opportunities to give feedback and minimize the likelihood of this being a major problem in the present study. Feedback could be provided promptly, individually or to the group and ensured that the students were studying the correct material.

One problem that remains to be resolved is the choice of appropriate outcome assessment measures to evaluate the effectiveness of technology and PBL as a mode of learning in undergraduate courses (Lim and Chen, 1999). In the present study, exam questions were developed and grades on selected questions as well as final course grades were used. Long-term retention of course material will also be assessed using the same exam questions. Although present assessment methods may not be the best, in the present situation, they were deemed the most appropriate.

Conclusions and Perspectives

To our knowledge, experimental learning such as problem-based learning has not been performed previously using the computer as a learning tool in exercise physiology. This pilot project verified the viability of these teaching methods and demonstrated their acceptance by undergraduate students in kinesiology. In summary, we suggest that regular use of problem-based learning activities and technology education can be useful assets in teaching undergraduate exercise physiology or other kinesiology courses. The integration of technology education into an alternative approach such as problem-based learning to teach exercise physiology could very well motivate students to learn as well as improve student performance particularly with regard to information application. There is little research on the effectiveness of the use of computer technology to help teach using a problem-based learning approach although there is a vast potential for education using these methods. For example, these methods could be very useful for continuing and distance education. Finally, this first project demonstrates the short-term benefits of using technology in problem-based instruction in exercise physiology.

References

Abdulla, A.M., Watkins, L.O., Henke, J.S., Weitz, F.I., & Frank, M.J. (1983). Classroom use of personal computers in medial education: A practical approach. *Med. Educ.* 17(4), 229-232.

Barrows, H.S. (1998). The essentials of problem-based learning. *J. Dent. Educ.* 62(9), 630-633.

Béliveau, L., & Martel, D. (1995). L'apprentissage par problèmes: une expérience d'implantation en éducation physique. Dans Enseignement supérieur: stratégies d'enseignement appropriées. Actes du colloque de l'Association internationale de pédagogie universitaire, Presses de l'Université du Québec à Hull.

Bloom, B. (Ed.) (1956). *Taxonomy of Educational Objectives*. New York: David McKay.

Blumberg, P., & Sparks, J. (1999). Tracing the evolution of critical evaluation skills in student's use of the Internet. *Bull. Med. Libr. Assoc.* 87(2), 200-205.

Birgegard, G., & Lindquist, U. (1998). Change in student attitudes to medical school after the introduction of problem-based learning in spite of low ratings. *Med. Educ.* 32(1), 46-49.

Carroll, R.G. (1998). Current and future impact of technology on physiology education. *Adv. Physiol. Educ.* 20(1), 8-11.

Cliff, W.H., & Wright, A.W. (1996). Directed case study method for teaching human anatomy and physiology. *Adv. Physiol. Educ.* 15(1), 19-28.

Dalton, S. (1999). Problem-based learning: a method that encourages critical thinking. *Health Care Food Nutr. Focus.* 15(9), 4-6.

Davis, M.J., Wythe, J., .Rozum, J.S., & Gore, R.W. (1997). Use of world wide web server and browser software to support a first-year medical physiology course. *Adv. Physiol. Educ.* 17(1), 1-13.

Delbeck, A.L., Van de Ven, A.H., & Gustafson, H. (1975). *Group Techniques for Program Planning: A Guide to Nominal and Delphy Process.* Glenview, Ill: Scott, Foresman Co.

Des Marchais, J.E. (1999). New pedagogic approaches adapted to the teaching of pharmacology, the activities centered on the student. *Therapie* 54(1), 171-181.

Devitt, P., & Palmer. E. (1998). Computers in medical education 1: evaluation of a problem-orientated learning package. *Aust. N.Z. J. Surg.* 68(4), 284-287.

Doucet, M.D., Purdy, R.A., Kaufman, D. M., & Langille, D.B. (1998). Comparison of problem-based learning and lecture format in continuing medical education on headache diagnosis and management. *Med. Educ.* 32(6), 590-596.

Dwyer, T.M., Fleming, J., Randall, J.E., & Coleman, T.G. (1997). Teaching physiology and the world wide web: Electrochemistry and electrophysiology on the internet. *Adv. Physiol. Educ.* 18(1), 2-13.

Edwards, N., Hugo, K., Gragg, B., & Peterson, J. (1999). The integration of problem-based learning strategies in distance education. *Nurse Educ.* 24(1), 36-41.

Finch, P.M. (1999). The effect of problem-based learning on the academic performance of students studying podiatric medicine in Ontario. *Med Educ.* 33(6), 411-417.

Galey, W.R. (1998). What is the future of problem-based learning in medical education? *Adv. Physiol. Educ.* 20(1), 12-15.

Huang, A.H., & Carroll, R.G. (1997). Incorporating active learning into a traditional curriculum. *Adv. Physiol. Educ.* 18(1), 14-23.

Kaufman, D.M., & Mann, K.V. (1998). Comparing achievement on the Medical Council of Canada. Qualifying Examination Part I of students in conventional and problem-based learning curricula. *Acad. Med.* 73(11), 1211-1213.

Kuhnigk, O., & Schauenburg, H. (1999). Psychological health, locus of control and personality of medical students of a traditional and alternative study program. *Psychother. Psychosom. Med. Psychol.* 49(1), 29-36.

Landcaster, C.J., Bradley, E., Smith, I.K., Chessman, A., Stroup-Benham, C.A.. & Camp, M.G. (1997). The effect of PBL on students' perceptions on learning environment. *Acad. Med.* 72(10 Suppl. 1), S10-12.

Levine, M.G., Stempak, J., Conyers, G., & Walters, J.A. (1999). Implementing and integrating computer-based activities into a problem-based gross anatomy curriculum. *Clin. Anat.* 12(3), 191-198.

Lim, L.P., & Chen, A.Y. (1999). Challenges and relevance of problem-based learning in dental education. *Eur. J. Dent. Educ.* 3(1), 20-26.

McInerney, P.A. (1998). Recurriculating to a problem-based learning curriculum: The Wits Experience. *Curationis.* 21(2), 53-56.

Niederman, R., & Badovinac, R. (1999). Tradition-based dental care and evidence-based dental care. *J. Dent. Res.* 78(7), 1288-1291.

Phipps, R., & Merisotis, J. (1999) What's the difference? *Institute For Higher Education Policy.*

Purdy, R.A., Benstead, T.J., Holmes, D.B., & Kaufman, D.M. (1999). Using problem-based learning in neurosciences education for medical students. *Can. J. Neurol. Sci.* 26(3), 211-216.

Richardson, D. (1997). Student perceptions and learning outcome of computer-assisted versus traditional instruction in physiology. *Adv. Physiol. Educ.* 18(1), 55-58.

Saarinen-Rahiika, H., & Binkley, J.M. (1998). Problem-based learning in physical therapy: a review of the literature and overview of the McMaster University experience. *Phys. Ther.* 78(2), 207-211.

Stern, P. (1997). Student perceptions of a problem-based learning course. *Am. J. Occup. Ther.* 51(7), 589-596.

Sullivan, M.E., Hitchcock, M.A., & Dunnington, G.L. (1999). Peer and self assessment during problem-based tutorials. *Am. J. Surg.* 177(3), 266-269.

Svinicki, M. D. (1998). A theoretical foundation for discovery learning. *Adv. Physiol. Educ.* 18(1), 4-7.

Talbot, R., & Bordage, G. (1985). Une appréciation préliminaire d'une nouvelle méthode d'évaluation des cours par animation de groupe. Service des ressources pédagogiques, Faculté des sciences de l'éducation, Université Laval.

Todd, N.A. (1998). Using e-mail in an undergraduate nursing course to increase critical thinking skills. *Comput. Nurs.* 16(2), 115-118.

Weimer, W. (1998). It's a long way to multimedia: An account of 18 years of pursuing a new media project in physiology. *Adv. Physiol. Educ.* 20(1), 96-105.

White, M.J., Amos, E., & Kouzekanani, K. (1999). Problem-based learning: An outcomes study. *Nurse Educ.* 24(2), 33-36.

Acknoweledgements

The authors wish to thank the Acadia Institute for Teaching and Technology for technical assistance as well as for financial support for this project.

Adapting Critical Thinking Models to a Technological Approach

Dr. Janice Nath
Teacher Education and Certification
University of Houston
United States
jnath@flash.net

Helen Farran
Teacher Education and Certification
University of Houston
United States
hfarran@pdq.net

Abstract

Teachers must be prepared to teach higher-level thinking skills and to incorporate technology so that students will have the proficiencies and skills needed to enter this new and creative era. The purpose of this paper is to present several critical thinking models that have been researched and used successfully across the curriculum for all grade levels and are now being adapted to incorporate technology such as: Concept Attainment, Suchman Inquiry, Conflict Resolution, and the Memorymodel.

Introduction

The introduction of critical thinking skills into teaching repertoires is crucial to helping all students reach for excellence in the 21st century. However, if teachers are unprepared to teach those higher-level thinking models that invite active learning (beginning with the early grades and onward) students will not have the proficiencies and skills needed to enter a new and creative era. Furthermore, most assessment procedures for teachers require that higher-level thinking be included in their lessons. Teachers may fail to achieve excellence on their evaluations if critical thinking skills are absent in their classroom observations. In addition, testing for many state certification examinations also require preservice teachers to have a clear understanding of critical thinking and those methods needed to increase critical thought for their students. Teachers who understand and implement teaching models that provide students with the necessary opportunities to improve critical thinking skills will better prepare their students and better prepare themselves professionally as well.

The purpose of this paper is to present critical thinking models that have been researched and successfully used (Eggen *et al*, 2000; Gunter *et a*l, 1998; & Weil *et al*, 1998) and are now being adapted to incorporate technology to encompass a wider variety of resources and presentation tools. Teachers currently integrate technology into their lessons in many ways: student research projects, web page design, online projects, Internet lessons, and reports and presentations via slideshows such as PowerPoint, KidPix, and so forth. For teachers willing to do a bit of online research, multitudes of resources are available for Internet lesson plans and projects. Such lessons undoubtedly enhance thinking skills for the students. It is important, however, that teachers consciously plan and utilize teaching models specifically intended to further develop these skills. We have adapted several critical thinking models by incorporating technology (another often-required and highly desired element in current lesson planning). The results are that many critical thinking activities and ideas in the classroom can be improved and enhanced through the addition of multimedia sources, computer software, and Internet resources.

Concept Attainment

The first model adapted is the Concept Attainment model (Gunter *et al*, 1990). This model is extremely constructivist in nature and requires inductive thinking. Students must formulate their own definitions from positive and negative examples rather than gain the concept through a direct teaching manner. For a simple example, let us say that the concept to be taught is "transportation." Instead of a stated or written definition, students are first given the words "airplane" and "train" as examples, while they are given "book" as a non-example. The game continues, adding words such as "kayak" and "bicycle" in the examples column and "table" and "dress" in the non-examples column. Students and teacher add to the list of examples/non-examples until the students "get it" or the concept is "attained." Continuing, students define the concept and list all other examples they know. This example game is one for young children, but it is easy to see that by increasing the difficulty of the concept and adapting it to any subject area, this process can be used across all grade levels.

Preparing children from an early age to do this type of thinking is a skill that is most desired. Bruner (1977) explains that when students are allowed to "discover" the attributes of a category that is already formed in their minds (as opposed to simply being given a definition), they are engaging in higher level thinking. Eggen and Kauchak (1996) note that this "game" capitalizes on a "sense of the unknown." This triggers motivation through student arousal, defined as a "physical or psychological reaction to the environment" (p. 118).

Our preservice teachers and teachers in post-baccalaureate programs have described their success in teaching this model. Preservice teachers were given the format and rules for the model, and after practicing with each other in small groups, they were required to use the model in several lessons "out in the field." They reported excellent attention and results with their students at every age level and across all subjects.

The traditional use of this model is to list examples and non-examples of a concept orally or by writing them on the board. While this is an effective way to introduce the Concept Attainment model, we took it a step further and introduced pictorial representations of the concept. Most often this would involve cutting images out of magazines or copying them from books. This naturally led us to the addition of images found in various graphic art collections on the computer as well as searches on the Internet for specific pictures to use in the "game." When teaching our students this model at the university level, we then decided to move from the customary presentation of "holding up the pictures and walking around the room" to a more updated technological presentation using PowerPoint. This allowed a more interactive approach in a class of over 50 preservice teachers. As the images appeared on-screen everyone could easily see them and could make decisions as to whether the picture belonged in the example or non-example category. Using the Internet and graphics programs to gather images saved time, and presenting them on the large-screen monitor allowed everyone to see them at once. Finally, a larger range of examples can be quickly accessed on the Internet, allowing learners to see a greater variety. For instance, in social studies, if the concept is "mountains," a number of pictures of various types of mountains can be found, such as those with jagged peaks, those that have been weathered to smoothness, those formed from volcanoes, those covered with snow or jungle, and so forth. This is certainly a more optimal approach than simply writing a definition on the board or referencing a single picture in a book. This model is also very motivating for teachers, as they must also be constantly thinking and engaged with students during the "play." Imagine how much more thinking students do in this model than if they are simply given the definition of the concept followed by one or two examples.

The format we used for designing this was simple. A PowerPoint slide show was created with approximately 20 slides per concept. First a new picture is introduced and the class is told whether it is an example or a nonexample. The next slide shows the first picture placed in the correct category, example or nonexample. The third slide introduces a new picture by itself and students are told to consider in which category it might fit. The fourth slide shows the picture in the appropriate category. From this point on, a new picture is introduced on every other slide, followed by its correct placement among all of the previous pictures. The teacher uses his or her discretion to stop and ask students for other possible examples and when students are ready the teacher directs them to name the concept. The concept is written on the last slide of the show. Education students were then encouraged to select concepts for their own classrooms.

Suchman Inquiry

After successfully adapting the Concept Attainment model to include technology, we then examined several other higher-level thinking models usually presented in education classes. The Suchman

Inquiry model (Gunter *et al*, 1998) seemed to be another easily adaptable model to technology. This model requires that students actively use questioning that can be answered with only "yes" or "no" responses to find the answer to a situation or idea. It is very much like the game of "Twenty Questions." The teacher keeps an answer to him/herself ("an eggplant" for example), and students in a whole class situation ask questions ("Is it green? Is it round?) to narrow their thinking until they reach the correct answer. Of course, in upper level classrooms, the item/situation is more complicated. One difficulty in bringing children into a productive pattern of questioning is that they tend to "pot shot " their questions with no logic or organized system of thought. However, we sought to help students develop logical questioning patterns by utilizing a variation of this model adapted to technology.

While the whole-class version of this Inquiry model has its advantages, we felt that students could also improve their understanding of successful questioning patterns by playing a version of this "game" individually at the computer. We developed a flow-chart approach using HTML documents that provided options for narrowing the inquiry process. Students correctly navigated through a questioning pattern that logically led to the correct answer. In this way, they were forced to develop the questioning patterns we sought to build. For example, instead of young students guessing, "Is it a cabbage? Is it a carrot? Is it a potato?" we directed them to make choices, beginning with "Is it a large vegetable or a small vegetable?" followed by "Do we eat it cooked or not?" and "Is it red or not?" In the first step students make a guess among several broad choices, such as "Animal" "Mineral" "Vegetable." If they choose the wrong one a message flashes saying "Try again!" When they choose the correct picture, the next page offers several more choices such as "Has wings" "Has fur" "Has fins." Some choices are purposely written to distract students, for example after choosing "Has fur" another choice might be "Has gills." Clicking on this choice would reveal a silly picture of an imaginary creature and information about mammals explaining how they breathe. Students continue to navigate through the options until they reach the correct answer. With the use of technology, pictures and clip art can be used with or without text so that even nonreaders can engage in this activity. By navigating through the available pictures and options, students naturally begin to develop a sense of logic for the hierarchical arrangement of information. They are informally utilizing patterns of classification and organization to find the correct answer. It is believed that such learning enhances students' critical thinking processes.

Conflict Resolution

Another teaching model that requires critical thinking is that of Conflict Resolution (Weil *et al*, 1998). In this model students are divided into groups, given a topic to debate, and then guided through the process of gathering information. They list important issues or points to support their position and present their arguments to the other side. Naturally, this process requires students to use higher-level thinking skills (analysis, synthesis, and evaluation). For this model, we assigned a topic and divided students into groups. They gathered information to support their views by searching the Internet. Here they collected up-to-date information; they assessed the importance or popularity of the issue based on how many web pages or URLs were associated with it; and they collected data and made comparative judgements about their side of the debate after reviewing contrasting and supporting information. Current researchers encourage both cooperative groupings for upper level decision-making as well as the use of active technology in the classroom. The combination of the Conflict Resolution model with technology works best to provide these elements.

Memory Model

Another teaching model that is often recommended for higher levels of thinking is the Memory model (Weil *et al*, 1998). Students are asked to create a method to help them remember pieces of information. Quite often ridiculous association pictures are encouraged. For example, one might remember the hard minerals (quartz, beryl corundum, pyrite) by picturing a man in a car (for corundum) pulled up to a stand made of barrels (beryl) where he is purchasing a pie (pyrite) for a quarter (quartz).

Once more, we wished to involve a higher-level thinking activity (creating) through technology by having students use technology tools to design these ridiculous images. After students are given information, they are assigned to a computer as a small group and given the task of developing images that aid in memorization of the materials. For example, in a fourth grade science class studying groups of animals, students constructed a picture of military men marching along in rows ...but they had changed the heads to those of chimpanzees. This funny image illustrated that many chimpanzees are a "troop." Because the students generated the image themselves, the information is more meaningful and the memory association is likely to be much stronger than one shown to them by the teacher or some other source. The resources available to students on the computer offer many options for creating these "silly associations." Various graphics software can be used to create such images, and students who may not consider themselves artists are quite capable of producing unique and creative Memory models using technological resources.

Models of teaching "engage" students in higher-level thinking skills. In combining these various models with technology, both areas reach for excellence in the classroom. The value of these models of teaching is in their versatility. Teachers and students are able to employ these models in their own classrooms across subject areas to gain a much greater depth of understanding. Using technology as a tool, there are few limitations.

References

Bruner, J. S., Goodnow, & Austin, G. A. (1977). *A study of thinking.* New York: Robert E. Krieger Publishing, 1977.

Eggen, P. & Kauchak, D. (2000). *Strategies for teachers: Teaching content and critical thinking (4th Ed.)* Boston: Allyn and Bacon.

Gunter, M. A., Estes, T., & Schwab, J. H. (1998). *Instruction: A models approach* (3rd Ed.) Boston: Allyn and Bacon.

Weil, M., Calhoun, E., & Joyce, B. (1998). *Models of teaching* (6th Ed.) Boston: Allyn and Bacon.

How Can We Share Teaching Experiences in Different Countries through ICT?
- Concepts, Models and Propositions for Instructional Design and Analysis -

NISHINOSONO Haruo
Bukkyo University
Kyoto, Japan
E-mail: nisinohr@bukkyo-u.ac.jp

Abstract: Information and Communication Technology (ICT) enables pre-service and in-service teachers to share their experiences with one another while in different places. In other professions such as architecture, medicine, engineering, etc, specific symbols and models are used to express ideas and inventions. In the educational profession, there are no common symbols or models for teachers to express their ideas or to share experiences. This paper proposes a procedure of instructional synthesis and analysis, concepts for teaching, graphic representation of models and logical expression of instructional propositions to enable teachers to share their experiences through ICT.

Introduction

The new Information and Communication Technology (ICT) comes to teachers' desks and into classrooms enabling teachers and children to communicate each other from different places. The Internet, Cyberspace, Computer-Mediated Communication (Ryan 1992) and other concepts emerging from ICT are opening a new era in education on a worldwide scale, connecting people from different culture and countries. Computational communication technologies can play a vital role in the formation and successful operation of work-based learning communities, (Gordin, et al, 1996). Direct communication between children in foreign countries is spreading widely on the Internet despite their insufficient fluency in foreign languages. On the contrary, teachers cannot share their teaching experiences fully with others in a different culture or even within the same county due to the different frameworks used to express ideas and professional experiences. In professional areas such as engineering, medicine, music and other disciplines, members can express ideas, inventions and efforts in common international languages or symbols which are different from daily spoken languages. The teaching profession also needs an internationally understandable language to facilitate communication among teachers from different areas. This paper examines the possibility of sharing experiences among teachers in different workplaces through ICT.

A Framework for Generating Lesson Plans

In the case of conventional lesson plans, we start by describing educational aims and goals, specify instructional objectives and predict teaching and learning events which may occur in the classroom. In this procedure, we start from our educational intention and aims and move to instructional contents, teachers' actions, teaching materials, students' activities and other remarks. However, when we start to develop our ideas from educational norms, educational values differ from teacher to teacher, from school to school and from society to society. It is not difficult to express ideas as expectations and philosophical views in written statements, but it is hard to reach common agreement on educational goals and subsequent teaching, or to describe instructional events which will occur in the teaching process in advance. The same description of teachers' intentions and instructional objectives does not necessarily result in a similar learning or common visible student outcome due to differences in teachers' experiences. Teachers' intentions in written form are easy to read, but it is difficult to reach a common understanding and agreement, to modify the statements or replace them with other statements. On the other hand, when we start from students' activities, learning environment and a visible outcome, it is possible to describe them, to reach same agreement after critical discussion on visible events, to collaborate each other and work together to assess and support students' learning. In this context, we try to describe the physical and psychological environment needed for an effective learning by means of concepts, models and propositions.

There are two directions to follow regarding instructional design. One is to start from our specific intentions and aims for instruction, proceed to images, models and a rational sequence of teaching, develop a concrete lesson plan and conduct it in the actual classroom. Another direction is to start with a flexible instructional strategy, conduct the lesson, observe the teaching-learning process, analyze the behavior of teacher and students in the classroom and predict teaching-learning events for the next lesson. In the real teaching situation, both directions are taken into consideration to generate a lesson plan. The designing procedure proposed here consists of several components; images, codes/categories, synthetic and analytic concepts, empirical models and propositions, which form sequential steps shown in the following figure in English and Japanese.

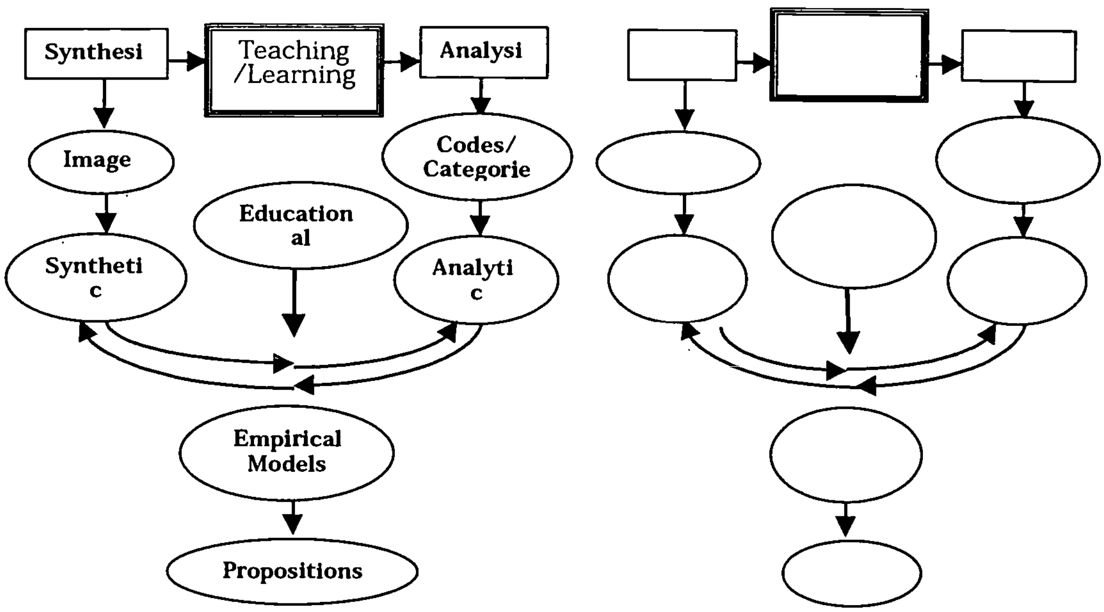


Figure 1. Procedure for instructional synthesis and analysis in English and Japanese

In other professions such as construction, architecture and chemistry, internationally understandable symbols, concepts and models are available to express ideas and facilitate communication. When we start to develop a lesson plan from a prescription of teaching-learning events, it is easy to select common symbols, concepts, models and propositions from a database of instructional materials and to describe the lesson plan with such elemental components. If a theoretical model applicable to the lesson is available, it is suitable to adopt it for effective teaching. Whole configuration of symbols, concepts, models and propositions constitutes a structured lesson plan and represents specific educational aims. Graphic representations of symbols and concepts for instructional design enable teachers to develop their ideas and revise them ceaselessly. These components stored in a database are applicable to other instructional situations to be utilized by other teachers. In this context, the components of symbols, concepts, models and propositions are free from any specific educational values.

The proposal described here aims to give in-service as well as pre-service teachers a new framework for preparing instructional plans in daily teaching. They construct a lesson plan by selecting images/models and propositions stored in computers. They can add and store new images, models and propositions at will. They start writing lesson plans in a very primitive way using pictorial images, proceed to the stage of keywords or concepts, represent ideas in graphic models and describe judgment and explanations in propositions. The revising procedure is vital for improving an initial lesson plan before experiencing the actual situation to be observed in the classroom and reaching a refined plan to enable realizing and assessing the intended instructional goals. New models and propositions will be created endlessly just like new car models emerge one after another. Components for the synthesis and analysis will emerge always and will be far too many to memorize.

In spite of such a multiplying of components, we can store these components and utilize them to express our experiences through ICT.

Appendix I shows a tree structure of variables and Appendix II PowerPoint slides representing a few examples of images and models. Appendix III represents examples of propositions. The method for instructional design is named a MACETO model representing meaning/values, activities/actions, concepts/contents, environment, tools/techniques and outcome. The following table shows pairs of components in both English and Japanese If a teacher describes a lesson plan in English, it will be simultaneously translated into Japanese, and vice versa.

English		Japanese
M: meaning/values	↔	M:
A: activities/actions	↔	A:
C: concepts/contents	↔	C:
E: environment	↔	E:
T: tools/techniques	↔	T:
O: outcomes	↔	O:

Table 1 Pairs of variables in English and Japanese

Each component has a number of items arranged in a tree-structure as shown in the following table. Other variables of MACETO are given in Appendix II.

English	Japanese
1. Meaning/Value	1.
1.1 Contextual/situational	1.1
1.1.1 Interest and inquiry into subject matter	1.1.1
1.1.2 Self-awareness	1.1.2
1.1.2.1 Self-recognition through learning and achievement	1.1.2.1
1.1.2.2 Social recognition through learning and achievement	1.1.2.2
1.1.2.3 Experiences in the past	1.1.2.3

Table 2 Some variables in tree structure

If there is a correspondence between English technical words and the foreign equivalents, teachers in different countries can exchange their experiences through English as an international language.

Implementation of the Procedure in Pre-service Education

The procedure of synthesis and analysis for instructional design was introduced during the course 'Instructional Technology' to confirm its applicability in pre-service education. Students in this course were requested to follow these instructions.

1. Describe an imaginary lesson to be developed in workgroups with images and models and elaborate it further according to their own ideas. Explain the rationale used to design such lesson referring to documents of instructional standards (issued by the Ministry of Education and/or Local Boards of Education in Japan) and literature on education.
2. Develop a lesson plan using images and models referring to the MACETO model to select synthetic and analytic concepts. The plan should be relevant to children's activities, learning situations and the educational environment.
3. Report their learning experiences during the course and evaluate them referring to the learning plan prepared at the beginning of the lessons.

At the beginning of every session, 'Topics for this week' and 'Learning plan of this week' were distributed. The class was conducted by showing the lesson plan of this course through PowerPoint presentation and handouts of 'Learning plan of this week' to be filled and submitted at the end of each session. Students worked hard collaboratively in groups as well as individually to accomplish their tasks.

Pre-service students have a long history of attending classes in elementary and secondary schools. They hold rigid and sustaining images on teaching from these experiences. At the initial stage of instructional designing, they tend to refer to such images and follow the experienced framework to generate lesson plan. It is hard for them to change the framework and accept new types of instruction not written in the form of a conventional lesson plans. New types of software such as PowerPoint enable us to express ideas in a flexible way and to revise them with ease. Repetitive revisions enable us to refine these ideas and making them relevant to instructional events observed in the real teaching situation. In this context, components used to describe a lesson plan should be flexible enough to change its structure at a very early stage of designing.

The following figure shows the image of a whole course representing students' ambiguous states at the beginning, gradual clarification, creative contribution, panel presentations and submission of final report. This image has an entirely similar structure and representation in English as in Japanese without any modification.

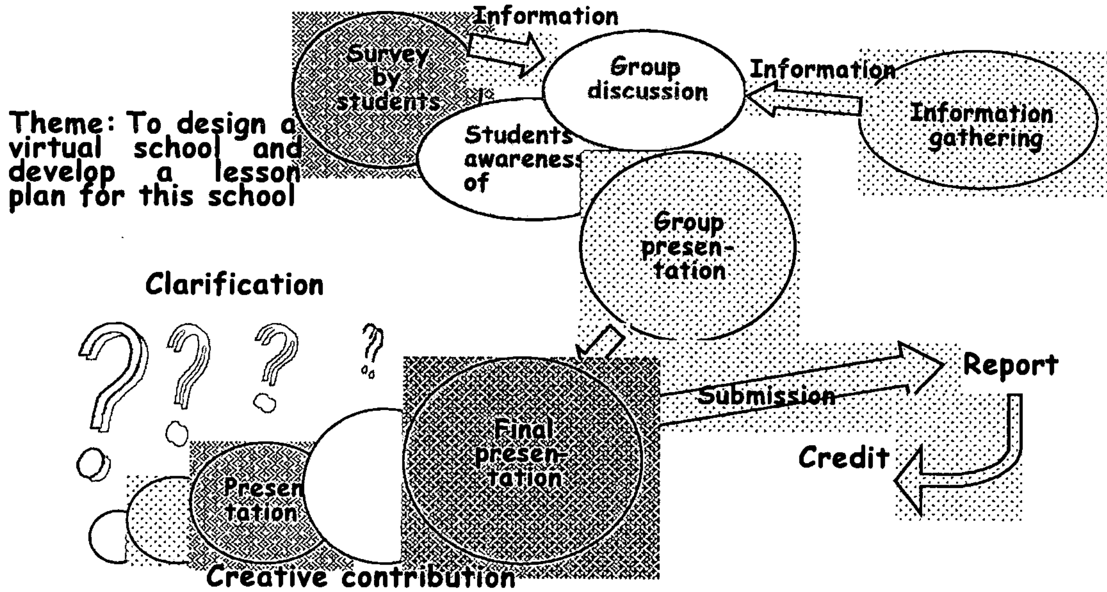


Figure 1. Instructional procedure of 'Instructional Technology' representing graphic images

Conclusion

The course can be described in the form of images, concepts, models and propositions that are exportable to professional teachers through the Internet or other communication technology, enabling them to share professional experiences on teaching. There is no clear cut distinctions between image and model, but the image represents teachers' ideas and expectations, while the model represents teaching and learning events observed in actual classes in the form of conceptual figures and concepts. Synthetic concepts are derived from images and are intention-oriented; analytic concepts come from an analysis of teaching/learning process and are behavior-oriented. There is no continuous or reliable procedure for converting a lesson plan from concept to empirical model. This requires intuitive ideas and back and forth repetition to refine the lesson plan. If we succeed in standardizing symbols and concepts internationally, it is possible to share our teaching experiences in other countries.

Teachers try to predict learners' activities in a class, develop instructional materials, provide an interesting learning environment, select tools for effective learning, support students' learning and then expect to achieve their instructional goals. There may be various procedures to develop instructional plans, teaching in classroom and evaluation after teaching. This developing procedure should be described in internationally understandable symbols and languages to enable teachers to share their experiences with people from different cultural backgrounds.

Researchers propose models to apply scientific knowledge to solve problems in teaching/learning, and teachers adopt them to improve their teaching. Many models have been proposed to make this procedure rational and effective so as to achieve predetermined educational goals and instructional objectives. However, the unilateral application from theory to practice is not always effective in the complicated real situation. Teachers have to develop their own framework to confirm applicability of their knowledge accumulated from previous experiences. In this circumstance, they have to equip themselves with the competency to originate practical knowledge suitable to solve problems tackled in their work place. Teachers share a strong feelings of the ineffectiveness of instructional theory as taught in teacher education schools, especially, regarding pre-service education. Experienced teachers nominated by the Local Board of Education in each school district supervise novice teachers and give them advice on teaching during the first year of their professional careers. Nevertheless, novice teachers heavily rely on their individual experiences but share them with colleagues only occasionally. This procedure reproduces empirical consistency and professional continuity in successive generations among teachers. It is hard to change the framework of writing lesson plans in the conventional style or to introduce a new concept of instruction. However, it is indispensable to develop a new style of lesson plan that enables teachers to express ideas in very primitive state and revise them repeatedly in order to create a refined lesson plan.

References

Nishinosono, Haruo (2000): 'Integration of Working, Learning and Researching in Teacher Education', paper presented at SITE2000 held in San Diego, USA

Ryan, R.(1992): 'International connectivity: A survey of attitudes about cultural and national differences encountered in computer-mediated communication. *The Online Chronicle of Distance Education and Communication.*

Bump, W et al. (1999): 'Virtual Teams in the Classroom' Proceeding of SITE1999,

Gordin, D.N., Gomez, L.M., Pea, R.D., Fishman, B.J. (1996): 'Using the World Wide Web to Build Learning Communities in K-12' Journal of Computer-Mediated Communication. Vol. 2. No. 3

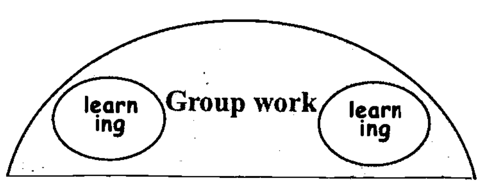
Appendix I : Tentative list of concepts/keywords used to design lessons (about 400 items are stored)

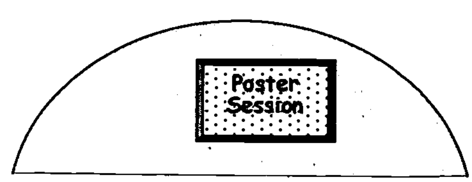
1. Meaning/Value

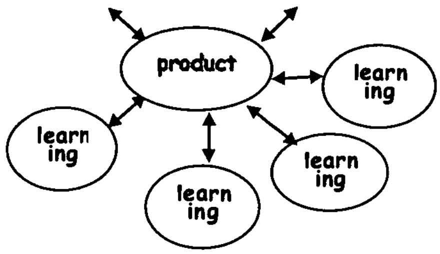
- 1.1 Contextual/situational
  - 1.1.1 Interest and inquiry into subject matter
  - 1.1.2 Self-awareness
    - 1.1.2.1 Self-recognition through learning and achievement
    - 1.1.2.2 Social recognition through learning and achievement
    - 1.1.2.3 Experiences in the past
- 1.2 Awareness of problems
  - 1.2.1 Social problem: economy, environment, social welfare, information, health
  - 1.2.2 International problem: peace, poverty, development, education
  - 1.2.3 Community problems
  - 1.2.4 Personal problems
- 1.3 Preparation for future
  - 1.3.1 Preparation for entrance examination
  - 1.3.2 Acquisition of certificates
  - 1.3.3 Preparation for specific profession
- 1.4 Self cultivation: (details omitted)

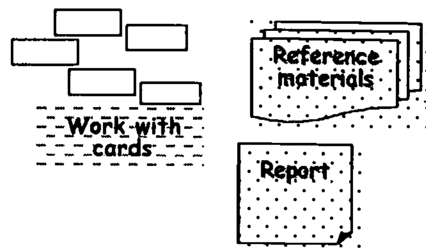
2. **Activities & Actions:** (details omitted)
3. **Contents/Concepts:** (details omitted)
4. **Environment:** (details omitted)
5. **Tools/Techniques:** (details omitted)
6. **Outcome:** (details omitted)

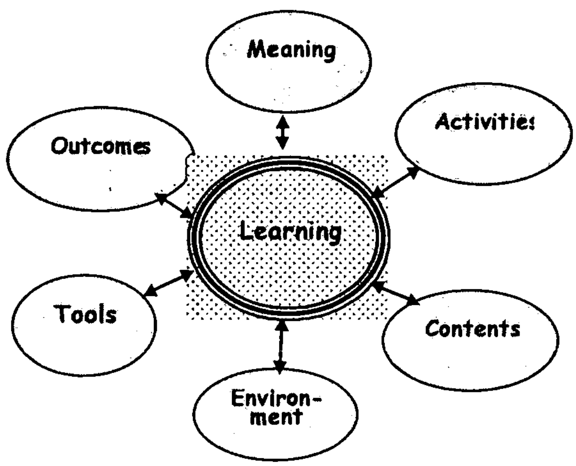
Appendix II : Images and models for instructional designing using PowerPoint

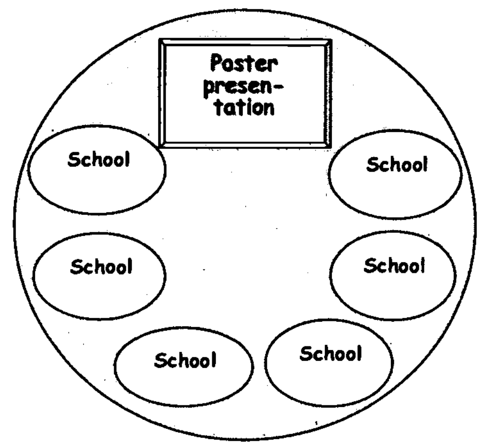












Appendix III : List of instructional propositions (about 60 propositions are stored)

It is possible to develop students' competency for instructional designing through a sequence of training sessions to form pictorial images, key concepts, graphic representations, models and propositions.

Alternative strategies regarding degree of freedom in learning

1. When we increase the degree of freedom in learning and give more initiative to students, learning results in a wide range from excellent to poor outcomes in quality and quantity.
2. When we decrease the degree of freedom in learning and give less initiative to students, learning results in more reliable but a mediocre outcome of less quality.

When we feel confident by a gradual formation of an outcome in ourselves, we realize the meaning of learning.

There are two possible ways to proceed to forming empirical models.

1. Students observe recorded teaching, take notes and analyze them. After this analysis, they try to describe the process in keywords and put them in a graphic representation.
2. Students repeat describing their own experiences in keywords and show activities in a graphic representation, and succeed to express relationship and procedure in a model.

To recover autonomous learning, it is effective to concentrate on developing a lesson plan dominated by activities, rather than one dominated by contents of the subject matter.

To manage a large group of students to learn autonomously, it is effective to form groups or clusters of groups, to encourage active participation and let them recognize their responsibility for autonomous learning.

Continuous Zoom applied to texts

Francisco Carlos de Mattos Brito Oliveira
unimedfor-fran@secrel.com.br
Computer Science Department
Universidade de Fortaleza
Brazil

José Bezerra da Silva Filho
Computer Science Department
Universidade de Fortaleza
Brazil
bezerra@banconordeste.gov.br

Abstract: The amount of text that we are required to read in the present days is amazing. One of the reasons for a poor performance of electronic text systems may result from the fact of users to avoid reading the whole text and make decisions mostly based on their headings (Fox, 1992). Aiming to minimize this problem, we have developed a computer-based tool for continuous zoom interfaces (graphic interface that allows a text to be continuously magnified of decreased). Prior to displaying the text, this tool performs a previous analysis of the text, taking into account its grammatical classification. Then, the text is displayed in its most condensed format and lowest zoom level, where only the most important words are shown. For that, the tool uses the artificial intelligence technique (pattern matching). The text is then displayed in its most condensed format and lowest zoom level. As zoom increases, more elements of the text become visible. It should be highlighted that the tool deals with language "traps" and whenever the pattern recognizer fails to classify a certain word, it makes that word visible in its most reduced zoom format.

Introduction

One of the most important aspects of an eletronic document reading is the user interface (Knight 1999). Zoomable User Interfaces are a kind of information visualization (Benderson 2000). *Ken Perlin* of New York University defined the concept of *Zoomable* surface *(Perlin 1993). Ben Benderson* designed and implemented *PAD++* tool, which in Maryland University gave rise to *Jazz (Benderson 2000)*, which in turn provided a *Java API to* develop the *Zoomable User Interfaces (ZUI)*. When working with version 1.0 of *Jazz*, we had to made several extensions to its original format.

The objective of this work is to contribute to reduce the effort to read general electronic documents; to produce and test new ways to analyze texts and identify patterns of sentence constructions, as well as to classify grammatically each of their components. One of the most important questions about electronic documents lies in the research of their usability, which advantages will be provided and how they will be *(Maes 1992)*.

Pattern Recognition

One critical natural language processing task is that of determining the syntatic structure of a sentence, also known as parsing. Correct parsing of unrestricted text is and exceedingly dificult task, due to the ambiguities in part of speech (noun, verb and so on) and structure (Goldstein 1999).Natural languages constitute a number of *traps* for any pattern recognition tool; for instance, a Word may have several meanings under diverse contexts. Such meanings could lead to a different grammatical class. In English, the word *Kiss* analyzed separately can be either a verb or a noun. The final definition will depend on the context it is employed. In other words, almost always it is necessary to analyze a whole sentence to be able to define the grammatical class of each of its components. Sometimes, the definition of a particular element of the text can influence that of another text. This problem may lead the inference algorithm to an endless *loop* condition. In this case, after a certain number of attempts, our program ends by classifying the word as "*indefinite classification*". This special class is given a differentiated treatment. Should a second element, in order to obtain its classification, need the classification of another element in the same sentence and the latter is defined as "*indefinite classification*", the former also assumes this condition. Therefore, as shown below, at constructing our patterns, we should be more economic in generic expressions, that is, we should use to the extent possible rules that should not depend on others. The more *indefinite classification* we have, the poorer the results obtained. There is also the problem of verb conjugations. Here, the existence of a rule to deal with them is indispensable. Otherwise, we would fall into the "*indefinite classification*" condition. Word classifications may be constant, such as adjective, adverb, definite article, verb, etc., or indefinite.

Continuous Zoom Interface

Of all extensions, that dealing with the management of the zoom stands out. Since we are working with text, each element will be assigned its particular zoom control. This is due to the fact that we will control the exact time when the element (text) will be visible to the final user. That time basically depends on both its *classification* defined as above and the text style.
Style, as briefly mentioned in the introduction, may vary greatly according to the purposes for which the text was produced. Documents can differ along several dimensions, such as length, writing style and lexical usage. Thus, specific classifications and expressions assume diverse importance in different *styles*.

To address this issue, the program will be provided with a zoom *dictionary* specific for each *style*. Note that while the *pattern dictionary* defined in the previous section is generic for a given natural language, our Zoom *dictionary* is more specific. This way, the program can work with any combination of both the dictionaries predefined by the final user.

Conclusions

Initial tests have proved promising. It was clearly confirmed that the law for formation of rules for the natural language dictionary are sufficiently consistent to express any set of <Exception1>, <Exception2>, <ExceptionN>, ... <Rule> for word classification in Portuguese language. We have also succeeded in introducing Continuous Zoom resources to the list of computer resources that help online reading.

References:

Perlin, K.M. & Fox, D. (1993). Pad: An Alternative Approach to the Computer Interface. *In proceedings of Computer Graphics* (SIGGRAPH 93) New York, NY: ACM Press , pp. 57-64.

Benderson, B.B., Meyer, J. & Good, Lance (200*). Jazz: An Extensible Zoomable User Interface Graphics Toolkit in Java* : [Web Page] URL : http://www.cs.umd.edu/hcil/jazz/learn/papers

Muter, P. , Latremouille, S.A., Treunet, W.C., and Beam *(1992)*. P. *Extended reading of continuous text on television screens. Human Factors 501-508*

Maes, °A., Goutier °S., (1992) *Online Reading and Offline Tradition*. Sigdoc'92.

Knight, Kevin ; *Commun. ACM* 42, 11 (Nov. 1999), Pages 58 – 61

Goldstein ,Jade , Kantrowitz, Mark, Mittal, Vibhu and Carbonell, Jaime; *Proceedings of the 22nd annual international ACM SIGIR conference on Research and development in information retrieval*, 1999, Pages 121 - 128

Cognitive Design of Instructional Databases

Michael S. Pilant
Department of Mathematics and Computer Science
Texas A&M University
mpilant@math.tamu.edu

Robert J. Hall
Department of Educational Psychology
Texas A&M University
bobhall@tamu.edu

R. Arlen Strader
Department of Educational Psychology
Texas A&M University
strader@tamu.edu

Abstract: One of the fundamental problems in distance delivery of educational content is to determine the amount of learning that is taking place. Merely delivering content is not enough - some form of assessment (at a distance) is necessary. Traditional methods for assessing students' understanding of course content (e.g. multiple choice problems short answer problems) can be enhanced and supplemented through the use of computers and information technology. Timing and tracking information collected in real time, coupled with information from interactive, specially designed Java applets and scripts, can be used to supplement traditional assessment methods by capturing information about students' decision-making processes. This paper describes how to develop databases and assessment methods based on cognitive models of information processing, to better interpret performance data and more effectively deliver instruction at a distance.

Cognitive Foundations

To address issues related to the diversity of educational problems and lack of consistency in instructional approaches, the field of education is moving to models of cognition based on logical-mathematical principles (Anderson et al. 1998). Using models that can be implemented and tested on modern computer systems, performance can be analyzed rigorously and compared to experimental observations. This offers some defense against recent criticisms of poor scientific practice (Labaree, 1998). We feel that theories of information processing (Anderson 1996), cognition (Anderson et al. 1998), knowledge representation (Sowa 2000) and database design have progressed far enough to enable one to design, analyze and test the effectiveness of instructional delivery systems. The particular systems we have in mind are web-based, and designed for use both in-class and at a distance.

Borrowing from classical Philosophy, "ontology" is defined as an explicit formal specification of how to represent objects, concepts and other entities that are assumed to exist in some area of interest and the relationships that hold among them (Gruber 1995, Guarino 1998, Guarino et al. 2000, Stutt 1997). "Knowledge Engineering" is a relatively new discipline that has arisen to transfer human knowledge and expertise into computer systems (Sowa 2000). The goal is to build Knowledge Based Systems (KBS), systems that store and use very large amounts of information about an application (or knowledge domain) and serve as an intelligent assistant rather than an expert system. An example of this has been the work done in the area of Intelligent Tutoring Systems (ITS). There is an enormous body of literature regarding the construction and design of KBS to which we refer the interested reader (Boose et al. 1988, Gauthier et al. 2000, Ringland et al. 1988).

Rather than pursue an abstract theoretical approach, we will focus on a concrete example. Suppose we wish to teach methods of integration to students in Mathematics. The identified knowledge domain within mathematics would be integration methods. From the standpoint of student comprehension, however, integration methods is too broad a topic to teach, thus, the knowledge domain would be broken down into sub-domains or components that restrict both the teaching and learning focus. In this example, our target sub-domain might be integration of functions of a single variable. Subsequently, we may recognize that the sub-domain itself is too broad, so instructional focus may shift to a single objective, for example, integration by parts. Although integration by parts might also be considered a sub-domain, we refer to it as an *objective*, and view the sub-domain of single variable function integration as being covered by multiple objectives as depicted in Figure 1.

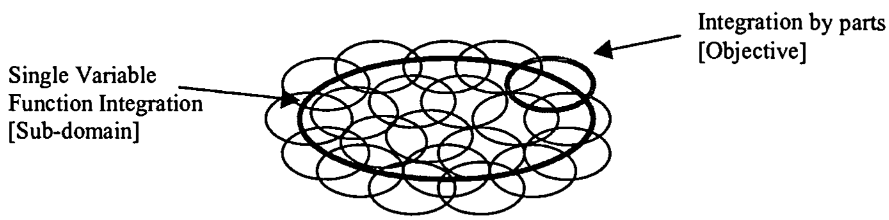


Figure 1: Decomposition of a knowledge sub-domain into overlapping objectives

Once we have identified a specific objective, we must come up with a suitable knowledge representation. We follow the general information processing approach (Anderson et al. 1998) by identifying three types of knowledge: declarative, procedural and strategic. Roughly speaking:

Declarative knowledge consists of basic factual knowledge; for example, formulae or rules of a restricted form (such as derivatives of polynomials, trigonometric and exponential functions).
Procedural knowledge consists of algorithms; for example, changes of variable or trigonometric substitution.
Strategic knowledge consists of information about alternate ways to perform sequences of actions, usually in the course of problem solving; for example, identifying groupings of terms or reducing terms to standard forms.

The knowledge needed to accomplish the objective (in this case, integration by parts methods for functions of a single variable) is then partitioned into declarative, procedural and strategic knowledge. This process is analogous to the Cognitive Task Analysis done when building an ITS (see Figure 2).

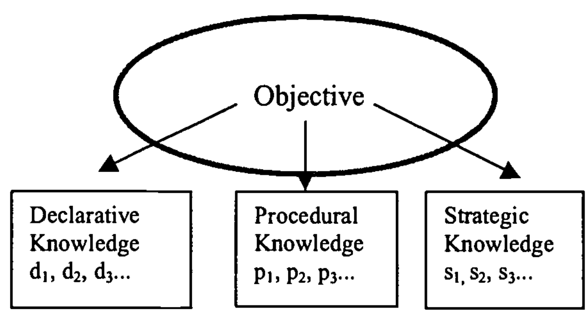


Figure 2: Decomposing an objective into declarative, procedural, and strategic knowledge components.

This decomposition is usually performed by a Subject Matter Expert (SME), someone who is knowledgeable about the sub-domain and the relationships among the knowledge components. The decomposition is not necessarily complete, and should be extensible to allow for improving the model.

One of the problems encountered in knowledge engineering is designing systems that are independent of the knowledge domain ("re-usability"). We need to design a structure that is flexible enough to capture relationships but allows for variable content. We accomplish this through a particular database "schema."

Database Design

The knowledge representation within the database includes both the content and meta-data about the content. The data are all listed within a single table that includes the name and description of the datum, the data type (e.g. declaration or procedure or strategy) a list of dependent data, and a list of questions that test a student's knowledge of the content area. These data **content** and the **relationships** between the data are dependent on the particular knowledge domain (sub-domain or objective), but the **structure** of the database is independent of any specific content area.

Figure 3 illustrates the inter-relationships between the declarative, procedural, and strategic knowledge associated with a specific objective.

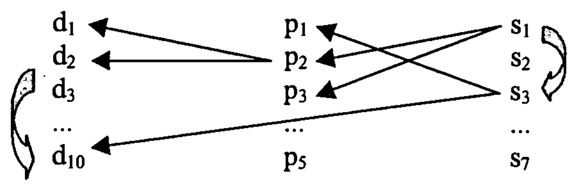


Figure 3: Linkages between declarative, procedural and strategic knowledge.

In this example, strategy 1 depends on strategy 3 and procedures 2 and 3. Strategy 3 depends on declaration 10 and procedure 1. Procedure 2 depends on declaration 1 and declaration 2. Declaration 2 depends on declaration 10, etc. An important constraint to these relationships is that no circular references should occur. A second constraint is that no lower order meta-datum should depend upon a higher order meta-datum. That is, a declaration cannot depend upon a procedure and a procedure cannot depend upon a strategy. All other inter-relationships would be legitimate.

The final piece of the knowledge representation is the questions. The database stores the questions and their properties within a single table. The primary fields are:

question id, question type, question text, variable definitions, stems, solution, explanation, keywords, estimated time for completion, estimated difficulty, comments, evaluation method, hints

It is important to note that because the structure of the database and tables are not dependent on the particular knowledge domain (or sub-domain or objective) under consideration, it is possible to design software tools and interfaces which help build a knowledge representation as part of an iterative process.

Assessment

Up to this point, this type of conceptual modeling or knowledge representation can be done without any instructional goals in mind. In order to test whether learning is taking place, a set of questions is created which address the particular objective. These questions act as "probes" which help build a model of the student's understanding. The simplest questions merely test the basic factual knowledge (declarative knowledge) through true-false or multiple-choice questions. Single-step procedural knowledge can be tested through multiple-choice or short answer questions. More complicated multi-step procedural knowledge can be tested through short-answer, multiple-choice or workout problems. Strategic knowledge can be probed through workout problems that are skill based.

One of the benefits of the question database is that during the process of adding questions to the database (e.g. by an instructor, through an authoring tool) it may become apparent that some type of knowledge has not been included (e.g. a basic differentiation rule has been omitted). This provides an opportunity for the knowledgebases to be updated or edited. The author benefits from greater awareness of the underlying knowledge representation.

Although this seems like a complicated structure, it is invisible to the student. When a question is presented to the student, it is in the form of standard HTML (which may include graphics, multimedia, forms, scripts or applets!) The student's response is then recorded and compared to the solution, using the appropriate evaluation method. This includes the following:

Strict numerical equality or equivalence ("5/2" or "2.5" compared to "2.50")
Numerical equality within a prescribed tolerance (e.g. "3.14" compared to "3.14159")
Strict string equality, ignoring case (e.g. "Parabola" compared to "parabola")
Symbolic equivalence (e.g. "$\sin^2 (ax)+\cos^2 (ax)$" compared to "1")

The evaluation method then returns a measure of student performance (which can then be weighted by difficulty, elapsed time, number of hints received, etc.)

Pre-tests can be given to provide information on the students understanding of declarative and procedural knowledge, prior to instruction. Post-tests can be given to test strategic understanding after instruction. Tests for "retention" are also useful to see how much knowledge has been "proceduralized" and how much is in long-term memory versus short-term memory.

Based on the performance metrics returned for each question, and because of the underlying database structure of the questions, an analysis can be performed for each student. For example, suppose 10 questions on integration by parts were given, of these 5 questions were missed. Suppose further that each question that was missed involved differentiation of trigonometric functions (one element of the declarative knowledgebase). If none of the questions that were answered correctly involved differentiation of trigonometric functions (only polynomials or exponentials), a recommendation would be given to the student to work on a module involving differentiation of trigonometric functions. This recommendation could be in the form of a diagnostic report to the student or possibly by forcing the student to complete (successfully) a module on trigonometric differentiation prior to resuming instruction. In either case, we are following the general paradigm of "assessment inform instruction."

Assessment takes place continually, in conjunction with content delivery. Assessment may be formal (pre-test or post-test), it may be graded or non-graded (for use in tutorials or practice tests). Usually it will occur informally as part of the feedback provided by the student back to the instructional delivery system.

Implementation

The assessment components described in this paper have been used for several semesters in two Educational Psychology Statistics courses and an analysis of the effectiveness of this system can be found in (Hall et al. 1999, Pilant et al. 2000). In the Hall, et al. (1999) study, 41 graduate and undergraduate students enrolled an applied statistics course self-selected into one of three groups. Group 1 took chapter pretests online and printed out results. Subjects in group 2 printed copies of the pretests but did not take tests online. Group 3 did not access the pretests. Pretests for exams 1 and 3 were made available through a class. Groups could not be distinguished, *a priori*, based on demographic data, self-reported motivation, time spent studying, class goals, or math skill scores. There were, however, statistically significant differences among groups on exam performance, favoring students in the online-pretest group.

Currently, the authors have developed and are testing a limited version of the assessment tool outlined in this paper. A series of linked components make up the online testing instrument. The first is an "administration" or "authoring" component that is web-based and password protected. In this environment, an instructor can build or modify questions and exams and create classroom databases. A second component provides students access to the actual interactive testing. Finally, the third part is the database itself, currently *Microsoft ® Access,* which is completely hidden behind a web front-end (for portability).

One of the unusual features programmed into the online testing tool is the ability to capture information related to motivation through use of sliders that measure student's "familiarity" with content objectives prior to testing, and "confidence" about response accuracy as the test proceeds. This provides students and instructors with information regarding depth of preparation, level of skill, and degree of uncertainty. Each question is timed transparently to the student. The format of the questions is unstructured - any valid HTML code can be included. Question types currently supported are true/false, multiple choice, short workout, and detailed workout. Questions can be interactive (through embedded *JAVA* applets), and can contain graphics and multi-media. Responses are recorded and a printable summary of the students' work - including computer-graded questions (true/false and multiple choice), explanations, time spent answering individual questions, reported confidence and help, and reported familiarity with learning objectives - can be returned to students when all questions have been answered. In the pretest mode, students review one question at a time and once questions are submitted, they cannot be revisited. If there is not enough time to complete a pretest, a bookmark feature allows a student to return to the test at the point where he/she stopped.

Using this tool, instructors can maintain question, exam, student, and class databases, and link questions to categories and/or objectives to individual questions. The authoring tool is completely accessible through the Web (although it is password protected for security reasons). In not providing immediate feedback to students regarding the correctness of their responses, students experience exam level questions in a context that mimics in-class exams. When the pretest is completed, students are provided with their test results and with explanations for each of the questions. These reports are intended to be used as study guides and include detailed explanations for each question with embedded links to tutorial material, detailed workouts, and interactive graphics.

A more recent version of the online testing program is being used in actual classroom testing. This version features a random question function so that students sitting next to one another are not working on the same question at the same time and allows students to review their exams (all or targeted questions) at the end of the test before submission, to skip questions that they want to return to later, and to justify responses to multiple-choice or true-false questions. All question types are supported and graphics and applets can be integrated into the questions.

Conclusions

In this paper, we have outlined a methodology that a significant portion of the system is independent of the knowledge domain - specifically, the database structure (schema), authoring tools and HTML delivery system. The main features of this process are:

1) Identify a set of objectives that cover the knowledge (sub) domain
2) For each objective, identify an initial set of:
   a) Declarative Knowledge
   b) Procedural Knowledge
   c) Strategic Knowledge
3) Create a question database

The main driving mechanism is the creation of a question database that dynamically updates the declarative, procedural and strategic knowledgebases. This is accomplished through an interactive HTML based authoring tool. One of the side benefits is the explicit awareness of the underlying knowledge structure (ontology) on the part of the instructor.

Questions may be formulated using any valid HTML code, which allows the inclusion of JavaScript and Java applets. Java Applets allow much more interactivity, and provide the opportunity for skills-based testing. Recording time-on-task, either through the applets or through JavaScript, provides additional insight into the learning patterns of individual users.

Finally, it should be emphasized that this type of knowledge engineering approach works in the field, having been tested in two different Educational Psychology courses during the last two years.

Acknowledgements

This research was supported in part by a grant from Brooks/Cole Publishing, Inc. We are grateful for the support of our respective departments, as well as all the instructors and students who have participated in the development of the assessment tools described in this paper.

References

Anderson, J. (1996). *The Architecture of Cognition.* Mahwah, NJ. Lawrence Erlbaum Associates, Inc.

Anderson, J. & Lebiere, C. (1998). *The Atomic Components of Thought.* Mahwah, NJ. Lawrence Erlbaum Associates, Inc.

Boose, J.H. and Gaines, B.R. (1988). *Knowledge Acquisition Tools for Expert Systems.* Vols. 1, 2. Academic Press, 1988

Gauthier, G., Frasson, C. & Vanlehn, K. (2000). *Intelligent Tutoring Systems*, Springer-Verlag, vol. 1839, *Lecture Notes in Computer Science.*

Gruber, T. (1995). Toward Principles for the Design of Ontologies Used for Knowledge Sharing. *International Journal of Human and Computer Studies*, 43 (5/6), 907-928.

Guarino, N. & Welty, C. (2000). A Formal Ontology of Properties. In Benjamins, R., Gomez-Perez, A., Guarino, N. and Uschold, M. (Eds.), *Proceedings of the ECAI-2000 Workshop on Applications of Ontologies and Problem-Solving Methods.*

Guarino, N. (1998). Formal Ontology and Information Systems. In Guarino, N. (Ed.), *Formal Ontology in Information Systems. Proceedings of FOIS'98* (pp. 3-15). Amsterdam, IOS Press.

Hall, R., Pilant, M, Strader, R. (1999), The Impact of Web-Based Instruction on Performance in an Applied Statistics Course, (pp. 261-266), *Proceedings of International Conference on Mathematics/Science Education and Technology*

Pilant, M., Hall, R., Epstein, J., Hester, Y., & Strader, R., (2000), Issues Involved in a Large Scale Implementation of Web-Based Mathematics Instruction, (pp. 334-339), *Proceedings of International Conference on Mathematics/Science Education and Technology*

Labaree, D. F. (1998). Educational researchers: Living with a lesser form of knowledge. *Educational Researcher*, 27(8), 4-14.

Ringland, G.A. and Duce, D.A. *Approaches to Knowledge Representation.* Research Studies Press, 1988.

Sowa, J. (2000), Knowledge Representation: Logical, Philosophical and Computational Foundations, Brooks/Cole

Stutt, A., (1997), Knowledge Engineering Ontologies, Constructivist Epistemology, Computer Rhetoric: A *Trivium* for the Knowledge Age. (pp. 1914-1919) *Proceedings of Ed-Media 97 and Ed-Telecom 97*

URLs

Advanced Computer Tutoring Project, ACT Research Group, Carnegie Mellon University, Pittsburgh PA http://domino.psy.cmu.edu/ACT/awpt/

OnlineTesting Project, TexasA&M University, College Station, TX http://onlinetesting.tamu.edu/

Ontolingua, Knowledge Systems Laboratory, Stanford University, Stanford CA
http:// http://www-ksl-svc.stanford.edu:5915/

A "fearless approach" to technology integration in the elementary classroom

Joyce Pittman, Ph.D.
Joyce.pittman@uc.edu
Teachers College of Education
University of Cincinnati
Cincinnati, OH

Sheila Seitz, MS. Ed.
Teachers College of Education
University of Cincinnati
Cincinnati, OH
Sksfoley@yahoo.com

Abstract: Taking on this challenge, a professor and graduate student at a major urban university with over 40,000 students and 600 preservice teachers restructured a traditional instructional technology course and piloted a constructivist model without changing the content. The mission was to train teachers to utilize current technologies in the classroom effectively through a two-credit course. During this project, the researchers tracked the progress of both the course and the success of the students. Multiple variables merged to create a meaningful experience for preservice teachers about to embark on their teaching career. Approximately twenty-one technology skills were assessed using a pre-post self-assessment tool. All 26 teachers in the sample reported a significant increase in their technology skills by the end of a 10-week restructured instructional technology course for elementary teachers (ISTE, 1999).

Introduction

The overriding purpose of the course was not have students become "technology proficient" in every application, but that preservice teachers (students) in the class develop a "fearless approach" to learning new technology. Objectives focused on the development of skills necessary to model lifelong independent learning. To achieve this, the class setting modeled both constructivist and behaviorist perspectives. Demonstration of technology integration into traditional transmission and constructivist-compatible instruction was presented. Students observed the differences in learning with technology within both types of pedagogy.

Approach

Topics covered in the course were flexible and evolving, centering on the needs of the learners (students). Relevant learning theories discussed included a diverse segment of scholars: Piaget, Vygotsky, Skinner, Papert, Gagne, H. Gardner, Bloom, Bruner, and Dale (Cone of Experience.) Students engaged in on-line discussions as well as essay writings in studying the learning experience.

Instructors placed special emphasis on lesson planning analysis, particularly in the areas of objectives and assessment. Students utilized the learning plan model called "ASSURE" to examine effective planning for integration of technology. Class members created rubrics and utilized them to evaluate various assignments to include the final presentation.

Instructional Design

In designing the course content, both students' interest and newly implemented standards became important. The preservice teachers in this course will soon be subject to technology standards being implemented by the state of Ohio and based on the nationally developed standards by ISTE (International Society for Technology in Education). This course attempted to instill the confidence these future teachers will need to meet the new standards.

Participants

The convenience sample for this exploratory analysis of an isolated instructional technology class for elementary preservice teachers included 26 preservice teachers. The teachers were classified as interns or teaching assistants who were in their 4th and 5th year of teaching preparation. Class members completed projects and presented their authentic learning in using technology to enhance the instructional process and student understanding over a 10-week period. Thus, sharing of multiple examples that demonstrated "appropriate use of technology" occurred. Students engaged in software evaluation, multimedia production, and portfolio presentation. A particular assignment involving action research by the students challenged them to observe and interview a classroom teacher on the topic of technology integration. Results of this particular learning experienced varied as much as the use of technology in today's classroom. It became a very telling event for all. Figure 1 provides a description of the course structure, instructional approach, activities, assessments, and outcomes.

Course Description: Instructional Technology for Elementary Teachers:

This is a two-credit course offered on foundation technology skills, pedagogy, and instructional designs, which support learning and teaching with technology in elementary learning communities. The course structure and content are intended to address educational reform and basic technology foundation skills. (National Commission for the Accreditation of Teacher Education and the International Society for Technology Education (NCATE/ISTE; Available: iste.org)

Prerequisites: Recommended for 4th and 5th Year Preservice Teachers and a Basic Computer Literacy

Readings:
Textbook required: Heinich, R., Molenda, M., Russell, J., & Smaldino, S. (1998). *Instructional media and technologies for learning* (6th ed.). Upper Saddle River, NJ:Prentice Hall

All textbook reading should be completed before class. After reading, complete a summary KWL reflection for class discussion and your portfolio. Summaries must be "word processed".

Other required reading and Internet Web-sites

Paper #1: Papert readings are available by querying the Search Engine Lycos using the essential phrase, "The Children's Machine by Seymour Papert". You will find over 100 websites to choose from. Write a report based on the sites that describes Papert's beliefs about technology in education. Compare and contrast his views with your perspective as a future teacher. Due in the portfolio at the end of the term. (E.g. Papert, S. (1982). *Mindstorms: Children, computers, and powerful ideas*. New York: Basic Books. Paper due in portfolios at the end of the term, double-spaced, references, and cover sheet.

Websites to visit:
Software Review Projects, Supportive Online Lessons, and Ohio Technology Standards for Students http://www.ohioschoolnet.k12.oh.us/home/contents.asp
Tutorials: http://microsoft.com/education/tutorial/classroom/default.asp
Kathy Shrock's Guide for Educators (http://www.capecod.net/schrockguide/)

Overview:
The course will incorporate activities connected to the *Ohio SchoolNet Learner Technology Profiles* sites and other Internet resources that were created to guide teachers as they integrate technology into the curriculum. The course is organized around the six categories:

(1) Basic operations and concepts
(2) Social, ethical, and human issues
(3) Technology productivity tools

(4) Technology communication tools
(5) Technology research tools
(6) Technology problem-solving and decision-making tools.

Instructional Design:
The course structure is based on learner-centered theoretical perspectives. This approach is supported by multiple instructional strategies to encourage a constructivist learning environment. Technology skills learn technology skills by engaging in integrated and collaborative activities. The activities are intended to demonstrate ways in which technology tools can be effectively integrated into the instructional environment to encourage collaboration, exploration, and/or the development of problem solving skills.

Coursework:

The modular units incorporate discussion, project-based, and exploratory approaches throughout the learning and instructional process. A few specific technologies include: PowerPoint, HyperStudio*, Netscape Communicator, Excel, Internet/WWW, basic Windows computing skills, and reviews of educational software (See SchoolNet Software Review Project at: http://www.ohioschoolnet.k12.oh.us/home/contents.asp

Weekly Assignments

Grading Criteria

Assessment and Evaluation: Student performance is based on individual and team projects. The final grade will be based on all completed papers, projects, comprehensive portfolio, and an oral presentation. The final grade will be based on a 200 point system (100 points for class assignments and 100 points for a final project/portfolio). See grading scale following assignments.

All assignments will be graded based on an appropriate rubric for each project--- guided by the following principles:

1. Clarity of assignment –covers the relevant details required for the specific project.
2. Integration – ideas for classroom use discussed.
3. Products are clear and useful following all principles of visual presentations.
4. Choice of software is appropriate for the audience and environment.
5. The ease of presentation, quality of the assignment, and the ability to answer questions evidence knowledge of the software and technology.

Summary Class Projects 1/3= 100 points, Portfolio 1/3, and Final Presentation 1/3 = 100 points
Total:200 points.

Figure 1. Sample Syllabus for Instructional Technology Class

Course Objectives:

The course is designed to help students:

Basic Operation and Concepts

1. Demonstrate a sound understanding of the nature and operation of technology systems.
2. Become proficient in the use of technology.

Social, ethical, and human issues

1. Understand the ethical, cultural, and societal issues related to technology.

2. Practice responsible use of technology systems, information, and software.
3. Develop positive attitudes toward technology uses that support lifelong learning, collaboration, personal pursuits, and productivity.

Productivity tools

1. Use technology tools to enhance learning, increase productivity, and promote creativity.
2. Use productivity tools to collaborate in constructing technology-enhanced models, preparing publications, and producing other creative works.

Technology communication tools

1. Use telecommunications to collaborate, publish, and interact with peers, experts, and other audiences.
2. Use a variety of media and formats to communicate information and ideas effectively to multiple audiences.

Technology research tools

1. Use technology to locate, evaluate, and collect information from a variety of sources.
2. Use technology tools to process data and report results.
3. Evaluate and select new information resources and technological innovations based on the appropriateness to specific tasks.

Technology problem-solving and decision-making tools

1. Use technology resources for solving problems and making informed decisions when planning and assessing classroom learning activities.
2. Employ technology in the development of strategies to solving problems encountered in real classroom environments.

Attendance Policy

Student presence in class and labs is required to earn credit for assignments. Please arrange with the professor for planned absence. In case of emergency you must call (513) 556-4385 and leave a voicemail message. Sending E-mail is not a substitute, but you may do both.

Collaborative Work: There is only one group assignment. Each member of the group is equally responsible for the work.

Portfolio: Details on your portfolio will be given at a later date. However, all assignments completed in class will become a part of your portfolio. Your are asked to keep a journal of your reflections on all readings and class projects/assignments.

Online Participation and Discussion

Due dates: All assignments will be given a due date during the class time and updated on E-mail each week in case of a change.

Performance-based Assessment

Pre & post assessments administered to students determined their self-perception in the acquisition of technology integration skills. The results of the assessments, along with evaluations of individual assignments, presentations and a cumulative portfolio, combined to determine students' final grades. Course analysis was used for planning and restructuring the class as indicated by student achievement and performance.

Lessons Learned

In recent years, the vision for technology in the Division of Teacher Education at the University of Cincinnati has increasingly been shaped by both state and national standards for the teaching and use of technology in the classroom. SchoolNet, an Ohio technology education agency, has established standards for identifying and strengthening skill levels for preservices' appropriate use of technology in the classroom. Nationally, the National Council for Accreditation of Teacher Education (NCATE) standards, which incorporate International Society for Technology in Education (ISTE) standards, outlines those skills that are necessary for preservices and faculty to hold. This project will result in comprehensive incorporation of these standards into the University of Cincinnati's nationally recognized preservice education program. In 1998 UC College of Education [CITE program] received the *Exemplary Practice Award in Support of Teacher Education Accreditation* by the American Association of Colleges for Teacher Education (AACTE, 1998). *U.S. News & World Report and Modern Maturity* hailed the UC College of Education as "cutting-edge" for teacher reform (*Educator*, 1999).

The Cincinnati Initiative for Teacher Education (CITE) at the University of Cincinnati's College of Education is a five year preparation program that is nationally recognized as a leader in systemic school reform and innovative methods of teacher education. The program is built on the Holmes Group model and has been in place for five (5) years. During the professional preparation year (Year 4), students are considered Teaching Associates. They take methods classes, content area classes, and spend 4 to 6 hours per week each quarter in schools, teaching and observing. During their internship year (Year 5), students complete their advanced methods requirements, participate in coordinated seminars, and teach half time in a school for a complete and full school year.

Interns typically receive pay from the school systems and are teachers of record in their classrooms, bearing the full responsibility of two classes of students in a secondary school and a half-day teaching in an elementary school. Students are placed in schools (Professional Development Schools) that have agreed to work closely with the College of Education to provide supportive and extended induction experiences. Currently five high schools and 11 elementary schools support teaching associates and intern teachers through the Professional Development School concept and in keeping with the College's urban mission. Many of these schools are located in the Cincinnati Public Schools district.

Identification of Specific Gaps and Weaknesses

The mission of the CITE program is to develop high quality teachers experienced in working with the special needs of inner city schools and pupils. A primary focus is the Cincinnati Public Schools (CPS). Currently, pre-service teachers in the CITE program receive inadequate training in technology. A comprehensive program analysis has determined that one critical component missing from this program and from many of the courses taught by the teaching associates and intern teachers, is technology. At the present time the average number of IT hours per CITE student is between two and three credit hours (2.5 cr. hrs.). Students get these hours of technology instruction only in the 4th or 5th year of the program (Figure).

The use of technology has been infused only sparsely into methods and curriculum areas. Of even greater concern are the inconsistent and ineffective methodologies employed during instruction. Access to professional development and technical assistance for faculty is only rudimentary. Although, during 1997-1998, the instructional technology methods for courses were revised to introduce focus on curricular integration; project based learning, inquiry-based and exploratory learning, collaborative learning, standards-based lesson planning, and technology integration, the small insulated change was inadequate to meet the need of preservice teachers with little or no experience in technology environments.

Evaluation data indicates that students participating in the enhanced courses demonstrated increased potential to perform at higher levels of achievement and an ability to use a variety of instructional technologies with their own pupils in the schools. However, a large percentage of students expressed frustration with non-traditional constructivist learning and teaching strategies and most did not include new instructional strategies in their technology integration lesson plans. This was evident across all the teacher education programs. An analysis of the course evaluations revealed that students skills varies widely, over half of the students wanted more direct instruction. Students also expressed that in a constructivist learning setting the traditional textbook and syllabus are highly ineffective tools because of the emerging information and new knowledge from web-sites and practical field experiences. In addition, teachers indicated that most of their mentor teachers preferred the traditional lesson plan format, therefore they were unable to apply much of what they learned in their field experiences in the public schools.

Conclusions

After fully evaluating the data, it became apparent that to bring about a comprehensive change in teaching practices it would be necessary to expand the implementation to include all methods, faculty, and students across programs and subject areas.

References

Heinich, R., Molenda, M., Russell, J., & Smaldino, S. (1998). *Instructional media and technologies for learning* (6th ed.). Upper Saddle River, NJ:Prentice Hall.

International Society for Technology in Teacher Education (ISTE) (1999). National Educational Technology Standards for All Teachers. Available at: iste.org.

Educator (1999).*U.S. News & World Report and Modern Maturity* Article.UC College of Education as "cutting-edge" for teacher reform.

Software Review Projects, Supportive Online Lessons, and Ohio Ohio Technology Standards for Students http://www.ohioschoolnet.k12.oh.us/home/contents.asp

Tutorials: http://microsoft.com/education/tutorial/classroom/default.asp

Kathy Shrock's Guide for Educators (http://www.capecod.net/schrockguide/)

Extending the Learning Environment: Potentials and Possibilities in a Web Mediated Course

Rose M. Pringle Ph.D
University of Florida
rpringle@coe.ufl.edu

Abstract: Asynchronous learning tools on the World Wide Web have opened up possibilities and potential for a new environment for teaching and learning. One program, employing this learning tool was the Connecting Communities of Learners (CCL) developed by a team of science educators and programmers at Florida State university in the mid 1990's. This paper describes how it was used as one tool in a science education course for pre-service teachers. Facilitating dialogue journal, notice board, grade book and critical review, the CCL extended the physical learning environment beyond the traditional class contact periods. Learners were afforded the opportunities to work with materials and tools while operating at a pace convenient to them and appropriate for learning within the social context of the learning community being developed.

Introduction

Modern computer technology has made possible a new and rich learning environment (Lee, 1999). Today as we perch, poised for the next millennium there is evidence that the computer and the World Wide Web (WWW), have become a more viable option for teaching and learning. The Internet has quickly become a ubiquitous open WWW of interconnected, global computer networks (McIntyre, & Wolff, 1998), allowing for interaction and much collaboration among learning communities.

Developments in technology coupled with research in teaching and learning have led to substantial alterations in the way computer technology is now used in education. Today, asynchronous learning tools on the WWW have opened up possibilities and potential for a new environment for teaching and learning. The central pedagogical idea in an asynchronous learning network is collaborative learning at the time and place of the individual learner's convenience (Nulden & Hardless, 1999). Researchers contend that learners are afforded the opportunities to contribute their understandings on issues from any place and at any time that is personally convenient. At the same time, it allows for multiple discussions to occur simultaneously. Asynchronous learning network utilizes different tools for computer mediated communication. It employs the integration of these tools as a means of slowing down the dynamic face-to-face interactions, characteristic of the traditional classrooms (Nulden & Hardless, 1999). One of the hallmarks of the asynchronous learning network is that it reduces competition for airtime among participants allowing for equal voice in communications. In part, this is accomplished as the time available for reading or rereading materials is increased, allowing for critical reflection and formulation of thoughts.

Connecting Communities of Learners (CCL)

One program employing the asynchronous learning tool was the Internet application known as Connecting Communities of Learning (CCL). This was developed by Kenneth Tobin and a team of educators and programmers at Florida State University (FSU) in the mid 1990's. Embracing social constructivism, giving credence to the social context of learners and their individual needs, emphasis was placed on the active role of learners in knowledge construction and the social construction of this knowledge.

Structure of the CCL

The CCL consisted of a number of sites for posting students' work. Identified by a named button, some of these were critical reviews, dialogue journals, research papers, proposals, portfolios and notice board. A mailroom system also allowed for selective or mass dispatching of e-mails to all members enrolled in the course along with the instructor. Access was facilitated through the use of a log-in name and a private password that allowed entry into the website. In this paper I will discuss how the CCL was used as one tool to facilitate learning in a science education course for pre-service teachers.

Website Teaching and Learning Tools

Dialogue Journal

The dialogue journal, a semi-private site, offered a safe base, learning environment where participants became involved in academic discourse, shared perspectives and had access to the ideas of their peers. It also provided a platform where group members could work collaboratively on projects. One project, The Moon Model, required group members to observe the moon over a period of time and create a model to explain their observations. Group members were able to continue their discussion on their science project without having the constraints of a common meeting time. Within this environment they shared their observations, offered explanations and reflected on their model as it was being constructed.

Critical Review

Critical review was one of the teaching strategies used in the course. As a course requirement, each week the students were required to read one chapter of the assigned text: Teaching with the Brain in Mind, Jensen (1998). For each chapter the students wrote formal critical reviews that were posted in the appropriate sections on the web. To complete the assignment, each student critiqued the review of one of his or her peers who was randomly assigned. This forum provided useful feedback to the individual whose work was being critiqued and at the same time provided an avenue for further learning to the person doing and receiving the critique.

Notice board

The notice board was a site for brainstorming and speculative thinking. At the beginning of the semester the notice board served the purpose for easy accessible instructor's general notices and public communication. However, as the semester unfolded the notice board provided the forum for participants to verbalize their positions on specific ideas generated from reading, or other experiences such as observation and reactions to micro-teaching. Topics such as assessment, the nature of science and the level of science teaching in elementary schools became the focus of discussion on the notice boards. Responses in the form of feedback then provided the opportunities for elaboration or modification of views while interacting with the ideas of their peers. This provided the opportunities for the creation of shared beliefs and enabled much critical thinking.

Grade Book

The grade book provided easy access to feedback and grades. It included distribution of ratings from each peer review as well as all the related feedbacks from peer, instructor and self. These feedbacks occurred at two levels; providing private comments addressed to the individual and public comments that served to inform the work of the general class.

Conclusion

There is no doubt that the computer and the WWW have revolutionized much of our day to day actions and interactions. Harasim, (1990) and Linn, (1998) note that computer technology has introduced unprecedented options for teaching and knowledge building while expanding the opportunities for creating communities of learners. The possibilities now exist for learners outside of traditional classroom settings to become active, reflect on interesting issues raised during the development of a course of studies and then share with their peers in a non-threatening environment. Extending the traditional learning environment and the contact times, the CCL has moved the on-line capabilities offered in university classrooms beyond e-mail only communication. The challenge therefore, is for instructors to strive for more effective teaching strategies and instructional design in this new social context afforded by web technology.

References

Harasim, L. (1990). *On-line education: An environment for collaboration and intellectual amplification in on-line education: Perspectives on a new environment.* New York: Praeger.

Jensen, E. (1998). *Teaching with the brain in mind.* Virginia, Association for Supervision and curriculum Development.

Lee, J. (1999). Effectiveness of computer based instructional simulation: A meta analysis. *International Journal of Instructional Media 26(1)*, 71-85.

Linn, M. (1998). The Impact of technology on science instruction: historical trends and current opportunities. In Barry J. Fraser & Kenneth G. Tobin (Eds.), *International Handbook of Science Education.* Great Britain: Kluwer.

McIntyre, D. & Wolff, F. (1998). An Experiment with WWW interactive learning in University Education. *Computers and Education 31* (1998), 255-264.

Nulden, U. & Hardless, C. (1999). Activity Visualization and Formative Assessment in Virtual Learning Environments. In J. A. Chambers (Ed.). Selected Papers from the 10th International Conference on College Teaching and Learning. Florida Community College, Jacksonville.

Effective Online Learning at Western Governor's University

Ian J. Quitadamo
Department of Teaching and Learning,
Washington State University, Pullman, WA 99164-2132
Email: quitadamo@wsu.edu

Abbie Brown, Ph.D.
Department of Teaching and Learning,
Washington State University, Pullman, WA 99164-2132
Email: abbie_brown@wsu.edu

Abstract: Internet-based, distance learning solutions may prove effective in facilitating advanced study coursework for remotely located, place-bound students. However, the conditions for promoting online learning success have not been entirely defined. We present as an example the teaching challenges and benefits of an online graduate-level Instructional Design course for in-service teachers taught through Western Governors University and Washington State University. This paper addresses some of the teaching challenges for this online instructional experience, focusing specifically on how teaching styles were used to build online learning community, to effectively promote productive and satisfying learning interactions, and develop student problem-solving and critical thinking abilities. Also discussed are those instructional design strategies that were repeatedly employed in multiple course sections to increase online student engagement, critical thinking, and enhance student learning. This paper should prove of interest to anyone currently developing or delivering online instruction.

Introduction

Online Learning Environments

Computer-mediated instructional environments, or online learning environments (OLEs), are networked learning tools that are finding increased use in institutions of higher education. Online learning environments provide an interaction space that allows students to actively engage in critical dialogue and reflect on information in a way that facilitates knowledge construction and higher order thinking (Jonassen, Carr, & Yueh, 1998). Effectively designed OLEs also provide a communal workspace for group and peer-based teaching and learning (Collis, Andernach, & van Diepen, 1996). By incorporating instructional methodologies that support higher order thinking, OLEs can provide an interaction space for increasing student metacognitive awareness, critical understanding rather than simple knowledge retention, and problem solving abilities (Hannafin, Hill, & Land, 1997). Online learning environments are seeing increased use in institutions of higher education that are feeling pressures for delivering educational materials to a wider student audience. Many colleges and universities are investing considerable time and money in distance delivery methods to meet the diverse needs of learners. In spite of the effort and resources being spent, we do not have a comprehensive understanding of what factors influence successful student learning in online domains (Brahler, N.S., & Johnson, 1999).

Online learning environments are thought to provide a venue for developing higher order thinking skills in college students (Ewing, Dowling, & Coutts, 1999; Jonassen, 1995a), and are widely assumed to have a positive impact on student higher order thinking and learning. However, opinions differ greatly on how to effectively implement online technologies into learning (Ewing et al., 1999). Technology-enhanced OLEs can potentially provide higher order thinking opportunities, but technology does not of itself cause the development of these advanced cognitive abilities (Jonassen, 1995a). Rather, a major determinant of higher order thinking skills development is the quality of discourse that occurs within well designed, properly structured OLEs (Oliver, Omari, & Herrington, 1998). Ideally, OLEs possess several characteristics: a means of accessing, generating, and sharing information; support learner articulation of knowledge and reflection on what they have learned; represent and simulate authentic, real-world problems and contexts; provide structure for student thinking; support critical discourse among learners within a learning community (Jonassen, 1995b); promote student control of learning decisions; and integrate multiple learning perspectives (Jonassen, 1993). In reality, the promise of OLEs is largely unrealized, as many instructors use online learning environments as simple knowledge repositories (Jacobson & Spiro, 1993). When properly structured and utilized to their potential, OLEs are capable of moving education from teacher-centered, lecture-based, passive instruction to learner-centered, self-reflective, active learning (Lan, 1999). Emphasizing this concept, Diaz and Cartnal (2000) state, "Because more online courses will invariably be offered in the future, some assurance must be provided to the college, the faculty, and the students that distance education will meet expectations for a good education. Not only will students expect an education that is equal in quality to that provided by traditional offerings, they will expect a student-centered learning environment, designed to meet their individual needs (Diaz & Cartnal, 2000). While considerable research has touted the purported benefits of OLEs (Collis & Smith, 1997; Goldberg & McKhann, 2000; Hiltz & Turoff, 1994; Jones, 1996; Koschmann, 1994; Scott et al., 1997); little work has been done specifically dealing with how instructional design and styles of teaching influence student higher order thinking in these environments.

Teaching Styles, Instructional Design, and Online Learning

Teaching styles, hypothetical constructs used to characterize the teacher-student interaction (Fischer & Fischer, 1979), are based on several criteria. An instructor's beliefs regarding teaching and learning, how these beliefs are translated into teaching practice within a learning environment (Fereshteh, 1996; Grasha, 1994), how instructors present information, interact with students, manage and supervise learning tasks, and mentor students (Fereshteh, 1996; Grasha, 1994) are all components of teaching style. Instructors' teaching styles vary considerably; unfortunately, not all variations effectively promote student learning. The question remains: which styles of teaching most effectively develop student higher order thinking skills in OLEs? Many instructors are under the impression that the same teaching styles and approaches used in their traditional classes will also work in an online classroom (Diaz & Cartnal, 2000). While it is unclear whether traditional classroom teaching styles can translate to online domains, instructors utilizing facilitative, guidance-based, interactive teaching styles more effectively create critical thinking opportunities for the majority of students (Kember & Gow, 1994). Students report greater learning satisfaction with facilitative styles of teaching as compared to traditional authoritative instruction (Friday, 1990). Concurrently, facilitative teaching approaches that promote problem solving and critical thinking can be uncomfortable for students, and may be in contrast to students' superficial approaches to learning (Andrews, 1996). Collectively, these findings indicate that teachers that use facilitative, problem solving-based instructional approaches provide thinking challenges despite student discomfort with critical thinking.

Instructional design also plays a significant role in online learning success (Winfield, Mealy, & Scheibel, 1998). While technology can enable learning opportunities, it is teachers' careful planning and incorporation of instructional strategies that contribute to student interaction, growth, and learning (Kirby, 1999). In particular, instructional designs that incorporate student-centered learning approaches in online learning environments support student reasoning, problem solving, and higher order thinking (Land & Hannafin, 1997). Furthermore, the instructor's questioning skills significantly affect student critical thinking outcomes in college courses (Bonnstetter, 1988; Elder & Paul, 1997). By using systematic questioning techniques (Hannel & Hannel, 1998) and/or research-based questioning methods (Adams, 1993) in their teaching style and instructional design, teachers can enhance critical thinking skills in student learners (Adams, 1993; Hannel & Hannel, 1998).

Instructional strategies used to enhance student mental engagement and critical thinking include: not asking questions with known answers; waiting an appropriate length of time for students to think; increasing instructors' non-evaluative responses to students; and avoiding questions requiring a "yes" or "no" response (Bonnstetter, 1988). In addition to questioning techniques, the quality of the college student learning experience (i.e. critical thinking) is partially determined through other, less tangible, instructional design components like planned social interactions, alternative, non-lecture teaching formats, student learning choices that exploit personal interests and strengths, teaching approaches that provide real-world contexts for learning, and course material demonstrating the value of diverse cultures and perspectives (Stage, Muller, Kinzie, & Simmons, 1998).

The Study

The present work focused on the quality of student learning as a function of teaching style in an online learning environment hosted by Western Governor's University and Washington State University. Student participants, a collection of technology professionals for their respective K-12 school districts, were enrolled in a graduate level "Instructional Design and Performance Improvement" course as part of the Masters in Technology and Learning degree at Western Governor's University. For this content area, class size was strictly limited to 20 or fewer students, based on recent suggested benchmarks for Internet-based distance education (*Quality on the Line: Benchmarks for Success in Internet-based Distance Education*, 2000).

The Instructional Design and Performance Improvement course was comprised of an informational website (http://education.wsu.edu/TL/522/) and the primary communicative tool for the course, an email listserve. The course website contained an outline of course requirements, student evaluation criteria and grading procedures, required and recommended texts, and instructions for completing the primary assignments for the course, three problem-based Instructional Design projects. In addition, several descriptive hints for project development were included. The three projects comprised the majority of the course grade (90%) with the remaining 10% for student participation in weekly online discussions. Also included on the course website were email hyperlinks for direct student access to the course instructors and coordinator, as well as instructions for subscribing to the email listserve. Students were assigned readings from the required textbooks, and the instructor posed weekly questions to the listserve so that all class members could potentially participate in any aspect of any posted discussion. Questions were structured and goal-oriented but open ended, and were designed to develop student research and evaluation skills that were necessary to successfully complete each of the three projects. An email listserve format was chosen as the discussion tool as it was anticipated that all students had ready access to email technology. Hardware and software requirements for full email functionality were minimal; using more sophisticated communication systems could have limited student access potentially. Students were required to post at least one well-developed, thoughtful answer to each weekly question as a criterion for student course performance.

The course design specifically emphasized problem-based learning by requiring students to develop three in-depth research projects that were distinct but built upon one another. The first project invited each student to evaluate and assess their specific, unique instructional environment by constructing a well-developed instructional technology assessment rubric, and to preliminarily identify a pressing instructional problem particular to their environment. The second project requested that each student describe in further detail his or her specific instructional problem, and provide supporting rationale with relevant literature. The primary goal of the second project was to research and develop a proof-of-concept model for pilot testing a potential solution to the identified instructional need, and to determine the instructional effectiveness of the proposed solution via educational testing. Finally, the third project bid each student to critically reflect how their instructional practice has changed, what aspects or models of the instructional design process were most useful to them, and how they planned to implement their solution in future instruction.

Methods

Research Question and Variables

In an attempt to identify and comprehend some of the important criteria for learning online success, our research question was: Does teaching style and instructional design affect the quality of student learning and satisfaction in online courses? For this study, our first independent variable was the instructor's teaching styles, which represented 1) instructional design content expertise, 2) provided learning structure and guidance, 3) provided a personal example for learning and instructional leadership, 4) guided, questioned, and facilitated student interaction, active learning, and critical thinking, and 5) cultivated student learning abilities so as to empower student learners to become independent, functional Instructional Designers. Our second independent variable was the course instructional design, which reflected the structure and purpose of inherent course activities. Our dependent variable was the overall quality of student learning in the online domain. Indicators of student learning quality included the frequency of interaction, the quality of weekly teacher-student and student-student discourse, the level of student writing confidence and development of content expertise, and the degree of reflection and revision indicated in student responses.

Learning Quality Assessment

The categories of the teaching styles independent variable were determined using a validated Teaching Styles Inventory (Grasha, 1996), whereas the student learning quality dependent variable was evaluated qualitatively (Guba & Lincoln, 1982) via weekly and semester observation. In addition, students evaluated various aspects of the course, the instructor, and their learning experience with a 140-item, validated survey questionnaire (Silhouette Flashlight). Specifically, the Flashlight survey asked students: 1) the degree to which course assignments were stimulating, challenging, and encouraged student creativity; how quickly students received feedback, and how effective the reflection and revision process was; 2) the instructor's teaching effectiveness with regards to the teacher's ability to build students' confidence and promote student learning success; 3) how authentic the context and relevance to working environment was; 4) whether the instructor provided an informative, thorough evaluation of student thinking process and course performance specifically highlighting strong points and points for improvement; 5) the degree to which the instructor provided yes or no answers; 6) how well the instructor bolstered student learning confidence and stimulated excitement about course material and productive student interaction; and 7) whether students would recommend this general type of distance course, this particular course, and the course instructor to others. The survey also assessed student comfort with the course, specifically focusing on 1): student satisfaction with assignments; aspects of community building; 2) the level of thought put into responses; 3) whether students were likely to spend time on issues not related to course; 4) whether students were more likely to try and search for their own answers before approaching the instructor; 5) if they were better able to visualize course concepts; and 6) the effectiveness of the course structure and design.

Results

Below are the results of the Teaching Styles Inventory (Table 1), which was used to characterize the course instructor's instructional approach, and a profile of interaction within the Instructional Design and Performance Improvement course.

	Teaching Styles				
	Expert	Formal Authority	Personal Model	Facilitator	Delegator
Instructor	4.2	4.2	5.3	6.6	5.1
Norming Equivalent	Moderate	Moderate	Moderate	High	High

Table 1: Instructor Teaching Styles profile

Term	Total Responses	Instructor Responses	Instructor / Total Responses
Spring 2000	916	229	25%
Summer 2000	904	345	38%

Table 2: Instructor Interaction with Online Students over the Course Term

A collection of student quotes regarding the effectiveness of online instruction and utility of the online learning experience are as follows:

> "Given the fact that the facilitation was on-line and we never talked face to face, I feel it covered all the needed areas and provided the feedback and information needed as well. Answers to questions were prompt and to the point. You gave useful feedback and insight into the instructional design field."

> "Overall this course has been a very good experience. I have learned a great deal. Thank-you for letting me make this course relevant to my day job. Being able to do that has been invaluable."

> "This was my first experience with a listproc, and it was very helpful to be able to read all the comments and submitted assignments. The weekly assignments did a great job guiding us into the different projects. I now feel I have a very good understanding of the instructional design process. The personal and professional growth attained through participating in this class has made me a better professional educator."

"I did appreciate your comments, and took them to heart whether it was on a weekly question, or as part of evaluating my projects. Your sense of humor kept things in proportion, but still deadlines were deadlines, etc. I always want to know where the line is and with your reminders, there was never a doubt."

"[I] wanted to say that although I didn't think that operating through a listserv was the best way to take this class, I've changed my mind over the last month and a half... this class has been straight forward and I think that the listserv has actually drawn us into the class more effectively than using web boards."

Discussion and Conclusions

Online learning, for better or worse, appears to be an educational trend that will continue for some time as educational institutions look for innovative ways to provide a quality learning experience for their students (Brahler et al., 1999). This qualitative study provides some insight into the distance learning process, and identifies some factors that may partially determine learning success for students in online domains.

The results of this study suggest that specific teaching styles can be used to promote effective student learning in online learning environments. In this distance learning experience, Facilitator and Delegator teaching styles were used most by the instructor, and were characterized by such activities as problem-based project development, guided student exploration, online group discussion, self-discovery exercises, learning debates, case studies and independent, student-designed research, and using the instructor as an independent resource (Grasha, 1994). To a slightly lesser extent, the Personal Model style was used by the instructor to illustrate alternatives, demonstrate ways of thinking, outline the thought processes involved in research-based project development, and to share personal viewpoints (Grasha, 1994). Finally, both Expert and Formal Authority teaching styles were used to provide a modicum of content expertise; however, the primary instructional goal for this online course was to begin with graduate students with little or no research or instructional design experience, and guide them on a path of self-discovery to a point of autonomy and independence within the Instructional Design field. Accomplishing this goal meant that students needed to develop their own content to a large extent. Collectively this meant that the instructor had to nurture student confidence and guide student development of independent research and individual critical thinking skills; thus the high scores for Facilitator and Delegator teaching styles. In this case, Expert and Formal Authority styles were utilized to provide structure within the independent learning environment, and to emphasize the high performance standards set for the students.

For the graduate Instructional Design and Performance Improvement course offered through Western Governor's University and Washington State University, we found that interplay between the teacher's and students' personalities was essential to productive learning. These findings were consistent with previous research that states teachers' personalities must be built into online courses (Winfield et al., 1998). Initially, it was essential that the WGU instructor establish a level of trust, professional credibility, and community with the students. Since the students were unable to 'see' any physical expressions of the instructor, it was vital that the teacher's initial responses were confident and competent, and that students felt part of a larger community of learners. As teacher confidence and competence was conveyed, the students expressed more trust and confidence in learning from a teacher in an online context, and shared more personal information in initial community building exercises as a result. When one has a class of 20 students, small, collaborative subgroups may spontaneously form. This phenomenon was also observed in the online classroom. Much research has shown the benefits of small group collaborative learning in online environments (Collis et al., 1996; Hiltz, 1998; Newman, Johnson, Webb, & Cochrane, 1997); however, in this context, small online groups served the purpose of community cohesion rather than collaborative learning.

Despite the high demand for this course, the course coordinator strictly limited the number of students to 20, a number that ensured a reasonable teacher/student ratio and was consistent with professional recommendations (*Quality on the Line: Benchmarks for Success in Internet-based Distance Education*, 2000). In addition, it was important that student learning become the focus of the course, not the teacher. In this case, the simple technologies used for this course and the design of the instruction allowed the technology to blend into the background and become more transparent; as a result, the students spent more time engaged in rigorous discourse and developing research abilities and critical thinking skills. In this scenario, the technology was a convenient, effective means to an end.

An interesting observation from the WGU teaching experience was how student perception led to increased performance expectations. In traditional face-to-face classrooms, student work is generally not publicly displayed, and the instructor is many times limited to teaching to students with the worst performance to try and increase average class performance. In the online classroom, students were encouraged to submit works in progress to the listserve as project development proceeded. This had the unexpected effect of increasing average class performance, presumably because less motivated students were exposed to high-quality projects and were prompted to increase their efforts by class overachievers. In this case, the instructor was not limited to teaching to the lowest performing students; instead students tried to emulate the project quality of the best students. It is unclear whether this shift in student perception would have occurred in a traditional classroom.

The Instructional Design and Performance Improvement course relied on an email listserve. This asynchronous method of communication allowed students to contemplate their submitted comments prior to submitting them for perusal by their class peers and the course instructor. Face-to-face interactions, such as those that occur in a traditional classroom, tend to be more spontaneous and unstructured. As a result of the asynchronous method, student responses in the online classroom tended to be more structured and well thought out.

In conclusion, we maintain it is the quality of human interaction that determines online learning success. We conclude that online instructors can use teaching styles to achieve instructional goals and provide rich, satisfying learning experiences for online students. The results of this study are intriguing; however, this study is not without limitations, and the conclusions drawn by the authors are speculative and preliminary. Only a small sample was used for this qualitative investigation, and as such there are limitations to how far these findings can be generalized. Additional studies in this area are necessary to more definitively support these conclusions.

References

Adams, D. L. (1993). Instructional Techniques for Critical Thinking and Life-Long Learning in Science Courses. *Journal of College Science Teaching, 23*(2), 100-104.

Andrews, J. (1996). The Teaching and Learning Transaction in Higher Education: A Study of Excellent Professors and Their Students. *Teaching in Higher Education, 1*(1), 81-103.

Bonnstetter, R. J. (1988). Research & Teaching: Active Learning Often Starts with a Question. *Journal of College Science Teaching, 18*(2), 95-97.

Brahler, C. J., N.S., P., & Johnson, E. C. (1999). Developing On-line Learning Materials for Higher Education. *Educational Technology & Society, 2*(2).

Collis, B., Andernach, T., & van Diepen, N. (1996, October 15-19). *The Web as Process Tool and Product Environment for Group- Based Project Work in Higher Education.* Paper presented at the WebNet 96, San Francisco, CA.

Collis, B., & Smith, C. (1997). Desktop Multimedia Environments To Support Collaborative Distance Learning. *Instructional Science, 25*(6), 433-462.

Diaz, D. P., & Cartnal, R. B. (2000). Students' Learning Styles in Two Classes: Online Distance Learning and Equivalent On-Campus. *College Teaching, 47*(4), 130-135.

Elder, L., & Paul, R. (1997). Critical Thinking: Crucial Distinctions for Questioning. *Journal of Developmental Education, 21*(2), 34-35.

Ewing, J. M., Dowling, J. D., & Coutts, N. (1999). Learning Using the World Wide Web: A Collaborative Learning Event. *Journal of Educational Multimedia and Hypermedia, 8*(1), 3-22.

Fereshteh, H. (1996). The Nature of Teaching, Effective Instruction, and Roles to Play: A Social Foundation's Perspective. *Contemporary Education, 68*(1), 73-75.

Fischer, B. B., & Fischer, L. (1979). *Styles in Teaching and Learning.*

Friday, R. A. (1990). Faculty Training: From Group Process to Collaborative Learning. *Journal of the Freshman Year Experience, 2*(1), 49-67.

Goldberg, H. R., & McKhann, G. M. (2000). Student Test Scores Are Improved in a Virtual Learning Environment. *Advances in Physiology Education, 23*(1), 59-66.

Grasha, A. F. (1994). A Matter of Style: The Teacher as Expert, Formal Authority, Personal Model, Facilitator, and Delegator. *College Teaching, 42*(4), 142-149.

Grasha, A. F. (1996). *Teaching with Style.* Pittsburg, PA: Alliance Publishers.

Guba, E. G., & Lincoln, Y. S. (1982). Epistemological and Methodological Bases of Naturalistic Inquiry. *Educational Communication and Technology: A Journal of Theory, Research, and Development, 30*(4), 233-252.

Hannafin, M. J., Hill, J. R., & Land, S. M. (1997). Student-Centered Learning and Interactive Multimedia: Status, Issues, and Implications. *Contemporary Education, 68*(2), 94-97.

Hannel, G. I., & Hannel, L. (1998). The Seven Steps to Critical Thinking: A Practical Application of Critical Thinking Skills. *NASSP Bulletin, 82*(598), 87-93.
Hiltz, S. R. (1998, November 7-12). *Collaborative Learning in Asynchronous Learning Networks: Building Learning Communities.* Paper presented at the WebNet 98 World Conference of the WWW, Internet, and Intranet Proceedings, Orlando, FL.
Hiltz, S. R., & Turoff, M. (1994, June 25-30). *Virtual Classroom Plus Video: Technology for Educational Excellence.* Paper presented at the Proceedings of ED-MEDIA 94--World Conference on Educational Multimedia and Hypermedia, Vancouver, British Columbia, Canada.
Jacobson, M. J., & Spiro, R. J. (1993). *Hypertext Learning Environments, Cognitive Flexibility, and the Transfer of Complex Knowledge: An Empirical Investigation.* Urbana, IL: Center for the Study of Reading - University of Illinois.
Jonassen, D. H. (1993). Thinking Technology: The Trouble with Learning Environments. *Educational Technology, 33*(1), 35-37.
Jonassen, D. H. (1995a). Computers as Cognitive Tools: Learning with Technology, Not from Technology. *Journal of Computing in Higher Education, 6*(2), 40-73.
Jonassen, D. H. (1995b). Supporting Communities of Learners with Technology: A Vision for Integrating Technology with Learning in Schools. *Educational Technology, 35*(4), 60-63.
Jonassen, D. H., Carr, C., & Yueh, H.-P. (1998). Computers as Mindtools for Engaging Learners in Critical Thinking. *TechTrends, 43*(2), 24-32.
Jones, D. (1996). *Solving Some Problems of University Education: A Case Study,* [WWW]. Available: http://cq-pan.cqu.edu.au/david-jones/Publications/Papers_and_Books/96ausweb/.
Kember, D., & Gow, L. (1994). Orientations to Teaching and Their Effect on the Quality of Student Learning. *Journal of Higher Education, 65*(1), 58-74.
Kirby, E. (1999, February 28-March 4). *Building Interaction in Online and Distance Education Courses.* Paper presented at the SITE 99: 10th Society for Information Technology & Teacher Education International Conference, San Antonio, TX.
Koschmann, T. D. (1994). Using Technology to Assist in Realizing Effective Learning and Instruction: A Principled Approach to the Use of Computers in Collaborative Learning. *Journal of the Learning Sciences, 3*(3), 227-264.
Lan, J. J. (1999). *The Impact of Internet-Based Instruction on Teacher Education: The "Paradigm Shift."*
Land, S. M., & Hannafin, M. J. (1997). The Foundations and Assumptions of Technology-Enhanced Student-Centered Learning Environments. *Instructional Science, 25*(3), 167-202.
Newman, D. R., Johnson, C., Webb, B., & Cochrane, C. (1997). Evaluating the Quality of Learning in Computer Supported Co- Operative Learning. *Journal of the American Society for Information Science, 48*(6), 484-495.
Oliver, R., Omari, A., & Herrington, J. (1998). Exploring Student Interactions in Collaborative World Wide Web Computer-Based Learning Environments. *Journal of Educational Multimedia and Hypermedia, 7*(2-3), 263-.
Quality on the Line: Benchmarks for Success in Internet-based Distance Education. (2000). Washington DC: The Institute for Higher Education Policy.
Scott, D., Durnell Crampton, C., Guavin, S., Lobert, B., Steinke, G., & Patterson, K. (1997). *Internet Based Collaborative Learning: An Empirical Evaluation,* [WWW]. Available: http://ausweb.wsu.edu.au/proceedings/donscott/index.html.
Stage, F. K., Muller, P. A., Kinzie, J., & Simmons, A. (1998). *Creating Learning Centered Classrooms. What Does Learning Theory Have To Say? ERIC Digest*: George Washington Univ., Washington, DC. Graduate School of Education and Human Development. ERIC Clearinghouse on Higher Education, Washington, DC.
Winfield, W., Mealy, M., & Scheibel, P. (1998, August 5-7). *Design Considerations for Enhancing Confidence and Participation in Web Based Courses.* Paper presented at the Annual Conference on Distance Teaching & Learning (14th), Madison, WI.

Acknowledgments

The authors would like to thank Jona Crosier for her support of this work. In addition, the authors would like to acknowledge the support of the U.S. Department of Education and the Preparing Tomorrow's Teachers to Use Technology (PT3) grant, who sponsored the preparation of this paper.

Interactive Training Video and Software
(For Faculty & Staff Development)

Imtiaz Rasool
Country Manager / Trainer
British Education & Training Systems (BETS)
Pakistan
imtiaz@diploma.com

Nadia Imtiaz
Director Academics
Misali Public School, Lahore
Pakistan
inshal@hotmail.com

The process of learning has been a source of amazement and fascination for centuries. Investigators have continually attempted to describe both animal and human learning in a wide variety of interactions and contexts. More recently, larger number of actual experiments has been conducted. It is perhaps ironic, given the sheer magnitude of the learning research that has been undertaken that we still do not know precisely how human beings learn.

Learning process has its own science at the level of professionals. New research and development has always been a key issue at all levels and at all geographic regions around the world. Teaching and training staff has been the backbone of the whole learning methodology, as to how disciplined training staff would be, and how effective the training would be. To improve the quality of training and its disciplines, an interesting training video has been developed and pictured. It is been presented in the form of a VCD, which also includes user-friendly software designed and developed for Faculty and Staff Development. This VCD is a helping tool for teachers and trainers involved in professional education and deals with students or trainees of competence-based vocational areas like computing, multimedia, CAD/CAM etc.

This training video is a helping tool to acquire qualifications in Teaching and Training, especially covering the course "International Diploma in Teaching and Training" by City and Guilds International (UK awarding body).

The video-training program has been categorized into five main stages and subsequently sub-stages:

a) Identify individual learning requirements
- Identify individual learning needs
- Identify suitable available learning opportunities

b) Plan and prepare learning sessions and materials
- Prepare learning session plans
- Select and prepare resources for a learning session

c) Deliver teaching and training sessions
- Establish a positive learning environment
- Make presentations to groups
- Instruct learners
- Promote group learning

d) Assessment, evaluation and review

- Assess learner performance
- Review progress with learners

e) Evaluate own performance and identify self development needs

- Evaluate own performance
- Identify self-development needs

As this video covers the Learning Cycle with 5 stages of learning and then 12 sub-stages; for each sub-stage a detailed learning session has been shown. Stages have been captured through role-plays, role-demos, different techniques used by trainers at each level and the moods and styles of trainers and its effect on the trainees. The video also includes trainer's body language and personality improvement techniques.

The other important part of this video CD is software designed by keeping in view the requirements of training staff. At each stage or sub-stage, the software helps to design and prepare slides, material, write-ups, records, data and other training updates.

In the help-line, this software has the provision to get connected via the Internet with the producers to get more assistance, updates or any trouble shooting.

References

Manual (1998), City and Guilds International Diploma (1104) in teaching and training.
Belinda Ball (1999), NVQ in Training & Development, Tamworth &Lichfield College UK.

Acknowledgments

For Video-shoots, teachers and students of British Education & Training Systems (BETS) Pakistan have provided all the necessary support.
Special thanks to the Principal, Chris Bull and staff of Tamworth & Lichfield College, UK for providing information and training material in certain areas.

Sequence Independent Structure in Distance Learning

Richard Riedl
Theresa Barrett
Ginny Carpenter
Janice Rowe
Rick Smith
William Vinson
Susan Walker
Department of Leadership and Educational Studies
Reich College of Education
Appalachian State University
Boone, North Carolina
United States
riedlre@appstate.edu

Abstract: This paper is a preliminary report on a study of the use of a 3D virtual world designed to present a sequence independent distance learning environment. Students taking a class about the integration of computer technology into instruction were presented with a world that presented no prescribed sequence for exploring topics and no time schedule for completing various activities. The world was structured into "areas" that implied common topics and the students were asked to complete products that were identified with these "areas". Students were asked to report on their experience, participate in surveys about the world and their experience, and interviews about their experience. The instructor was interviewed about his intent for each of the readings and activities and his perceptions of student participation and completion of products.

Introduction

Teacher schedules and commitments make it difficult for them to pursue long term learning environments that help them develop the skills and understandings necessary to exploit the use of technology in their own classes. Therefore, there is a need to understand the role various technologies and formats play in distance learning environments for training and supporting teachers in the field.

Many web-based distance learning environments use web pages to transmit information and assignments and use email, chat and threaded discussions to afford students with opportunities to interact with the instructor and with each other. These courses tend to follow traditional schedules for student activity. Students may work at different locations and at different times during the day or week but the overall expectation is that they work on the same content and activities during roughly the same time frame.

The World Wide Web has the potential to provide a completely time independent exploration of content. Courses that have sought to exploit this potential have taken on the characteristic of programmed learning in which the students follows a sequence of content presentations and assessments of understanding. There is usually no opportunity afforded for interaction with other students and, often, little opportunity for interaction with an instructor. The student may move through the course at his or her own pace but must follow the sequence provided and must do so with little or no interaction with another person.

Another feature of the World Wide Web is the freedom with which an individual may explore information. A person may make many choices on what to pursue and in what depth to pursue information in a given area. While this may seem antithetical to the notion of a course, whether delivered via the web or otherwise it does pose an interesting avenue to explore when considering using a web-base environment as the basis for distance learning.

Can a learning environment be developed in which a time independent exploration of content is afforded the student and in which the students have an opportunity to interact with the instructor and other students? Further, can this learning environment provide an opportunity for students to plot their own path through the content rather than following a rigid specified sequence?

The Virtual World

Appedtec, a 3D virtual world, was built in which physical representations of the students (avatars) moved through representations of physical objects. Students in Appedtec could see other students' avatars when they were in the world together and could chat with them. The physical objects represented varied from buildings to walkways to trees and lampposts to chess pieces on a chessboard. There were signs to provide help and to indicate activities that were to be completed. The signs and many of the other objects (chess pieces, lampposts, tables) were linked to web pages that provided directions, links to readings, and links to forms to be completed or to the threaded discussions. Appedtec could be accessed by any Windows computer with access to the Internet

There were four areas in Appedtec that were part of the class in which the students were participating. Students entered into a main plaza. The side of the plaza they faced when entering this area had signs that provided directions and links to the threaded discussion areas. The other three sides of the plaza led to each of the other areas. One of these areas was a garden. In this garden the students were linked to readings and activities designed to help them focus on the role of computer technology in the learning setting. A second area was a chessboard with chess pieces on it. Each of the chess pieces linked to readings and activities designed to help the student explore the factors that influence the ability of teachers to integrate computer technology into instruction. And a third area was a building in which the students were linked to resources and activities designed to help them analyze their skills and knowledge related to the use of computers.

Students were asked to complete three products, in no particular order. One was a plan for integrating computers into an environment of their determination. Another was a statement of their concept of the role of the computer in learning settings. And another was an actual unit plan in which computer technology is an integral part of the learning activities. Students were informed that they could send their products in (as email attachments) at any time and that the instructor would provide feedback as many times as it was desired.

There were two chat times arranged for the whole class in which the nature of the products was discussed. The instructor also met with the class (face-to-face) periodically, to make sure everybody was comfortable with the experience, and was available via email at anytime and in Appedtec at prescribed times.

One assignment asked students to arrange a chat time with another student to discuss readings and to then post a set of conclusions. Other assignments asked students to contribute to threaded discussions. And some assignments asked the students to complete forms such as a self analysis of computer skills or perceptions of factors that influence computer integration. This experiment with Appedtec was conducted during the course of a regular semester rather than as an open entry completion experience.

Initial Results

At this writing not all surveys and interviews have been completed. Initial results indicate that there was early frustration with a class that did not impose a timeline (other than the fact of the end of a semester) or a clear starting place. However, this discomfort appeared to disappear with time spent in the Appedtec as students began establishing their own schedule for participation. Students initially expressing the most satisfaction were those who had the greatest distance to travel to get to a campus-based course. The degree to which students felt comfortable interacting with each other and with the instructor through the threaded discussion, chats, and other forms is still not clear. If such an environment is to be successful in bridging the opportunities to explore information in one's own time and order with the opportunities to interact with fellow explorers who may be working on a different timeline and sequence, then understanding the degree to which these tools functioned is vital.

Learn the principles of creating and administering Web-based tests and assessments using Question Mark™ Perception™ software. Find out how to use Perception's authoring wizard to create questions in a variety of formats: multiple choice, multiple response, hot spot, text, numeric, selection, and matrix questions as well as explanation screens that can include text, graphics, and multimedia. Participants will also learn how to create multiple question banks from which to assemble tests, surveys, and questionnaires. Other topics include how to set up interactive feedback, create adaptive tests, analyze test results, and create reports. . Example questions will be presented from various applications including competency testing, employee recruitment, customer satisfaction questionnaires, study aids, diagnostic tests, skills assessments, product knowledge exams, course evaluations, and certifications. The presentation will cover such issues as test security, linking with learning management systems, and the use of Perception Secure Browser for high-stakes tests.

Edu-Effectiveness and Distance Education: How to Measure Success in the Online Classroom

Judith M. Smith, Ph.D.
Vice President, Instructional Development
CertiLearn, Inc.
Herndon, Virginia, USA
Jsmith@certilearn.com

Abstract: How we determine the quality of online education in the classroom is of primary concern for all institutions and organizations providing continuing education via new technologies. Recent statistics from the National Center for Educational Statistics reveals that enrollment in distance learning courses roughly doubled in two years from 754,000 to 1.6 million. With heightened enrollments come heightened expectations from adult learners that the quality of their online instruction will be (at minimum) equivalent to that which they can obtain in traditional learning environments. Despite the lack of national standards (at present) for delivering online educational courses, there are effective (and peer-reviewed) strategies that online faculty can use to measure and ensure an effective online classroom experience for the learner. This session will explain those strategies, and provide models for other faculty to use in their online classroom experiences.

Introduction

How we determine the quality of online learning, which translates into success in the online classroom is at the heart of this research report. As more individuals turn to online education as a means of maintaining continuing education requirements for certification, as well as look for convenience without the sacrifice of quality in learning, the standard for online education providers will become a significant goal to achieve and use in online course development.

This project proposes to use previous research which measured the impact of critical incidents in the online classroom as a standard for identifying barriers to excellence and effectiveness in the online classroom, and for use in creating models of online learning excellence for institutions.

The Study

For this research, we are choosing to focus on measuring effectiveness in the facilitated online classroom of adult learners who are taking courses offered by associations and professional membership groups online. The measure of effectiveness was further defined as determined by faculty members facilitating the course and by students taking the courses, as: having completed the course from start to finish; having felt as if new knowledge was gained, which would be advantageous professionally (student perspective); having felt as if the learning was immediately applicable to current professional work or professional growth (student perspective). (Note: The learners, in this instance, do not necessarily receive "grades" as in a traditional academic course. Many individuals, depending on the industry in which they work, are required to take continuing education courses to maintain professional certification, and these courses do not necessarily return "grades," but proof of attendance or a record of completion for the learner having finished the course.)

The actual measure of effectiveness is being determined by: course participant persistence; number of completed assignments by course participants; level and intensity of interactivity between course participants; level and intensity of interactivity between adult learners and faculty members; frequency and amount of feedback among course participants; frequency and amount of feedback between faculty members and course participants; quality and quantity of written conversation among course members and faculty members; and, success in problem solving or resolution of course difficulties (if any) by course participants and faculty members.

Findings

At present, the findings are inconclusive, because the research is ongoing. However, a overview of current data on the associations reveals the main issues at the heart of determining effectiveness in an online course that includes association member-users tends to focus on consistency, quality, and reliability of regular communication, both in the online classroom and in using alternative communication tools when necessary.

Conclusions

While any conclusion is considered early at this stage of the research, it is hoped that the specific findings from this project result in the development of guidelines and an assessment tool for associations to use in creating viable online education opportunities for their members.

References

Brooks, David W. 1997. Web-teaching: A guide to designing interactive teaching for the world wide web. New York: Plenum Press.

Eastmond, Daniel V. Summer 1998. Adult learners and internet-based distance education. New Directions for Adult and Continuing Education: Adult Learning and the Internet 78: 33-41.

Gunawardena, Charlotte N. and Frank J. Zittle. 1997. Social presence as a predictor of satisfaction within a computer-mediated conferencing environment. The American Journal of Distance Education 11, no. 3.

Markowitz Jr., Harold. 1990. Continuing professional development in distance education. Contemporary Issues in American Distance Education, Editor Michael G. Moore, 58-66. Oxford: Pergamon Press.

Assessing Student Statistical Problem-Solving Skills using Interactive Java Applets

R. Arlen Strader
Department of Educational Psychology
Texas A&M University, USA
strader@tamu.edu

Robert J. Hall
Department of Educational Psychology
Texas A&M University, USA
bobhall@tamu.edu

Michael S. Pilant
Department of Mathematics and Computer Science
Texas A&M University, USA
mpilant@math.tamu.edu

Abstract: Problem-solving instruction is a growing field within education. However, for distance education and other Web-mediated courses the traditional methods of assessment, namely multiple choice and short answer, are not sufficient. Although these formats can record final answers they cannot assess detailed aspects of the problem-solving process without becoming intrusive. A better assessment strategy is to use simulations and other highly interactive systems. Such tools can discreetly track student performance data without interfering with the problem-solving process. This paper will explore the use of interactive environments as an assessment technique of the problem-solving processes within Web-mediated courses and will focus on an example developed by the authors for use in an applied statistics course.

Introduction

An essential component of effective teaching is to constantly assess the level of understanding throughout instruction. Within a classroom the teacher performs this task by observing students' actions while asking questions and assigning tasks. The teacher can then adjust the flow and method of instruction to better meet the needs of students. To obtain an equivalent result, Web-mediated materials must provide similar data to either an instructor or to another computer system for the purpose of guiding the next level of instruction. Traditional multiple choice and short answer questions can assess final solutions but fall short in addressing problem-solving questions such as "At what step did this student get off track?" or "At which steps do large groups of students fail?" One possible solution would be to ask multiple choice and short answers questions throughout the problem-solving process. However, this solution has the potential of affecting a student's actions by requiring him to mold his own solution path to one dictated by the assessment vehicle. This limitation makes this option an inferior choice. A better solution is to use highly interactive "sandbox" tools that allow a student to pursue his own problem-solving path. This solution contains a minimal amount of biasing information that would guide the learner in any particular direction. More importantly, such tools can record additional pieces of data necessary to properly evaluate problem-solving skills and to effectively prescribe remediation. Possible data to collect are the problem-solving steps taken, the order of those steps, the time required for each step, and the dead ends pursued and abandoned. All of this can be collected unobtrusively without affecting the students' actions.

Example

To accomplish these goals, we have developed several mathematical Java™ applets that provide the tools needed by a student to solve a wide range of problems within a "sandbox" environment. This paper considers a problem-solving exercise using a statistical applet to illustrate how how sequences of behavior can be captured through the applet and used to assess student problem-solving skills. Note: This example with the live applet is available at http://www.coe.tamu.edu/publications/strader/site2001/.

Problem. Consider the following scatter plot of data from ninety-two college students who were asked to report height, weight, and gender. When data from males and females are combined, the correlation between height and weight is 0.78. However, when you look at the data for males and females separately, the correlations are 0.60 and 0.49, respectively. Using the scatterplot below combined with your knowledge of how correlation coefficients describe relationships between variables, determine which of the points are "male" and which are "female." **Note**. The average height for males (20 to 29) is 68.8" (S.D. = 3.0") and the average height for females (20 to 29) is 64.6" (S.D. 2.5"). How would the correlation coefficients be interpreted? In general, what cautions must be must be exercised when interpreting correlation coefficients? Why?

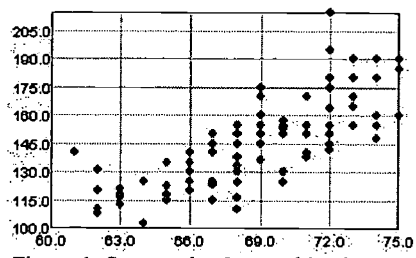


Figure 1: Scatter plot for combined sample

This problem sits on a Web page with the live applet. Each student will attempt to solve this problem by designating each point as either "Male" or "Female" so as to achieve the specified correlations. The objective of this exercise is to assess a student's understanding of correlations and in the process inform the student about potential problems with interpreting correlation coefficients when groups are combined. By having students solve this problem using the applet, we can look for important patterns within student solution processes. Figure 2 shows a subset of the sequence of steps a student might take to solve this problem.

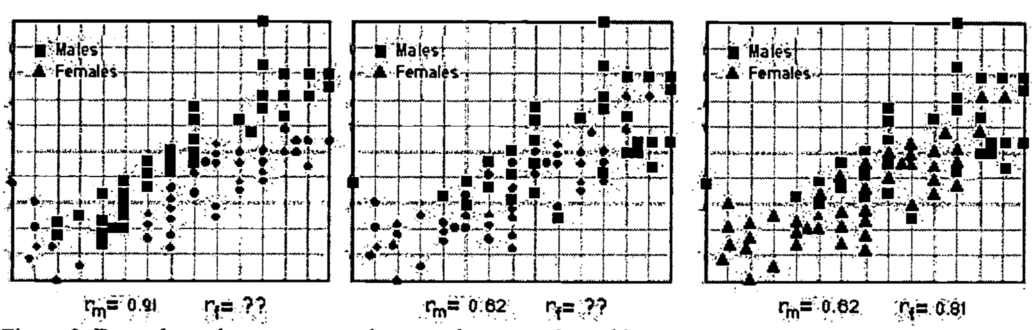


Figure 2. Example student sequence taken to solve example problem

The sequence in Figure 2 shows a student designating points as "Male." In the first screen, the student replaces cirlces in the scatterplot with the box symbol designating male and returns a correlation of 0.91. This is too high so in the second screen you can see that the student has modified the point selection to reduce the correlation coefficient to 0.62. Having achieved the target coefficient for males, the student then designates the rest of the points as "female." Clearly, the problem has not been resolved as the coefficient for females is 0.81. Presumably, the student would continue to revise the point selection to come up with better overall designations. The question is whether the modifications are systematic and informed by his/her knowledge base or more randomly targeted at an end point. Whatever solution path a student follows, a real-time record is preserved. The sequence of modifications can be replayed and form a basis for student/instructor or instructor/class discussion. Interactions between student and instructor can take place either face-to-face or at a distance with no loss of information.

The Formative Evaluation of a Computer-Managed Instruction Module: Metric Instruction for Pre-Service Elementary Teachers

A.W. Strickland, College of Education, Idaho State University, USA. strialbe@isu.edu
John Springer, College of Education, Idaho State University, USA. jspringer@ida.net
Martin Horejsi, College of Education, Idaho State University, USA. martinh@isu.edu
Jane Strickland, College of Education, Idaho State University, USA. strijane@isu.edu

Abstract: A Computer-Managed Metric Instruction Program (CMIP) providing instructional units on basic metric concepts has been developed. A blending of Gagné, et al. (1992) and the developmental theories of Bruner (1966) provides the pedagogical basis for the instructional design. The instructional design model used to create each lesson utilizes a system of "branches" allowing a student who has difficulty with a specific lesson to be routed to appropriate remedial exercises. Each unit has a companion review module for students who obtain a score that meets the pre-test criterion for that particular unit. The pre-test for the area module consisted of 15 questions, three each on the following square unit segments: kilometer, meter, decimeter, centimeter, and millimeter. Results indicate that the use of concrete materials adds a learning dimension to those students who need a transition between the "hands-on" learning modality and the more abstract learning module presented in the CMIP.

Introduction

One of the new facets of the elementary science methods program at Idaho State University is the increase in the science and mathematics general education requirements. These additional science and mathematics requirements were spawned by a survey that indicated a serious deficiency in the science content knowledge of elementary school teachers (Strickland & Horejsi, 1999).

One alarming feature found in the analysis of the survey data was the apparent lack of knowledge and understanding of the metric system within teacher work samples. A parallel survey was conducted of pre-service elementary students and the results were similar: Lack of science content knowledge and, of particular interest for this research, a serious lack of knowledge of the metric system. Two decades ago, Strickland (1980) reported a similar lack of science and metric system knowledge among pre-service teachers at Indiana University.

The solution at Indiana University was a computer-managed program using the PLATO computer-learning system. After using PLATO for five weeks (i.e., five 3-hour sessions on the system), the metric performance among pre-service elementary teachers increased by 86%, and there was a corresponding change in science content knowledge and science teaching in the elementary school classroom. Apparently, as evidenced by the survey data referred to earlier (Strickland & Horejsi, 1999), the issue of science and metric illiteracy has resurfaced.

Idaho State University has embarked on a much larger research effort focusing on the design and development of a Computer-Managed Metric Instruction Program (CMIP). The CMIP software comprises instructional units providing basic metric concepts for each of the following measures: Length, area, volume, mass, force, and temperature. Uniquely, this instructional package consistently uses a pedagogical model based on the behaviorist views of Gagné (1962, 1968, 1970), and Gagné, Briggs, and Wager (1992). While each of these theorists offers the premise that correct sequencing of conceptual knowledge in conjunction with a mastery approach leads to meaningful learning by the student, the design team for CMIP felt the most effective sequencing model would be a blending of Gagné, et al. (1992) and the developmental theories of Bruner (1967).

Bruner (1967) stresses that the effective use of information is found only when the learner has successfully translated the information into a form the learner normally uses in problem solving. Without this translation, according to Bruner, "Though it is logically usable, it is psychologically useless" (p. 53). To this end Bruner has applied a multi-branching model to learning. This model is incorporated into the metric instructional units discussed in this research.

Additionally, Rodrigues (2000) highlighted several fundamental differences between behaviorist and constructivist views as they impact multimedia development. These views are expressed in the following excerpt:

> Some of the strengths of behaviorist tutorials – for example, repeat practice, reinforcement, and control – are almost the opposite to goals advocated by constructivist philosophies (Heinich, 1984), where the notions of reflection, active construction, personal relevance, and autonomy (Lebow, 1993) are considered crucial constructivist learning facets. (p.1)

The instructional design model used to create each metric lesson utilizes a system of "branches" (as opposed to linear programmed learning). For example, a student who has difficulty with a specific lesson, or who shows deficiencies in command of a subject (identified by pretest results), can be routed to a review section or to remedial exercises, meanwhile all other students progress through increasingly more difficult exercises. Thus, the system is simultaneously a "Tutor, Tool and Tutee" (Taylor, 1980). As a result, this research concentrated on the design and development of the metric area module as the first module of the entire metric system course (and to act as a prototype for the remainder of the modules).

This selection, based on metric pretest data (see Table 1), indicated a serious deficiency among the students' ability to perform calculations in determining area (mean score = 4.620) and volume (mean score = 4.440).

Section		# questions	N	Mean	SD
Length	1	15	56	7.425	1.84
Area	2	15	56	4.620	2.30
Volume	3	15	56	4.440	1.77
Mass	4	9	56	3.717	0.98
Force	5	8	56	2.200	0.83
Temperature	6	8	56	2.680	0.68
Total		70	56	26.65	1.56

Table 1: Metric Unit Pre-Test Data

Metric area was selected instead of metric volume since the skills and concepts needed for the volume module were subsumed by the area module. The wide variation (SD = 2.30) in score on the metric area was an additional rationale for selecting this module to be first.

Computer-Managed Metric Instruction Package (CMIP): Unit Design

The CMIP software package (Fig. 1), has four primary elements; (1) the introduction to metrics module, (2) the pretest and skill assessment module, (3) the metric instructional module, and (4) the posttest and analysis of results module.

The introduction to metrics module is composed of an overview of the CMIP metric instruction. The student is guided through an array of examples which depict the metric system being used to measure length, area, volume, mass, force, and temperature.

The pretest and skill assessment module is designed to access the students preknowledge of the metric system, rudimentary mathematics skills and selected learner aptitudes.

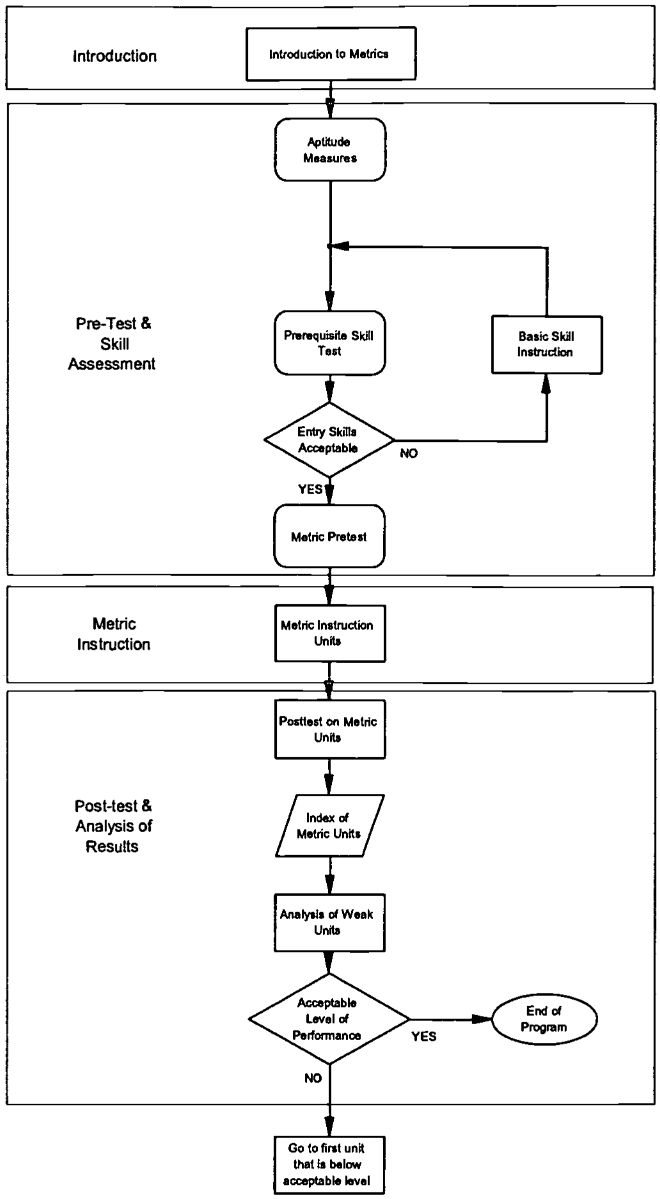


Figure 1: Computer-Managed Metric Instruction Package (CMIP) flow chart outlining the elements of the metric instruction. If the student does not meet acceptable level of performance they are returned to the first unit that was below the acceptable level.

The metric instructional module consists of six metric instructional units (Fig. 2): Length, area, volume, mass, force, and temperature. Each unit describes the basic unit of measurement and explores units, which are smaller and larger than the base units.

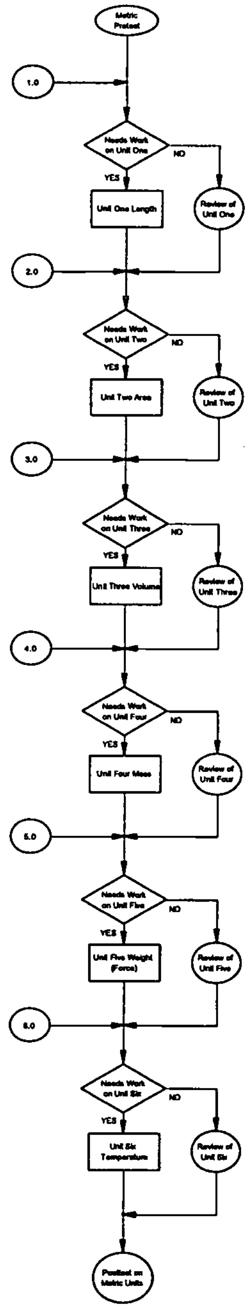


Figure 2: Expanded flow chart of the Metric Instructional Module of CMIP. The Metric Instruction Module uses data from the pre-test module to determine the appropriate lessons for the student.

The posttest and analysis of results module is designed to measure the performance level of each student. If the performance level is acceptable then the student passes the metric course, if weakness (low performance) exists in any unit the student is guided back through that unit until an acceptable performance level is reached.

Formative Evaluation of the Metric Area Module

The metric area unit consisted of four segments (Fig. 3): (1) An introduction to the module, (2) the base unit module (square meters), (3) three modules with measurements smaller than the base unit (square decimeters, square centimeters, and square millimeters), and (4) one module with measurements larger than the base unit (square kilometers).

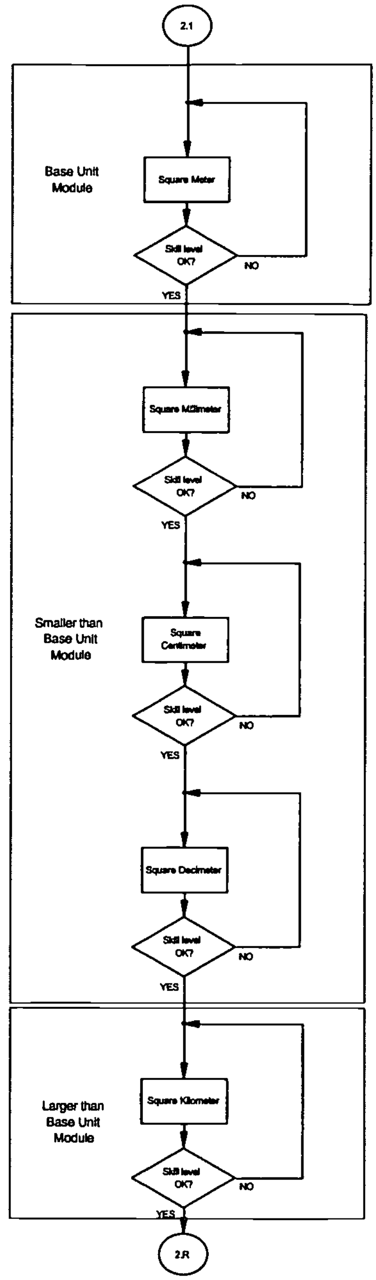


Figure 3: Metric Area Unit flow chart. After a brief introduction (2.1) the unit begins with the base unit of area and ends in a review and post-test (2.R) of the area unit.

The pre-test data for the metric area module consisted of 15 questions, 3 each on the following square unit segments: Kilometer, meter, decimeter, centimeter, and millimeter. The mean of the square kilometer was lowest (X = .20, SD = .09; out of 3); thus, this module was selected to be the initial module segment to be tested. The square kilometer segment (Fig. 2) consisted of several large regular shaped objects (scaled to fit on a standard monitor), such as New York's Central Park. Central Park is rectangular in shape and made a good first example of the area calculations for large objects. After several similar examples, the instruction moved forward to irregular shaped large objects, such as a large reservoir in the geographical area. A scaled one-square kilometer area was used with the technique of summing whole and partial grid squares. The instruction produced a significant change in the performance on the module segment (X = 1.35, SD = .57; out of 3).

Summary

The analysis of the data collected during pilot test of the Metric Area module: Square Kilometer segment was critical in determining alterations needed to this module segment and additional components. This data analysis has shaped the instructional process for each of the remaining modules. While observing the students participating in the computer-managed module segment on square kilometers, it became apparent that each module must be constructed with some use of a manipulative, as well as the computer software. Apparently, the use of concrete materials adds a learning dimension to those students who need a transition between the "hands-on" learning modality and the more abstract learning module presented in the computer software.

References

Bruner, J. S. (1967) *Toward a theory of instruction.* Massachusetts: Belknap Press.

Gagné, R. M. (1962) The acquisition of knowledge. *Psychology Review, 69*, 355-365.

Gagné, R. M. (1968) Learning hierarchies. *Educational Psychologist, 6*, 1-9.

Gagné, R. M. (1970) Conditions of learning. New York: Holt, Rinehart, and Winston.

Gagné, R. M., Briggs, L. J., & Wager, W. W. (1992) *Principles of instructional design.* Texas: Harcourt Brace Jovanovich, Publishers

Rodrigues, R. (2000) A Survey of Mathematical skills of Elementary Teachers. *Journal for Research Mathematics Education, 31*(4) 396-428

Strickland, A. W. (1980) Metric instruction in elementary science using computer-managed instruction. *Alberta Science Education Journal, 18*(2), 10-13.

Strickland, A. W., & Horejsi, M. (1999) An Examination of the Knowledge and Skills of pre-service Southeastern Idaho Elementary Teachers. Center for Technology Solutions, Technical Report No. 2

Taylor, R. (1980) *The computer in the school: tutor, tool, tutee.* New Jersey: Teachers College Press

Online Teaching Tools: Early Results of a Survey of Online Instructors

Dr. Lucio Teles
Centre for Distance Education
Simon Fraser University
Canada
teles@sfu.ca

Irina Tzoneva
Faculty of Education
Simon Fraser University
Canada
itzoneva@sfu.ca

Abstract: As online learning becomes increasingly common and an integral part of our educational system, it is important to investigate how instructors and students teach and learn in the online classroom. This paper presents preliminary results from a research in progress which studies the use of instructional tools by online instructors. We are collecting data on the most used tools, the tasks they accomplish, and on the impact of their use as reported by instructors. The research focus is on instructor tasks which are facilitated by online tools, whether the use of these tools increases or decreases instructors' workload, according to their own perceptions, and how online instructors value the use of tools for online teaching.

Introduction

The face-to-face classroom has been the vehicle for imparting instruction to learners for the last four hundred years. Instructors teaching in the classroom have used various traditional tools to support their teaching activities: the blackboard, the chalk, print material, media material for class presentations, classroom attendance list, and many other tools which have become essential components of classroom teaching (Ong, 1982). More recently, with the advent of the World Wide Web (Web) and the online classroom, instructors are also beginning to use tools to support online teaching (Harasim, 1999; Bonk, 1999; Teles, Ashton, & Roberts, 2000). Developers of these tools claim they help instructors in the task of online teaching.

While tools are used in both the face-to-face and the online classroom, the nature and function of these tools vary from a face-to-face to an online mode of teaching. Face-to-face and online teaching have similarities but have also their own specific attributes as learning environments. Berge (1998) developed a framework that captures the specificity of instructor's tasks in online environments. He identified four roles for the online instructor: pedagogical, managerial, social, and technical. Some of these roles may have a direct impact on online teaching, and others may be presented as supportive to teaching, such as the social role (Wegerif, 1998). These four roles and the teaching tasks associated with them can be supported by tools such as the online gradebook, usage statistics on student participation in the online classroom, automatic reminders for due assignments, chat for online office hours, etc.

Some instructors state that online tools help them to teach online and facilitate classroom management while others may argue that these tools are not very useful and also they add more workload to instructors. While the use of Web tools is on the increase with online educational services and portals offering various instructor tools, it is not yet known whether these tools are being used by instructors, which teaching tasks are supported by them, and whether they help online teaching.

This paper discusses the use of tools to support online instructors. We are investigating the use of tools that facilitate the process of online teaching: online grade books and evaluation, online classroom attendance, information-sharing capabilities, creation/management of group work, assessment, interaction with instructor, etc. While there are advanced systems for student record management, to generate statistics about students, and to keep track of payments and related administrative information, these tools are not of direct interest to our research.

For the purposes of this research study an online instructional tool is defined as a software that supports the instructor of the virtual classroom in his or her online teaching tasks and activities. We are mainly interested in tools currently being used by online instructors such as ICQ (for office hours communication), usage statistics generator for class attendance (hours spent in the different areas of the online classroom, number of messages read and written), gradebook, and other related teaching tools.

Related Literature

A review of the literature on the use of tools to support the online instructor was conducted. This was done through library research restricted in most cases to the years 1997-2000 and using the Eric database, (filtered through the Information Technology Clearing House), and Web online research, using primarily the Google.com search engine. The key words used for the search were: Instructional Technology, Online tools, Faculty Development and Online Learning, Evaluation of Instructional Technology, Tools for Interactive Course Delivery; Technology and Instructors, Computer Mediated Learning. The online search yielded the most current and relevant information, and provided links throughout the academic network which pointed to known, reputable sites and scholarly research in this area.

Information technology for teaching and learning is now being widely used in education, including tools by online instructors (Frayer, 1999; Fletcher, 1998; Heinich, Molenda, Russell, Smaldino, 1999; Lee, Groves, Stephens, Armitage 1999). Although there are some studies in evaluating and comparing online software tools, (FutureU, 2000; Marshall University 1999; University of Canberra, 1999; Douglas College, 1999 and University of Manitoba, 1999; University of British Columbia; University of Alberta; University of Toronto, etc.) there appears to be little research available on how the tools have impacted instructor's teaching activities.

Furthermore, there is not much evidence in the research literature of online tools being evaluated for their pedagogical benefits. The need very often expressed by educators, is that the online environment allows for more flexible teaching and access to resources and peers, promote collaborative student-centered learning and generally be more educationally effective (Britan, & Liber, 1999), and online tools support instructors tasks in these online environments.

In one of the few studies on the use of online tools, instructors from the Brigham Young University were surveyed on their reactions to an online course management tool used at the university (DLE, 1999). The findings show that in spite of a widespread acceptance of the potential of online teaching there is a fear by many instructors as to how they will make the transition to online teaching with the limited resources of time and money currently available. Findings also showed that instructors value tools as long as they help them to execute tasks and to save time. Tools have to facilitate the work of teaching and information-sharing, should take little time to learn, are easy to use, and have adequate university support structure in place.

There are many Web tools to support online teaching tasks, for managerial, pedagogical, social, and technical tasks. These tools offer features that supposedly make them valuable to instructors, such as:

- provide asynchronous and synchronous communication between students and instructors, and groups of students;
- allow instructors to gather data, (usage statistics tools) manage assignments, or test students via the Web;
- offer the opportunity for chats in real-time, (Olmstead, & Kontos, 1997) and
- allow instructors to continuously follow students' progress.

Method

The study involved online instructors from different educational institutions. Our approach consisted of: (1) review the literature in the field; (2) questionnaire with selected online instructors; (3)follow-up in-depth interviews with a group of online instructors who had previously responded to the questionnaire, (4) validation of findings by a group of expert online instructors and academics.

Participants

The survey started in November 2000 and it is expected to run to February 2001. The participants include online instructors teaching online or mixed mode from Canada, the United States, Mexico, the Netherlands, Greece, Colombia, and South Africa. Formal consent was obtained from all the instructors who participated in the study.

Procedure

The online instructors were chosen from Canada and other countries. The primary source were the scholars from the TeleLearning Network of Centres of Excellence, in Canada. However, we decided not to limit ourselves to Canada and tried to reach other online instructors through different ways including listservs, newsgroups, and our Web page. The survey began by contacting potential participants by e-mail or letters to find out whether they would like to participate. The next step was to complete our questionnaire. The questions sought some background information but were primary looking for answers for our research questions: (1) Which are the tools most commonly used by online instructors to support their online teaching activities; (2) Does the use of tools increase or decrease instructor's workload, according to his/hers perception; (3) How do online instructors value the use of tools for online teaching. The next step will be a follow-up in-depth interview with selected participants to help us expand findings and areas where more information is needed. The last step will be validation of findings with the help of academics considered experts in the field.

Early Results

Early results of the study provide information about online instructional tools and how they are used by the online instructors. The preliminary results from ten questionnaire responses are reported here. The respondents are from Canada, the USA, Colombia, and Greece. The information we are investigating is: the correlation between the teaching mode and the amount of used tools; the use of online teaching tools and the desire for newly developed tools; the tools that are found to be very and somewhat helpful, and the most beneficial tools. We found that the distribution of courses taught entirely online to mixed mode was half and half. All of the instructors stated that they find the use of online tools helpful. Here are some of the comments they made: "Much functionality is not even used"; "The variety of tools certainly helps with the effective delivery of the course"; "The communication between the students and me has improved a lot"; "The question is what can you do with the tools to provide a better learning for the students."

Asked whether the expectations about the amount of online tools needed to teach online had changed after they used these tools, we found that all of them would like to have more Web-based tools to support their teaching.

The instructors also stated that the following new tools are needed: instructional design tools, role-play tools, debate tools, brainstorming tools, videoconferencing tools, conferencing with wireless application protocol (WAP), streaming video tools, dynamic learning environment tools. The tools found to be the most beneficial are: e-mail, student tracking, sharing information tools, bulletin boards, conferencing tools. The advantages found in the use of online instructional tools include: learning process enhancement, different sets of learning opportunities in the classroom, place independence, providing structure and unity to the course, offering effective course delivery and flexibility, supporting time management. The disadvantages mentioned are relatively less compared to the advantages and they consisted of: difficulty when securing information, rigid structure, and technological glitches. The following table represents the ratings of how the online instructional tools facilitate and support the instructor.

Online Tools	Very helpful	Somewhat helpful	Requires additional support	Not used at all
Course Syllabus	50%	10%	10%	30%
Multiple choice questions	10%	40%	10%	40%
True/false questions	10%	40%	10%	40%
Matching questions	10%	40%	10%	40%
Short answer questions	10%	10%	30%	50%
Fill in the blank questions	10%	20%	10%	60%

Generation of random set of questions	10%	10%	10%	70%
Online gradebook	50%		10%	40%
Number of written messages	40%	40%	10%	10%
Number of read messages	50%	30%	10%	10%
Unread messages	20%	40%		40%
Reminders for due assignments	50%	20%	10%	20%
Glossary	20%		30%	50%
Chat	40%	30%		30%
Whiteboard	20%	10%	10%	60%
Plagiarism checking	30%			70%

Table 1: Ratings of Online Instructional Tools

Discussion and Conclusions

The results of this early survey show that online tools support and impact instructors teaching in different ways. Results also indicate there is a need for the development of new software tools and show as well that existing tools are being incorporated into the process of process of online teaching. While online tools in many cases are found to be supportive to the task of online teaching, technical problems associated with their use often disrupt online teaching.

Further data collection from this study in the next three months may add new information and may also extend and expand early findings of this survey. This preliminary study also points to new research directions needed to be conducted on the use of online tools to support online teaching, particularly in regards to which teaching tasks are supported by these tools, how they support the instructional method and the pedagogy of instructors, and what they offer regarding the assessment and evaluation of online students.

References

Berge, Z. (1997). Characteristics of online teaching in post-secondary, formal education. *Educational Technology*, 37, 35-37.

Bonk, C. J., & King, K. S. (Eds.). (1998). *Electronic Collaborators: Learner-centered technologies for literacy, apprenticeship, and discourse*. Mahwah, NJ: Lawrence Erlbaum Associates.

Britain, S., & Liber, O. (1999). A Framework for Pedagogical Evaluation of Virtual Learning Environments. *Report prepared for JISC Technology Applications Programme*. [Available online: <http://www.jtap.ac.uk/reports/htm/jtap-041.html#_Toc463843840>, retrieved June 21, 2000].

Chen, Z. (1999). *On Tools for Education*. School of Engineering, Kristiantad University, Sweden. [Available online: <http://rimula.hkr.se/~chen/webresources/edtool-report.html>, retrieved Aug. 13, 2000].

Fletcher, K. (1999). Teaching Nonprofit Management Online: Instructors' Experiences and Lessons Learned. *Paper presented at the 1998 ARNOVA Conference*. [Available online: <http://www.futureu.com/fletcherarnova98.html>, retrieved June 1, 2000].

Frayer, D. (1998). Creating a campus culture to support a teaching and learning revolution. *Cause/Effect*, 22(2). (EDUCASE) [Available online: <http://www.educause.edu/ir/library/html/cem9923.html>, retrieved Sept. 15, 2000].

Harasim, L. (1999). A framework for online teaching: The Virtual-U. *IEEE Computer*, 32(9), 44-49.

Heinich, R., Molenda, M., Russell, J., & Smaldino, S. (1999). *Instructional Media and Technologies for Learning*. Columbus, OH: Merrill/Prentice-Hall. [Available online: <http://www.indiana.edu/~mmweb98/imtl.html>, retrieved Nov. 22, 2000].

Landon, B. (1999). *Online educational delivery applications :A webtool for comparative analysis.* [Available online: <http://www.ctt.bc.ca/landonline/>, retrieved Aug. 15, 2000].

Lee, S., Groves, P., Stephens, C., & Armitage, S. (1999). On-Line Teaching: Tools and Projects. *JISC Technology Applications Programme,* report 28. [Available online: <http://www.jtap.ac.uk/reports/htm/jtap-028.html>, retrieved June 21, 2000].

Olmstead, P.M., & Kontos, G. (1997). Utilizing Inter-Relate Chat Auditorium for Graduate Instruction. *Paper presented at the Seventeenth Annual Microcomputers in education conference '97 (MEC '97) on Mastering the Electronic Classroom.* Tempe, AZ: Arizona State University.

Ong, W. (1982) *Orality and Literacy: The Technologizing of the Word.* London ; New York : Methuen.

Teles, L., Ahston, S., & Roberts, T. (2000). *The Role of the Instructor in Online Collaborative Environments.* TeleLearning Report: Project 5.25. [Available online: <http://www.telelearn.ca>, retrieved Oct. 20, 2000].

Wegerif, R. (1998) *The Social Dimension of Asynchronous Learning Networks.* Centre for Language and Communication. School of Education, The Open University, Milton Keynes. [Available online: <http:///www.aln.org/alnweb/ journal/vol2_issue/wererif.htm>, retrieved July 20, 2000].

Web Sites Containing Evaluation Results of Online Teaching Tools

Several comparisons of course management tools have been published on the Web, as a resource for others. They provide a good starting point for selecting software for further consideration.

Douglas College, New Westminister, British Columbia, 1999. Available online: <http://www.ctt.bc.ca/ landonline/>, retrieved June 21, 2000]. This site is a collaborative effort of the British Columbia Standing Committee On Educational Technology, the Centre for Curriculum, Transfer and Technology and the Office of Learning Technologies. The site is managed by Dr. Bruce Landon and helps evaluate software for educators.

FutureU, 2000. [Available online: <http://www.virtualu.com>, retrieved Nov. 22, 2000]. FutureU did a comprehensive evaluation of six leading course management software packages to help academic institutions make informed decisions when they purchase or upgrade CMS products and to help developers make informed decisions when they plan for development or marketing.

Western Washington University, Center for Instructional Innovation. [Available online: <http://pandora. cii.wwu.edu/ showcase>, retrieved Nov. 22, 2000]. Western Washington offers an excellent showcase of two online courses with details of what software they chose, how they implemented and how it contributed to a rich learning experience for students and instructors.

Marshall University, 1999. [Available online: <http://multimedia.marshall.edu/cit/webct/compare/comparison. html#instructor>, retrieved June 14, 2000]. This comparison provides reviews on the existing online course delivery software products categorized by developmental features, instructor features, instructional features, student tools, technical support, administrator tools, administrative features, software and hardware costs.

University of Canberra, 1999. [Available online at: <http://www2.canberra.edu.au/cc/flex/webct_report.html>, retrieved May 31, 2000]. Evaluation of WebCT was conducted with the notion to be used as a standard, supported university-wide online management system.

University of Manitoba, 1999. [Available online: <http://www.umanitoba.ca/ip/tools/courseware/evalmain. html>, retrieved June 14, 2000]. This site provides information on tools for developing interactive academic web courses and online educational delivery applications.

TeleLearning Project 7.8: Research Spotlight on National Networks for Learning. [Available online: <http://www.telelearn.ca/g_access/advances/spotlight.html>, retrieved June 1, 2000]. Wudeman, Owston and Shapson are conducting case studies at York University involved with Writers in Electronic Residence (WIER) and Satellite Networked Schools. Their project investigates how network innovations are implemented in the everyday practices of the teachers and the students.

WestEd. [Available online: <http://www.wested.org>, retrieved June 1, 2000]. One of the current projects of WestEd Technology in Education program is the Distance Learning Resource Network. It provides information for the constantly growing number of educational institutions that use distance learning and for the software developers who service the educational institutions.

Recently Developed Online Instructional Tools to Support Online Teaching

Convene.com is a recently developed e-learning platform with built-in instructors and trainers tools. It offers the possibility of creating a customized Home Page which serves as an interface with links to personal e-mail, course materials and Web resources (school and personal related). The currently available tools for the instructors are not significantly different from already existing ones with the difference for posting multimedia files, recorded presentations and video messages <http://www.convene.com>.

Jenzabar.com is a provider of integrated administrative software, Internet infrastructure, and services devoted exclusively to higher education. Jenzabar.com provides its Web-based Intranet application to educational institutions. The highlights include: communication, learning, organizational, and fun tools. The most valuable tools for the instructors would be: the syllabus posting with the daily remainder for the students, the calendar which automatically includes course schedule and the option to participate in a community with people with similar interests <http://www.jenzabar.com>.

MetaCollege.com provides Web-based tools that allow educators to easily develop, distribute, and archive instructional material online to supplement their classroom teaching methods, deliver distance-education courses, or build collaborative online communities. The tools are divided into two large groups: course and community tools <http://www.metacollege.com>.

Information in Place, Inc. (IIPI) is dedicated to helping organizations, enterprises, and individuals create and deliver Internet-based information and services. IIPI offers infrastructure software for mobile and wireless devices and customizable solutions. The company is currently developing a product called Your Information in Place Intellilink, Yiipi. It will be a browser and service system allowing anyone to create and view location-based information that can be authored and viewed by anyone <http://informationinplace.com>.

Plagiarism.org provides the online instructors and trainers with a document source analysis tools to detect plagiarism. The instructor is responsible for registering the class he/she is teaching and afterwards all the papers are submitted to a web site for plagiarism checking <http://www.plagiarism.org>.

The product developed by ThoughtShare Communications Inc. - PlanBee allows the user to map his/hers web journey and save all the relevant Web addresses. It allows for filtering and extracting of information, adding personal comments, attachments. In the end the compiled information could be shared and e-mailed as a knowledge packet <http://www.thoughtshare.com>.

The product Hot Potatoes is developed at University of Victoria, Canada. It enables the instructor to create interactive multiple-choice, short-answer, jumbled-sentence, crossword, matching/ordering and gap-fill exercises for the World Wide Web <http://castle.uvic.ca/hrd/halfbaked/>.

Creative Technology produces three groups of software: teaching and learning software, and development tools. Markin is an annotation program for online and electronic teaching environments. It replaces the traditional red pen with an on-screen marking environment. TexToys allows the instructors to produce on-screen learning exercises which could be delivered to the students as interactive Web pages. Choices is a multiple-choice quiz program. The tests are completed by the student in a password-protected environment. Word-Processor Annotation Buttons are templates containing customized button sectors for annotating sections of a document <http://www.cict.co.uk/software/>.

Inxight Software, Inc., provider of information access and content analysis software solutions, has developed tools which could be useful for the online facilitator. Summary Server extracts summaries from almost any electronic document. Thing FinderTM Server is a text analysis application that automatically identifies, tags and indexes key content–allowing end users to easily browse large amounts of unstructured text. Murax is designed to analyze relationships between concepts whilst users simultaneously could search and browse <http://www.inxight.com/>.

Acknowledgments

This project was funded by TeleLearning Centres of Excellence. We would like to thank all the online instructors who participated for their collaboration and assistance on this research project.

A Model to Design Technology Teacher Training Program

Dogan Tozoglu
Department of Educational Research, Instructional Systems
Florida State University
United States
dtt0212@garnet.acns.fsu.edu

Ilhan Varank
Department of Educational Research, Instructional Systems
Florida State University
United States
iiv1731@garnet.acns.fsu.edu

Abstract: Teacher training is one of the most important factors that determines teachers' use of educational computing in classroom. On Average five to seven-years of training is necessary for a teacher to become a confident user of educational technology (Hardy, 98). However, most teachers do not have enough computer skills (Dupagne, 92) and feel they have not taken adequate training to integrate computer in their classroom. The purpose of this paper is to describe a teacher technology-training model for a private high school in Turkey that incorporates the notion of instructional design and systems thinking. The training model is structured around the generic ADDIE model, which is Analyze, Design, Development, Implementation and Evaluation. However, the model provided in this paper is situation-specific and has additional elements to satisfy the need for in-service technology teacher training.

SETTING: ORGANIZATIONAL CHARACTERISTICS

The school for which the technology-training program will be designed is a private non-profit high school in Turkey. The goal of the school is to provide formal high school education and prepare its students for nationwide standardized university entrance exams. The school has 25 successful experienced teachers with approximately 300 students.

Due to the rapid diffusion of instructional technology in education, the high school management has decided to adapt computer technology in the classroom. Even though the school has an in-service teacher-training program with a little emphasis on computer technology there is no well-designed and specific technology training model and program for its teachers. The purpose of this paper is to create a new teacher training design model to replace with the present one. This model will assist the in-service trainers in the school to form a new training to help teachers become familiar with computer technology and integrate it into their classroom instructions. For example, if a teacher teaches mathematics, he/she will be trained on how to teach mathematics with the support of computers.

PROBLEM ANSLYSIS: GAPS IN THE PRESENT TRAINING PROCESS

Because of the nonsystematic procedure the school in-service trainers employ, there are numerous deficits with the current training programs indicated below:

- Needs assessment is not conducted to determine the minor and major gaps in teachers' technology use in the classroom
- There is no job analysis conducted as to how teachers can integrate technology in the instruction successfully

- There are no established performance objectives and performance measurements pertaining to successful technology integration.
- There are no defined rules specifying how to deliver the training efficiently.
- There are no standards for creating training materials.
- There is no quality control of training process and materials.
- There is no formative evaluation process.

THE RECOMMENDED TRAINING DESIGN MODEL

The recommended model is very similar to the general instructional design process, in which planning, design, production, and implementation are the main steps (Flagg, 1990). However, to make it efficient, three categories were added to it and the sub-categories were elaborated.

The New Model
Pre-design → Needs analysis → Job/Task analysis → Design → Development → Pilot test → Evaluation

1.) Pre-Design
Establish a design team (at least one instructional designer and one Subject Matter Experts (SME) from every teaching branch, such as computer-based math instruction, computer-based science instruction etc.)

2.) Needs Analysis/Assessment
2.1. Establish the objectives of needs assessment for technology teacher training
2.2. Determine target teachers to be trained
2.3. Determine data collection techniques for the needs assessment
2.4. Determine data collection procedure
2.5. Determine data analysis methods
2.6. Evaluate previous steps
2.7. Conduct needs analysis
2.8. Determine if there are discrepancies between required performance and actual on the job-performance in teachers' technology integration
2.9. Analyze performance problems
2.10. List evidences of the problems causing low performance in teachers' technology adaptation
2.11. Speculate on what would be the most important problem causing the insufficient integration
2.12. Evaluate the previous steps
2.13. Determine the training solution and non-training solution to help teachers use the technology successfully in the classroom

3.) Job/Tasks Analysis
3.1. Indicate desired results from job analysis
3.2. Decide how results will be used
3.3. Conduct the data collection
3.4. Identify job requirements for teachers to successfully integrate the technology in the curriculum
3.5. Divide the job into functions, duties, and tasks
3.6. Identify entry level behaviors, attitudes and skills to successfully integrate the technology in the curriculum
3.7. Identify the minimum acceptable criteria for each task
3.8. Evaluation

4.) Design
4.1. Write technology-training objectives
4.2. Sequence the objectives
4.3. Identify the content sources
4.4. Write course title
4.5. Make course map
4.6. Sequence learning activities

4.7. Determine level of training
4.8. Chose instructional strategies
4.9. Determine instructional tactics
4.10. Prepare training material specifications
4.11. Recommend delivery method
4.12. Make delivery schedule for training
4.13. Match performance, conditions, and criteria specified in the terminal objectives and each of the learning objectives.
4.14. Develop test
4.15. Evaluate

5.) Development
5.1. Conduct research pertaining to existing materials
5.2. If there are existing materials, evaluate, arrange and modify existing materials
5.3. If there are no existing materials, write new instructional and administrative materials
5.4. Produce necessary media
5.5. Evaluate

6.) Pilot test
6.1. Select a representative sample from the teacher population
6.2. Create a realistic pilot test environment
6.3. Conduct the plot test
6.4. Monitor the plot session
6.5. Get feedback
6.6. Conduct debriefing session
6.7. Document result of plot test
6.8. Make necessary modifications with instructional materials
6.9. Evaluate instructional materials for specific teaching/learning situations
6.10. Have all materials ready to distribute

7.) Evaluation
7.1. Select evaluation team
7.2. Determine purpose, objectives, audience, and subjects
7.3. Assess information needs
7.4. Create evaluation materials
7.5. Consider proper protocol
7.6. Conduct the evaluation plan

PRE-DESIGN

Pre-design is the first step in which the necessary personnel are identified to create the training program. Usually instructional designer(s) and subject matter experts (SMEs) are the key people who create the training. The SMEs should be individuals who have significant experience in teaching with the technology in different subject areas, such as math, science, literature etc. After the personnel are identified a project-planning meeting is held, and an action schedule, cost of the training and other relevant matters are determined.

NEEDS ANALYSIS

The second step, needs analysis, helps the instructional design team compare the current teachers' technology integration level and the expected level in the school in order to identify the teachers' performance gap. The purpose of needs assessment is to uncover(more precisely than performance analysis does) what the performance problems are, who they affect, how they affects them, and what results are to be achieved by training. Needs assessment is very important because all subsequent steps in the ISD model depend on its results. A needs assessment identifies gaps in results, places them in an order of priority, and selects the most important for closure or reduction. To develop a needs assessment plan, instructional designers should first clarify why they are doing the assessment. (Rothwell & Kazans, 1998)

JOB/TASKS ANALYSIS

The job/task analysis is conducted to identify the functions, tasks, and skills necessary to accomplish the job, namely, successful technology integration in the classroom. Job analysis determines what teachers actually do to employ computers and identify the job norms. A task analysis is carried out to determine components of job performance, identify activities that may be simplified or otherwise improved, determine precisely what a teacher must know, do, or feel to learn a specific job activity, clarify conditions, equipment and other resources needed for competent performance, and establish minimum standards for how well job incumbents should perform each task appearing in their job descriptions. Like a blueprint, data collection tools and evaluation of data are planned prior to conducting the analysis. After the data collection, the results are illustrated in a comprehensive manner. The preferred way to exhibit the job/task analysis results is tabular form. The table should show the job title and functions, duties, and tasks associated with the job. In addition to the table, the knowledge, the skills, the attitudes and the entry-level behaviors should also be reported.

The table and the report should be used to identify the training specifications. Our main purpose is to carefully inspect the table and find out the problems associated with the job's functions, duties, tasks, skills, knowledge etc. Then, according to the findings, the training programs are designed or several non-instructional solutions are identified, such as job aids to cover those problems.

DESIGN

The design step includes creating the training plan. Similar to a regular course plan, the design process includes writing and sequencing the objectives, targeting the problems, creating a course content including the information to recover the performance deficits caused by the problems, considering the learning strategies and tactics for the effective learning, creating the instructional materials and delivery platforms to facilitate the delivery while creating the evaluation tool to measure the performance at the end of the training. Some criteria for the good designs would be as include:1) training units in a harmony with objectives and content areas, 2) objectives associated with the duties and tasks, 3) instructional strategies, tactics, and activities consistent with the learner group, the content, the performance level and so on. The objectives should clarify in measurable terms what trainees should be able to do at the conclusion of the training, how well they should be able to do it and what conditions have to exist or equipment has to be available for them to exhibit the performance.

Performance objectives should contain at least two components of performance, criterion, and condition. The resulting sequence of objectives becomes the basis for an instructional outline. It is a blue print for choosing an instructional strategy and selecting, modifying or preparing instructional materials. Rules for sequencing instruction provide guidance for instructional design.

An instructional strategy is a plan for systematically exposing learners to experience that will help them acquire verbal information, establish cognitive strategy or develop intellectual skills, motor skills, or new attitudes. An instructional tactic is any instructional activity undertaken to facilitate a strategy. No, one instructional strategy works uniformly well under all conditions. To choose the appropriate strategy, consider the learners, the desired learning outcomes, the learning and working environments, and constraints on the instructional design process (Rothwell & Kazans, 1998).

Evaluation is one of the most important items in this step, because according to its results we will justify if the trainees gain the required skills, knowledge and performance levels. The proposed evaluation strategy is pre-test and posttest process. The pretest determines the trainees' knowledge before they engage in planned experiences. By the end of the planned training experience, posttest determines how well learners have achieved the terminal performance objectives (Rothwell & Kazans, 1998).

DEVELOPMENT

In this step the actual teaching and learning materials, such as teacher manuals, study materials, slides, computer presentation, etc., are created as specified in the design documents. The key persons are the subject matter experts and the developers. Before producing the course materials, due to cost effectiveness issue, research is conducted to find out if there are any ready-made materials that are compatible with the required specifications. If some existing materials are found, several modifications are performed to make them more appropriate for training purposes. If no materials are found, new materials and media will be produced. This includes storyboarding, outlining, proceeding through writing and editing, and developing visuals, tapes and other computer related media.

While using appropriate existing instructional materials, it may be necessary to organize or modify the materials in ways appropriate to satisfy the objectives. Based on the instructional strategy and media that were selected earlier, detailed outline will help summarize the content of planned learning experience or series of related learning experience. Storyboard will also be created for a visual representation, which illustrates the text, graphics, and interactivity that will appear in the training program (Rothwell & Kazans, 1998).

PILOT TEST

The pilot test aims to assure the quality of the training materials in terms of teaching and learning. According to the results of the pilot test, several revisions, if necessary, are made to improve the materials. During the pilot test, a representative sample from the target population is selected and like a real-life training environment is created. Then the test is conducted, data is collected on students' performance and attitudes, the results are discussed and evaluated, and the final modifications are made in the materials. The pilot test will capture participants' reactions to instructional materials in a setting similar to that in which the instruction will be delivered. It gives instructional designers valuable information about the effectiveness of the instructional materials by the information collected from the target trainees group (Rothwell & Kazans, 1998).

FORMATIVE EVALUATION

Formative evaluation is concerned with the quality of the instructional design process rather than effectiveness of the training materials. The plot test's scope is the quality assurance of the materials that will be used during the training. Prior to general use, instructional materials and methods should be evaluated and revised to increase their instructional effectiveness. This helps to minimize learner confusion (Rothwell & Kazans, 1998). It is advised that formative evaluation be conducted by a different team including subject matter experts and an evaluation expert or instructional designer. The formative evaluation is conducted and a suggestion report is written. The suggestion report will contain information including any necessary modifications with the segments of the ID process. As specified in the report, necessary changes are performed in the design process.

STAFFING

To conduct the instructional design process, several specialists are needed, such as instructional designer, evaluation specialist, subject matter experts, etc.

Instructional designer: Instructional designer is the manager of the process and responsible for hiring new staff, controlling the work process and writing scheduled reports to the principle of the school. Evaluation specialist is responsible for the formative evaluation conducted in the every step and in the plot test. If an evaluation specialist is not found, ideally another instructional designer can be hired for the evaluation task. Two sets of subject matter experts will be considered. The first group expert is responsible for the designing the training materials under the control of the instructional designer. Also, they are going to be involved in the production process to control the quality of media in terms of the materials' teaching capabilities. The second group of subject matter experts is responsible for conducting and evaluating the plot test with the evaluation specialist. Media developers are responsible for the material production. They work with the instructional designer and the subject matter experts. Moreover, it is possible to make an agreement with a media development company. Therefore, instead of hiring media developers, making an agreement with outside subcontractor is also a possibility.

JUSTIFICATION OF THE NEW MODEL

The main purpose is to create a teacher technology-training model that incorporates the notion of instructional design and systems thinking for the new teacher candidates as well as the experienced teachers who will integrate computer technology into their instructions. Before composing the model, many instructional design processes were reviewed. The appropriate models for training design were selected and reviewed. All steps and sub-steps were rearranged.

CONCLUSION

Our purpose is to create a technology training model and program for the high school teachers in the school in Turkey. The general instructional design model was not appropriate for this purpose because it has limitations with its four steps, which are planning, design, production, and implementation. We elaborated on this process and added three steps. The three steps emphasize team building, training (product) evaluation and process evaluation. Additionally, we elaborated on the sub-steps under the main seven steps to make the new model more systematic, clearer and effective to use.

In the new model, evaluation is divided into two different phases. Pilot training and formative evaluation activities are given more emphasis. Pilot training is concerned with the quality of training. It evaluates how well and accurately the training is created in terms of media and subject area information, how effectively it teaches, what impact it leaves on the trainees. Formative evaluation is concerned with how effectively and accurately the sub-steps are conducted.

We do not expect any obstacles in the implementation of the plan. However, this kind of training design is the first attempt in the high school. We think that the personnel in the school will naturally have specific questions and opinions concerning this project. It is important that we address any comments and/or concerns that arise, if we expect to obtain similar results as outlined in this paper. To prevent and potential negative results, we will arrange several briefing sessions with the personnel, to inform them of the benefits of instructional design. We will include examples of several successful ID applications.

References

Dupagne, M. & Krendl, K. A. (1992). Teachers' attitude toward computers: A review of the literature. *Journal of Research on Computing in Education*, 24(3), 420-429

Flagg, B. N. (1992). *Formative Evaluation for Educational Technologies*. Hillsdale, N.J L. Erlbaum Associates.

Hardy, J. V. (1998). Teacher attitudes toward and knowledge of computer technology. *Computers in the Schools,* 14(3/4), 119-136

Rothwell, W. J, & Kazanas, H. C. (1998). *Mastering the instructional design process: a systematic approach*. San Francisco, Jossey-Bass Inc.

Scheffler (1995). *The identification of computer competencies needed by public school teachers.* Unpublished Dissertation

Designing Web Based Constructivist Learning Environments

Emiel van Puffelen
Stoas Research
The Netherlands
EPu@Stoas.nl

Abstract: A group of 18 university teachers designing and constructing a Constructivist Learning Environment (CLE) was interviewed and monitored in order to find and test optimal design of web based CLEs. The information functions of the CLE were supported by web based technology and the social / collaborative functions were designed using "face to face" interaction. The learning environment was designed for use by a group of 180 first year students with no experience in using CLEs. The results show that supporting the information functions of a CLE with web based technology can be very useful for case oriented education. It also supplied good support for efficient instructional design by a group of teachers. In addition it resulted in a shift of teachers behavior towards facilitating active learning.

Introduction

The last decade of the previous century has brought two developments with important consequences for design of instruction (Tam, 2000). The first development is the changing perception of what learning is about. Learning has long been seen as the result of knowledge transfer from teachers or knowledge transmission from information sources. Now the constructivist conception of learning has gained recognition, stressing the idea that knowledge is individually constructed by learners based on their interpretations of experiences in the world. Instructional design should thus focus on creating constructivist learning environments (CLEs) that engage learners in meaning making and knowledge construction (Jonassen, 1998). The second development is the use of information technology enabling new ways of exploring information, social interaction and constructing information sources. These two developments combine well as virtual experiences and web based sharing of results and viewpoints adds possibilities to individually construct knowledge (Rice & Wilson, 1999).
According to Jonassen (1998) CLEs should supply:

- questions / cases / problems / projects
- related cases
- information resources
- cognitive (knowledge-construction) tools
- conservation and collaboration Tools
- social / contextual support

The first four functions are dealing with information (construction) and they can be supported by web based technology. The last two functions are aimed at social interaction, and the information technology support of them is well described in the literature covering Computer Supported Collaborative Learning (CSCL). CSCL is often the main focus for the introduction of information technology in education. However it is still not very clear what advantage CSCL has compared to "face to face" implementations of collaborative learning if there is no need to bridge time or location differences. In general the first four functions mentioned above might benefit from web based technology regardless of the need to bridge time and location differences.

Purpose

The purpose of the research reported in this paper was to find and test optimal design strategies for CLEs using web technology support for the information (construction) functions.

Methods

In 1999 Wageningen University (in the Netherlands) had planned a major change in its study programmes starting with the courses for the new students arriving in September 2000. As a result of this the educational institute for environmental sciences (EIES) had to design a new introduction course for environmental science students. The institute wanted the introduction course to be case oriented with active participation of students. In addition the course had to be multidisciplinary by using input of university teachers from 14 different department groups. Stoas assisted the EIES in this task by formulating a project aimed at interactive group design using Web technology. The EIES scheduled group design sessions from April till September 2000. The meetings were at irregular intervals about two times each month. The group of 18 designing teachers was formed between March and July with most teachers participating by June. The teachers were all new to ICT supported case oriented learning, and had not been working together in this group before. The course had to be ready for use in September. It would be used by 180 first year students with no experience in ICT supported case oriented learning.

The teachers were interviewed at the beginning of the design process and after the students had finished their tasks at the end of the course. The meetings of the teachers were monitored during the design, construction and utilization phases and student satisfaction was monitored at the end using a web based questionnaire.

Results and discussion

The design phase

At the beginning of the design process the teachers had no clear idea on how to proceed and they had doubts about the available resources for the design, construction and utilization phases. However in general they showed to be prepared to "jump in the dark" and were willing to discus instructional design based on principles they were not familiar with. In the first meetings the teachers agreed on an approach using cases build on problem specifications and information resources. In addition it was decided that the social interaction and collaborative work needed during the course would be done in group gatherings (18 groups of 10 students) of 4 hours during 7 weeks. There was a clear consensus to use a face to face approach for these meetings as that was considered essential for new students. The student groups would have to elaborate on the problems they could specify using the course cases presented on the web. The construction of group work presentations would be facilitated using general presentation software (Microsoft Power Point) and a student software training was included in the course. The students would be introduced to the course on a plenary introduction session on the first day.

By the beginning of June the teachers had thus made major decisions on all the functions of a CLE mentioned in the introduction and gathered some case material as well. Yet most group members had problems creating course content as a clear framework for the case information was missing. At that point Stoas made a design for the web based information functions, incorporating all the work the group had done so far. A simple design using web pages was selected as there was no need for student tracking or a secluded learning environment.

The construction phase

The design for the web based functions was approved and build on the web within one week. In the following weeks group discussions were based on the structure and examples on the web. Most teachers were able to provide substantial input as they had just attended a joined web page construction course (using Microsoft FrontPage). In addition to the case content, the group constructed a joint environmental science glossary. That was an important step as the 14 department involved had not confronted the students with consistency in definitions in the past. Course information functions like a work schedule, teacher contact data and a search function were added as well. Also a library containing pictures with environmental science related explanations was constructed. These pictures were described using an international standard for educational metadata (ARIADNE, 1999). This enables the collection to be part of a University wide or international database.

The course execution and evaluation phase

The course started on the 4th of September, by that time all web based information functions were completed. The design for the group work was almost finished (some parts for the last course weeks were added later) and the 18 group work rooms were made available that day. The course lasted 7 weeks and the students used the web based information functions to formulate and solve their case questions. The students assigned each other tasks and worked alone and in small groups to accomplish them. Each group room was equipped with 1-5 computers. Student couldn't work efficiently in the few rooms with only one or two computers. The students presented their work half way and at the end. The teachers were pleasantly surprised by the quality of these presentations. A web based questionnaire on the quality of the course was introduced in the last week. The response to this questionnaire was 60% (108 out of 180). In general the course scored well with exception of the first part which had suffered from the time stress due to the late start of the design process. The teachers were all pleased with this type of education and they had liked their new role.

Conclusions

Facilitating effective group interaction is essential for designing web based CLEs as usually all the CLE facilities needed can't be constructed by one person. A group design process requires frequent work meetings. In the first meetings the teachers can help each other in understanding new learning approaches. It is important that those discussions results in joint decisions about the instructional design. In addition the group should decide on web design standards to be used. Web based functions can be designed as soon as major decision on instructional design are taken. The construction of these functions is needed as a trigger to enable the entire design to be constructed by the group

Supporting the information (construction) functions with web based technology can result in a shift of teachers behavior towards facilitating active learning. In addition it can create a good basis for intensive group work.

Constructing cases for CLEs is time consuming and web based support doesn't change that much. Web based cases are an excellent use of information technology for education, however complicated case material requires combination with the social functions of CLEs in order to be effectively utilized.

The group work was done in large groups of 10 students. In general the groups reached good results but a design with more variation in group size as described by Heath et al. (1999) might be more efficient.

The CLE made the students cooperate nicely and it made the teachers cooperate in a way they had never done before.

References

Heath, M., Dimock, K.V., Adams, S. & Zuhn, J. (1999). Restructuring Teaching with Technology and Constructivism. In J.D. Price, J. Willis, D.A. Willis, M. Jost & S. Boger-Mehall, *Proceedings of SITE '99*. Association for the Advancement of Computing in Education. Charlottesville, VA. 657-659.

Jonassen, D. (1998). Designing Constructivist Learning Environments. In C.M. Reigeluth (Ed.), *Instructional theories and models*, 2nd Ed. Mahwah, NJ: Lawrence, 1998. Erlbaum

Rice, M.L. & Wilson, E.K. (1999). How technology aids constructivism in the social studies classroom, http://global.umi.com/pqdweb.

Tam, M. (2000). Constructivism, Instructional design, and technology: implications for transforming distance learning. *Educational Technology & Society* 3(2) 2000.

ARIADNE (1999). Educational Metadata Recommendation Version 3.0, December 1999 http://ariadne.unil.ch/Metadata/

URL's of organizations involved:

Wageningen University:	http://www.wau.nl/welcome.html
Stoas:	http://www.stoas.nl/english/

Acknowledgements

The teachers did a wonderful job, they cooperated efficiently while executing tasks they were not familiar with. This would not have been possible without the enthusiastic support of Adri Dietvorst; Director of the Wageningen University Educational Institute for Environmental Sciences who motivated the team and supplied the first example content for the learning environment. In addition Rob Hartog of the Information Technology Group supplied very valuable input for the design of the web based parts of the learning environment. In doing this he was efficiently assisted by Steven Ottens and Oscar Vonder. Important contributions to the research part of the project were made by Annet Jager of Stoas Research by doing the interviews and monitoring teacher meetings.

Using Information and Communication Technologies to Develop a Learner-Centred Approach With Pre-Service Elementary School Teachers : An Exploratory Research.

Jacques Viens
Département d'Études en Éducation, Université de Montréal,
Canada
viens@scedu.umontreal.ca

Geneviève Légaré
Department of Education, Concordia University
Canada
legare@vax2.concordia.ca

Abstract : This paper presents the preliminary results of our exploratory research concerning students' perceptions about their role as future elementary school teachers and the educational practice they integrate in the development of an integrative scenario. We have noticed that when a socio-constructivistic teaching/learning approach is used, many students still have problems assuming more freedom over their own learning experience. Indeed, they tend to fall back on their old ways of learning and they plan their lesson accordingly. We will present instructional strategies that are likely to facilitate the shift from a teacher-centred approach to a more genuine learner approach. We will shortly describe a Web site providing scaffolding tools to help students and teachers through the whole process of scenario production. In order to stimulate metacognitive processes and collective knowledge construction about the new roles of teachers, we use telediscussions in an electronic forum.

1. Introduction

The wide adoption of information and communication technologies (ICT) throughout all of our life domains push our society towards a knowledge society (Levy, 1994). Our working and learning environments are strongly transformed by ICT. Home, work and schools are all called to merge as they all make a more intensive use of these technologies. This emerging knowledge society calls for new and revised competencies for both teachers and learners (NCATE, 1997). Beyond technological competencies and probably more important, there are the pedagogical and knowledge construction competencies. Socio-constructivist teaching/learning approaches such as networked communities of learners (Brown, 1997; Wenger, 1998) are seen by many researchers as the way to rethink teaching and learning in order to meet society's new expectations. The principles that feed this epistemological stance could be synthesised in saying that significant learning is more likely to happen in: a project or problem based activity, anchored in a real life situation that makes it a meaningful and an ecologically rich context for the student; collaborative knowledge construction activities where learners are given more control over the executive decisions about and within the learning activity; activities involving individual and collaborative metacognitive work. But these principles do not fit with neither teachers' nor students' experience of teaching and learning. Most of us have learned in a more traditional and directed way with little initiative and responsibility given to the learners. Teachers and learners need to be prepared and supported to make this important shift. Experience with socio-constructivist learning activities are required to develop the related competencies.

Over the past six years, we have implemented a socio-constructivist approach in the two Information and Communication Technologies (ICT) mandatory courses provided to students registered in the teacher education program at l'Université de Montréal. Although we believe that ICT provide numerous opportunities to render students more autonomy over their learning, and despite the knowledge and experience gained over the past years, we have noticed that many students still have problems assuming more control and freedom over their own learning experience. Indeed, when they are facing a novel situation or when they encounter a difficult problem, students tend to fall back on their old ways of learning (Viens & Amélineau, 1997). They seem to do the same when they plan a lesson for a specific class situation An important challenge is then the scaffolding of both a comprehensive understanding of socio-constructivist principles and the ability to apply these in school practice.

In this paper, we will describe in more details the context and characteristics of our teacher education strategies, *Les Scenaristes* Web site, the research methods, the results of the first analyses and the solutions that emerged from our experiment. Ultimately, this exploratory research project will help us refine the strategies used in teacher education in order to help students benefit from a more efficient learner-centred model of learning.

2. Context

Students registered in our teacher education programme have to take a minimum of two courses about the integration of ICT in the classroom. The first course, *Les TIC en éducation* (ETA1700), is a general overview of the various technologies that could be integrated in a given learning environment. The final assignment consists of producing, as a team, a complete and fully working integrative scenario that will be available on the Web, for the benefit of their colleagues and the teaching community. A scaffolding procedure is proposed for lesson planning. Scenarios should integrate the following five basic elements : motivation and contextualisation activities; teaching/learning activities: metacognitive activities; modes of evaluation; and transfer activities. As the teams develop their integrative scenarios, individual members are invited to participate in telediscussions. For ETA1700, four themes are provided : the impact of ICT on society, the effective use of ICT in educational settings, the changing role of teachers and learners and continuing education of teachers. Since learning to use the technology is a sub-goal of the course, students are requested to make at least one contribution for each theme, as well as offer one reply to one of their colleague.

The second course, *Laboratoire d'intégration des TIC* (PED2000), is a full year course, offered to second or third year students and mostly at a distance. Team members are free to meet as they please. Students have to produce a more comprehensive scenario for a situation of their choice. However, prior to designing their scenario, students have to contact an in-service teacher who will let the students conduct their intervention in his or her classroom. The field experiment allows the teams to conduct a formative evaluation of their project. PED2000 students also have access to electronic forums of discussion, with the difference that no themes have been pre-determined. It is the students who create and launch topics of discussion. An on-line tutor is available to guide the students in their creative process.

Since three years, a multilingual Web site, http://facvirtuelle.scedu.umontreal.ca/scenaristes, *Les scénaristes*, provides additional scaffolding tools to help students through the entire process of scenario production. Scenarios are constructed and stored online so students can keep trace of their evolution. During the development process, pre-service teachers are supported by detailed questions for each of the following steps : 1-needs analysis; 2- in depth elaboration of teaching/learning strategies appropriate to the identified situation; 3- production of all related materials; 4- implementation of the lesson plan *in situ*; 5- formative evaluation and collective critical analyses. In addition, the Web site provides numerous resources such as a model of educational uses of ICT with four axes: Information source, Knowledge organiser and production, Teaching, and Communication; a description of 14 teaching strategies analysed to demonstrate their collaborative and student initiative potential; four scenarios presented as case examples, and so on. In ETA1700, students are asked to complete the first three steps of the model (until production). In PED200, students engage in the full developmental process, in collaboration with a school teacher who provides a real class situation in order to implement the scenario. Final products (scenarios and accompanying resources) are then posted on the Web so they can be shared with the teaching community.

3. Description of the Research

Essentially, we are aiming at discovering the links (or absence of links) between the constructivist discourse held in the forums and the application of those principles in their integrative scenarios. It is those two main sources of data– the forums and the integrative scenarios--that we are using to conduct our research. Based on the obtained results, we plan to develop instructional strategies that will use both the scenario's scaffolding tools offered by *Les Scénaristes* Web site and the reflective activities provided by the forums to help students harmonise their discourse with their practice.

3.1 Goals

Our goals are :

1- to identify students' perceptions about their *role as future teachers* while using ICT;
2- to verify the extent to which students *apply socio-constructivist principles* in their scenarios;

3- to explore the strength of the relationship between *discourse and practice.*

Ultimately, the research results will be used to improve and to enrich our scaffolding approach, which in turn will help the students not only discuss the socio-constructivist principles but also adopt them in practice. To do so, we explored the links between the discourse held in the telediscussions and the application of the principles in the integrative scenarios.

3.2 Analyses

We have proceeded to an in depth reading of all the forum messages of the two courses in search of descriptions of socio-constructivist teachers/learners' roles (student centred, student control, teacher as a guide, collaborative learning, etc.). Messages presenting such descriptions were identified and the team mates (scenario team) messages were all extracted and grouped to be analysed together. Our initial idea was to get the scenarios of these teams and to proceed to a comparative analysis. But the results of the forum analyses provided surprising data.

We found that while many ETA1700 students are indeed adopting a socio-constructivist discourse, almost no PED2000 students did. Our preliminary analyses showed that PED2000 students used forums to evaluate collaboratively their scenario implementation and to ventilate about emerging problems. Very few messages discussing the teacher/student roles were posted. The students who did, adopted a shallow perspective with very little justification or elaboration on the topic. Hence, in PED200, it would have been difficult to establish a relationship between the students' perceptions in the forums and the applications of those in the scenarios. Consequently, we decided to focus on the analysis of ETA1700 students' work.

3.3 Sampling

We selected four teams from the ETA1700 course, representing 18 students, who contributed a total of 80 messages in the forums. Two discussion themes were relevant for our analysis: They are the "perception about the role of the teacher " and the "effective use of ICT in the classroom". For both themes, students contributed 55 messages.

3.3 Criteria for Analysis

3.3.1 Integrative Scenarios

To assess the students' perceptions about their changing role as teachers, we referred to some of the criteria described in Viens (1993), as well as the general constructivist principles (Brown, Collins & Duguid, 1989; Lave & Wenger, 1991; Brown, 1997; Wenger 1998). Even though we used a Likert scale to evaluate each criterium, our intention was not to cumulate frequencies. We rather used the scales to guide our critical analysis of the constructivist aspects of each scenario. Consequently, the results are more descriptive in nature. The criteria are as follows :

<u>Learning strategies</u> . Notwithstanding the specific learning strategy to be used, we assessed whether during the instructional strategy the learners were « directed », « guided », « rather guided », or «free ».

<u>Team work</u>. We examined whether the students planned to have their learners work individually, in teams but to conduct a fragmented task, or in teams to conduct a collaborative and collective task.

<u>Content</u>. Did the students determine a specific content or did they leave it completely opened for their learners to decide of their specific subject, as it is usually done in project-based learning?

<u>Pedagogical goals</u>. Aside from the usual well-stipulated instructional goals, did the students add other learning objectives such as transversal competencies? Did they consider metacognitive processes?

<u>Interdisciplinarity</u>. Did the students focus on one subject matter or did they use the opportunity to integrate several disciplines?

It is to be noted that all criteria were considered simultaneously in order to assess the global constructivist flavour of each scenario.

3.3.2 Forums

For the forums we proceeded differently. First, we focused on two aspects : the positive/negative attitude toward the ICT. Secondly, we looked at the perception of the teacher's role. In addition, we attempted to assess the student's capacity to reflect critically, that is we observed whether the students were able to develop and support their thoughts rather than merely contributing an unsubstantiated opinion (Quellmaltz, 1987; Ennis, 1987).

4. Preliminary Results

4.1 Forums

4.1.1. Attitude Towards ICT

After conducting the preliminary analysis of the telediscussions for ETA1700, we noticed that the students positions about the integration of ICT in the classroom are not radical as one might expect. The majority seems relatively sensitive and cautious about technologies. In fact, several interventions were concerned about the fact that the computer will never replace the teacher and that the human factor is essential for the development of the pupils. In other words, aspects such as empathy, communication, emotional support are still essential for the learners development.

4.1.2. Perceptions of the Role of the Teacher

After listing all relevant interventions, we noted three recurrent themes that could constitute categories. First, some interventions directly mentioned the role of the teacher, but did not provide further explanations or examples. The second category encompasses interventions that focus on the learner and whereby the role of the teacher is addressed indirectly. In the third group, interventions were about more specific tasks of the teacher. We chose to use these categories to present the results about the perceptions of the role of the teacher. Although not all interventions under the theme « Perception of the role as teacher » referred directly to the subject, it is interesting to discover that the perception of the role is indeed changing. The students did mention that the ICT will help shift from a traditional role of « content deliverer » to one that assumes more guidance, more facilitation. Terms such as « facilitator », « animator », « councillor », « advisor » were used relatively frequently. However, we discovered that the majority of students limited their intervention at the opinion level. For example, they only named or listed the role without providing an explanation or a definition of what they meant by « facilitator ». Furthermore, they did not establish a priori what they mean by « traditional role ». Very few went as far as mentioning « content deliverer » or « lecturer ». In other words, students talk about the changing role without defining their assumptions. No one proceeded to compare and contrast the two positions or provide an illustration to support their thought. Indeed, most participants merely identified keywords and did not attempt to engage in a more critical discussion.

Some interventions were also addressing the issue of the changing role, but indirectly. Some students talked about the fact, for example, that the ICT will provide the opportunity for the pupils to be more active in their learning process. Here, the guiding role of the teacher is implied in the discussion. Participants mention the possibility that ICT will encourage the active construction process and consequently, will contribute to a more significant learning experience. In fact, in those indirect interventions, the learners are considered to be at the centre of their learning, actively engaged in the construction of their own knowledge and experience. Incidentally, the teacher assumes the role of guide in the learning process. In sum, the students in this category seem to think that ICT can be used to favour collaboration between the learners as long as the learners' needs are respected. It seems that participants perceived the ICT as an integrated tool to teaching that favours self-learning.

Interestingly, the same group of students also discussed a specific aspect of teaching that will be affected by the technology : the impact of broader access to information. Some students recognise the fact that a wider access to information will bring new tasks for their learners. One student mentioned that their pupils will have to « clarify their own research goals, define their information seeking strategy, make choices in the information, and sort the information ». This type of anticipation regarding « transversal » competencies was certainly an interesting discovery.

However, the same students who demonstrated their critical thinking abilities, still perceived themselves as the authority figure for their students. In fact, they mentioned that it will be their responsibility to assess the quality of information gathered on the Web as well as to judge the relevance of the source. Instead of making the link between the role of guide or facilitator, as it would be expected in a constructivist fashion, it seems that the higher cognitive skills required, such as analysis and evaluation, will remain in the mind of future teachers, as their own territory.

4.2 Integrative Scenarios

Two interesting trends have been identified in this analysis. First, the students who are more able to support their opinions by providing examples, using the literature, explaining their thoughts, seem to be more capable of producing a scenario that uses a genuine constructivist approach. In fact, if all the constructivist criteria are applied whenever it is reasonable to do so, the tone used to describe the learning activity is more opened, more respectful of both the freedom of the teacher and the learners. Here, we noticed that teams who produced a constructivist integrative scenario, were constituted of at least two members who demonstrated critical thinking abilities.

In the second trend, it seems that the students who claim that the role of the teacher is changing but who do not support their opinion, do not apply their values and perceptions in their integrative scenarios. In the telediscussions, they claim to be constructivist, but they fail to transfer their thoughts in practice. Their interventions tend to be opinions and value judgements rather than supported, critical reflections. As we anticipated, the majority of the scenarios produced were meant to be constructivist. Some teams for example, will have their students work in teams but in a fragmented fashion (individual students will provide parts that will make a whole); the content will be determined and not opened for change; the learner will be rather guided in the learning process.

Two sources or information reveal the lesser constructivist approach : the instructional goal statement and the description of the lesson plan. Statements of the instructional goals in those scenarios tend to be highly fragmented, clearly measurable, well stated. Often, the students will refer to the Ministère de l'éducation du Québec programme to write the goals. There is no reformulation of the goals to suit their situation or needs. Also, there is no interpretation or critical analysis or re-evaluation of the goals. In addition, the students do not go beyond the goals officially prescribed by considering, for instance, the development of transversal competencies. The students just take the goals as they come.

The design of the lesson plan is another indicator that a scenario might not represent a good application of constructivist principles. Lessons plans tend to be very organised and directed as well. The outcomes, ensuing the instructional goals, are well planned. In fact, the pre-service teachers, remain perfectly in control of the predetermined outcomes. Despite their good intentions, the students remain in control of the learning process. The steps are not only too well defined, that are also not flexible. The outcomes of the intervention using ICT are still pre-determined. Finally, the teams did not seize the opportunity to create a lesson plan that encompasses more than one subject matter. Since the students had the freedom of choosing what to cover, one would expect a project that draws on multiple disciplines. Here too the students did not fully exploit the potential of constructivist approaches.

5. Conclusions

In this exploratory research we highlighted two trends. Students who demonstrate critical thinking abilities in telediscussions are more likely to apply successfully their values and beliefs in their productions of integrative scenarios. We also found that teams made up of at least two members who substantiate their reflection tend to create scenarios that are more constructivist. Secondly, students who do not support their opinion in the telediscussions will be less able to apply the constructivist principles to their productions. The teams are constituted of students whose interventions are opiniated rather than being critically reflective. Those teams will remain in control of their pupils' learning.

Our analyses revealed some limitations related to team leadership and the understanding of the group dynamic. In fact, it is difficult to link one's work to a collective production without having a sufficient knowledge about how this individual influenced the group artefact. Hence, data about the evolution of the group's work and individual contributions could permit to run a more specific analysis of the collective knowledge construction processes. Nevertheless, our results suggest that scenarios production and discussions in a forum about teachers/learners roles may be used in a convergent way such as to provide rich scaffolding activities for pre-service teachers.

In conclusion, the next logical step would be to support the development of critical thinking skills in the telediscussions by having students to specifically discuss how they implement their representations of the teachers/learners' roles in their scenario. This would probably bring to front some ruptures in students representations by a process of confrontation to practical considerations. We believe that such a breakdown generative activity may be necessary to build a more coherent mental models of teachers/learners roles in socio-constructivist activities and to encourage a better transfer of the socio-constructivist principles to the development of integrative scenarios.

6. References

Brown, A. (1997). Transforming schools into communities of thinking and learning about serious matters. *American Psychologist*, 52 (4), 339-413.

Brown, J.S., Collins, A. & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher*, Jan.-Feb., 32-42.

Ennis, R.H. (1987). A taxonomy of critical thinking dispositions and abilities. In J.B. Baron & R.J. Sternberg (Eds.). *Teaching thinking skills: Theory and practice*. New York: W.H. Freeman & Company. 9-26.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge: Cambridge University Press.

Lévy, P. (1994). *L'intelligence collective. Pour une anthropologie du cyberespace*. Paris : La Découverte.

National Council for Accreditation of Teacher Education, NCATE (1997). Task Force on Technology and Teacher Education. *Technology and the new professional teacher: Preparing for the 21'st' century.* Washington, DC : NCATE.

Quellmaltz, E. S. (1987). Developing reasoning skills, In *Teaching thinking skills: theory and practice.* J.B.Baron and R.J. Sternberg, Eds. New York: Freeman, 86-105.

Site des Scénaristes : http://facvirtuelle.scedu.umontreal.ca/scenaristes

Viens, J. & Amélineau, C. (1997). Une expérience d'auto-apprentissage collaboratif avec le logiciel Modélisa. *Cahiers de la recherche en éducation*, 4 (3), 339-371.

Viens, J. (1993). Au-delà d'une certaine multidisciplinarité : Un prototype d'environnement informatisé permettant l'expérimentation d'outils pour la construction des connaissances. *Revue Educatechnologiques,* 1(2).83-106.

CRACTIC : towards a model for the implementation of socio-constructivists principles in multiple classrooms collaborative projects using the Web.

Jacques Viens
Département d'Études en Éducation, Université de Montréal,
Canada
viens@scedu.umontreal.ca

Alain Breuleux
Department of Education, Mc Gill University
Canada
Breuleux@Education.McGill.ca

Pierre Bordeleau
Département d'Études en Éducation, Université de Montréal,
Canada
Bordelea@scedu.umontreal.ca

Allen Istanffy
Department of Education, Mc Gill University
Canada
aistva@po-box.mcgill.ca

Sonia Rioux
Département d'Études en Éducation, Université de Montréal,
Canada
riouxso@MAGELLAN.UMontreal.CA

Abstract: CRACTIC stands for "Research Community on Collaborative Learning with Information and Communication Technologies". It is a collaborative research involving university professors, teachers and domain experts in the development and implementation of collaborative learning activities based on socio-constructivist principles. Our pedagogical model builds on having students from different schools along the St-Lawrence River to exchange questions and answers about the impact that the River have on their respective economical, social and geographical environment. Each school answering questions raised by another school and doing so, contributing to the construction of collective knowledge expressed in a community Web site. Six classrooms, matched in pairs, participate to our community. Each classroom developed a Web site presenting itself and the work done locally. We will present the theoretical foundations, the emerging model, the implementation conditions, the process of appropriation of the model by teachers and students and the outcomes of our three cycles of experimentation.

Socio-constructivist principles are raised as the basic guidelines for the use of Information and Communication Technologies (ICT) in almost every recommendation plan delivered by national orientation committees in the United States (NCATE, 1997 ; ASCD, 1998) and in Canada (MEQ, 2000). But there is a huge gap between the ideal vision and the day by day school's perspective. The pathway to a successful implementation of those principles in K-12 classroom activities is complex and requires numerous conditions to be met. In order to study those conditions and to develop a model of implementation that would take teachers' concerns as well as day by day classroom reality into consideration we have initiated, four years ago, a community of research on collaborative learning with

ICT. In fact, CRACTIC stands for the French appellation of "Research Community on Collaborative Learning with Information and Communication Technologies". This community gather some professors and researchers of the Université de Montréal and McGill University; teachers and pedagogical support staff from a Montreal schoolboard; and topic experts from a Montreal Museum, the Biosphere. It is financially supported by a National research fund, FCAR.

The basic idea was to initiate a collaborative research community linking universities, teachers and domain experts from a Museum, and to have them to develop and implement a model of collaborative learning activities based on socio-constructivist principles (Roschelle, 1995; Brown, 1997; Wenger, 1998). The basic model that was developed builds on having students from different schools along the St-Lawrence River to exchange questions and answers about the impact that the River have on their respective economical, social and geographical environment. Each school trying to answer questions raised by the other schools and doing so, contributing to the construction of collective knowledge expressed in a community Web site. Six classrooms from different schools were participating to our community. In order to establish a stronger relation between students, to facilitate the harmonisation of teachers strategies as well as students evolution in the projects, classrooms were matched in pairs. Each classroom developed a Web site presenting itself and the work done locally. Even if a classroom was to get involved more directly with a specific other, they could access the other classrooms Web sites and communicate with every participants of the enlarged community. Exchanges were taking place along a full academic year. The activity implementation procedures contain 9 steps that guide students in the collective knowledge construction process.

The conditions of development of the model and its implementation have been observed and documented. Data sources are numerous: meeting notes and reports; classroom observations; interviews with teachers, students and school administrators; students production such as email messages exchanges and Web site produced. The model have been revised after each annual experimentation based on the gathered data.

The gathered data all points out to numerous factors that impedes the implementation of such a collaborative knowledge construction strategy. In fact, it was very difficult to have teachers as well as students to systematically apply the proposed model which implies to communicate regularly with the matched classroom. Problems came from various sources : technical, pedagogical, research related and social problems. We will shortly describe the majors difficulties that were encountered and present the solutions that we applied. Finally, the model resulting from our 4 years experience of collaborative research will be presented.

References

ASCD (1998). *Yearbook on Learning with technology.* C. Dede, (Ed.). Alexandria, VI: ASCD.

Brown, A. (1997). Transforming schools into communities of thinking and learning about serious matters. *American Psychologist*, 52 (4), 339-413.

Brown, J.S., Collins, A. & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher*, Jan.-Feb., 32-42.

MEQ, (2000). Programme de formation à l'école Québécoise. Internet document (29-11-00). http://www.meq.gouv.qc.ca/dfgj/program/programm.htm

National Council for Accreditation of Teacher Education, NCATE (1997). Task Force on Technology and Teacher Education. *Technology and the new professional teacher: Preparing for the 21'st' century.* Washington, DC : NCATE.

Roschelle, J. (1995). What Should Collaborative Technology Be? A Perspective From Dewey and Situated Learning. Internet document (20-11-2000). http://www.cica.indiana.edu/cscl95/outlook/39_roschelle.html

Wenger, E. (1998). *Communities of practice: learning, meaning and identity.* Cambridge: Cambridge University Press.

Overview of Web-Based Pedagogical Strategies

Dr. Shirley Waterhouse
Director, Educational Technology Department
Embry-Riddle Aeronautical University
Shirley@db.erau.edu
http://edtech.erau.edu/Shirley

Abstract: Preparing teachers to utilize Web-based instruction requires a focus on Web-based pedagogy, not just Web-based technology. Teachers must understand that technology should be utilized as the enabling factor, not the primary factor if Web-based instruction is to be effective in enhancing teaching and learning. The Web provides an array of teaching strategies that can be added to those commonly utilized in traditional instruction; and today's teachers must understand both. Recommended Web-based pedagogical strategies are addressed in this paper as well as how they relate to Gagne's Nine Events of Instruction as well as the American Association of Higher Education's Seven Principles for Good Practices in education.

Major Web-Based Pedagogical Strategies

There are at least four important Web-based instructional elements including: (1) Course administration, (2) Interaction with content, (3) Testing, and (4) Discussions. A review of the major Web-based instructional software products such as Blackboard and WebCT illustrates a focus on functionality to accommodate these four elements. Effective utilization of these components allows course designers to utilize a broad array of features to establish extensive Web-based pedagogical strategies. Each major component is described in more detail below.

Course Administration. Course administration components make it possible to post course information on the Web, including the course syllabus, assignments, course notes, and other course documents. Students can access information easily, and instructors can post and update important course information conveniently. Most Web-based instructional software also allows students the capability of submitting assignments electronically.

Interaction with Content. Interactive components make it possible for students to engage in student-centered learning activities and interact with course content. Direct access to Web resources allows instructors the capability of creating student assignments that require students to perform Web research and apply critical thinking skills to analyze site information and document their findings. Another major advantage of the interactive component of Web-based instruction is enhanced remediation. Course content elements such as audio or video files, simulations, PowerPoint slides, and course notes, can be reviewed by students as often as necessary.

Testing. The self-testing component of Web-based instruction provides very important learning advantages. Students can practice newly acquired knowledge and skills and obtain instant feedback on their progress.

Discussion. One of the most important functions Web-based instructional software provides students and instructors is the ability to electronically communicate. Students who may be too shy to speak out in class often do so comfortably in electronic discussions. Teamwork is fostered through electronic discussions, and the obstacles of organizing team meetings around the schedules of team members are eliminated. Electronic communications also affords instructors many advantages such as engaging in one-on-one discussions with students electronically, as well as establishing electronic office hours.

Web-based Pedagogical Strategies to Engage Learners

There are a number of factors that must be implemented to engage learners in the learning process; when learning is Web-based, special care must be taken to insure learner engagement. Figure 1 lists twelve major factors needed to engage learners in the learning process and example Web-based strategies for each. This form is provided as a planning tool for creating Web-based strategies appropriate for Web-based instructional prototypes.

Figure 1

Web-based Pedagogical Strategies to Engage Learners

Needed for Learner Engagement	Recommended Web-Based Strategies
1. Must feel comfortable and not threatened.	Online orientations to Web-based learning. Online tutorials on template functions. Instructions on course technical requirements.
2. Are social by nature.	Instructor profiles posted on course website Include bios and photos Classmate profiles posted on course website Include bios and photos After class electronic discussion board.
3. Must make connections with the instructor.	Electronic Discussions one-on-one with instructor. Phone conversations with instructor.
4. Must make connections with fellow students.	Electronic discussions with fellow students. Team projects and assignments.
5. Must make connections with course content.	Effective instructional design principles. Effective Web-based design principles. Effective use of graphics and multimedia elements. Guest speakers via electronic discussions.
6. Must have an important reason to learn the content.	Learning activities such as frequent Web research that requires critical thinking skills. (For example, if students are asked to research websites, have them analyze information and document findings.) Frequent Web-based activities that count towards grade.
7. Must be actively engaged in the learning process.	Numerous Web-based research activities. Effective multimedia elements. Choices on learning activities. Numerous discussion opportunities. Self-testing activities.
8. Must be allowed to learn in their own styles.	A flexible choice of learning activities to Accommodate learning styles (audio, visual, "try out" exercises, and others)

Figure 1 Web-based Pedagogical Strategies to Engage Learners	
Needed for Learner Engagement	**Recommended Web-Based Strategies**
9. Must build on prerequisite skills and knowledge.	An introductory activity to relate prior knowledge such as an electronic discussion with instructor or students before course gets underway. A before you start self-test.
10. Must obtain feedback in a timely manner.	Instructors must respond to email in a timely fashion. Utilize course facilitators to answer questions, monitor discussions, and respond to email. Utilize student team leaders to answer questions, monitor discussions, and respond to email. Implement a Help Desk concept for the course.
11. Must apply knowledge or skills to real tasks.	Utilize case studies. Utilize team projects. Student portfolios. Practice activities to develop technology skills needed in the workplace.
12. Must be able to monitor their own progress.	Have students maintain journals, logs, or diaries. Self-tests Statistics on # of times Web-site accessed by students.

Figure 1 - Web-based pedagogical strategies to engage learners.

Web-based Pedagogical Strategies Applied to Gagne's Nine Events of Effective Teaching

The list of Gagne's Nine Events of Effective Teaching is one of the most popular tools used by educators to insure that instruction is effective (Gagne 1985). Gagne's Nine Events can also serve as guidelines for designing effective Web-based strategies for online learning. Figure 2 is a tool that lists Gagne's Nine Events and example Web-based strategies that comply with each event. (Harris and Watehrouse 2001). (Details of Gagne's Nine Events can be viewed at <http://ide.ed.psu.edu/idde/9events.htm>.)

Figure 2 Web-based Pedagogical Strategies and Gagne's Nine Events of Instruction	
Event	**Web-based Strategy**
1. Gain Attention	Effective use of graphical and multimedia elements.

Figure 2 Web-based Pedagogical Strategies and Gagne's Nine Events of Instruction	
Event	**Web-based Strategy**
	Effective Web-design including appropriate use of color, fonts, and text. An announcement section. A discussion on current topics. Referral to appropriate Web sites.
2. Inform Learners of Objectives	Course orientation. Course tutorial. Post course syllabus.
3. Stimulate Recall of Prior Learning	A getting started self-test to apply what you know. An electronic discussion about prior topics.
4. Present the Content	Web-enhance lectures, textbook activities, and other content delivery activities through Web-research, simulations, audio/video modules, and others.
5. Provide Learning Guide	Post syllabus, course notes, course assignments, and other course related documents. Facilitate discussions.
6. Elicit Feedback	Electronic student surveys, electronic discussions, electronic quizzes, and electronic office hours. Students submit work electronically.
7. Provide Feedback	Electronic discussions and electronic office hours. Respond to email in timely fashion.
8. Assess Performance	Electronic testing. Graded work is returned electronically. Student portfolios are reviewed electronically.
9. Enhance Retention and Transfer to the Job.	Web-research activities foster critical thinking. Team collaborations. Resolve case studies. Student Web-based portfolios. Utilize technologies common in workplace.

Figure 2 - Web-based pedagogical strategies applied to Gagne's Nine Events of Instruction.

Web-based Pedagogical Strategies Applied to the Seven Principles of Good Teaching

The American Association of Higher Education's Seven Principles of Good Teaching is another tool that is popular among educators and instructional designers. The Seven Principles of Good Teaching has been adapted by many educators, and one of the most renowned adaptations is the Chickering and Gamson (1991) application, The Seven Principles for Good Practices in Undergraduate Education. (A summary of Chickering and Gamson's work can be viewed at <http://www.msu.edu/user/coddejos/seven.htm>.)

Figure 3 is a tool that lists the Seven Principles for Good Practices in Undergraduate Education and provides an area for recording appropriate Web-based pedagogical strategies, depending on the learning activity.

Figure 3

Web-based Pedagogical Strategies and the Seven Principles for Good Practice in Undergraduate Education

Teaching Principle	**Web-based Strategy**
1. Encourages contact between students and faculty.	Electronic discussions with students. Electronic discussions with instructor.
2. Develops reciprocity and cooperation among students.	Electronic team projects and collaborations.
3. Uses active learning techniques.	Web research activities. Simulations and practice activities. Provide students choices.
4. Provides prompt feedback.	Self testing. Instructors respond to email in a timely fashion. Instructor returns graded work promptly.
5. Emphasizes time on task.	Numerous student-centered learning activities.
6. Communicates high expectations.	Students assume responsibility for learning.
7. Respects diversity in talents and ways of learning.	Learning styles are addressed through flexible learning activities. Students apply technology skills needed in the workplace.

Figure 3: Web-based pedagogical strategies applied to the Seven Principles for Good Practice in Undergraduate Education.

References

Chaffee, E. E. (2000). Finding the will and the way. In *Preparing your campus for a networked future,* edited by M. Luker. San Francisco: Jossey-Bass Publishers.

Chickering, A. W., and Z. F. Gamson. (1991). *Applying the seven principles for good practice in undergraduate education.* No. 47, Fall. San Francisco: Jossey-Bass Publishers.

Gagne, R. (1985). *The conditions of learning.* 4^{th} ed. New York: Holt, Rinehart & Winston.

Harris, R., Waterhouse, S. (2001). *A 10-Step Guide to Establishing Instructional Technology.* Washington, D.C.: Executive Leadership Foundation.

Additional Resources

Appling the Seven Principles for Good Practice in Undergraduate Education
From a book written by Arthur W. Chickering and Zelda F. Gamson

http://www.msu.edu/user/coddejos/seven.htm

Felder, Dr. Richard M.; Hoechst Celanese Professor Emeritus,
Chemical Engineering at North Carolina State University
Online learning styles assessment guide
http://www2.ncsu.edu/unity/lockers/users/f/felder/public/RMF.html

Gagne's Nine Events of Instruction
http://ide.ed.psu.edu/idde/9events.htm

Institute for Higher Education Policy
http://www.ihep.com

The Integrated Curriculum in Engineering Program,
Embry-Riddle Aeronautical University
http://www.db.erau.edu/campus/departments/aeroeng/ice/index.html

Penn State University
Guidelines for Developing Distance Education Web Sites
http://www.cde.psu.edu/de/id&d/DoDont.html

The Pew Grant Program in Course Redesign
http://www.center.rpi.edu/PewGrant.html

Cognitive Learning Theory Meets Technology: Incorporating Research on Attention into E-Design

Joan Wines, Associate Professor of English, California Lutheran University, USA wines@clunet.edu

Leanne Neilson, Associate Professor of Psychology, California Lutheran University, USA neilson@clunet.edu

Abstract: During the implementation of a two-year faculty development grant, California Lutheran University (CLU) has explored technology's potential for improving teaching and learning. In incorporating various technologies into the design and redesign of 27 undergraduate courses, we have found that certain cognitive and physiological processes are tremendously relevant to learning outcomes. Strategic uses of new technologies that capitalize on the dynamics of these processes can, we believe, optimize a student's ability to focus and sustain attention, improve comprehension, and facilitate the transfer of content into long-term memory. To develop new design strategies that incorporate relevant cognitive theory, we have set up the generic methodology we follow in this paper: 1) examining a specific cognitive phenomenon (Attention, in this case), 2) identifying its relations to learning, and 3) imagining how its principles might be best incorporated into the architecture of an e-designed instructional project.

In 1998, the Charles E. Culpeper Foundation provided California Lutheran University (CLU) with a grant to help faculty develop and deliver curriculum in technology-infused learning environments. Our Teaching, Technology, and Teamwork groups focused on integrating good pedagogical practices into 27 e-designed courses and other instructional multimedia projects.

We now want to integrate the principles of cognitive learning as well as good practices research into other e-designed projects. We are convinced that strategic uses of new technologies can capitalize on the dynamics of cognitive and physiological processes, optimizing a learner's ability to focus and sustain attention, improve comprehension, and facilitate the transfer of content into long-term memory.

We have identified several areas of cognitive learning theory that hold promise for technology-enhanced instructional products. This paper 1) briefly examines one of these areas (Attention), 2) identifies some of its interrelationships with learning, and 3) suggests how we might incorporate relevant Attention principles into multimedia instruction to achieve better learning results.

Teachers want to get information into a student's long term memory, but too often neglect to first ensure that learners are "paying attention" when that information is being delivered. Attention is learning's most crucial step. Educators have long known that better learning outcomes are inevitable when attention is focused, and that formal organization of content and flexible methods of delivery help direct and sustain student attention. Now, educators can use mechanical strategies to reinforce organizational and delivery methods that focus attention—something designers of ATM and other machines have been doing for a long time (e.g., that buzz directing our attention to the card slot!).

Reviewing concepts developed by Attention theorists can help us formulate strategies of incorporating Attention principles into educational multimedia design. Attentional Resource theorists propose that the number and kind of resources needed for processing information depend on the complexity of the incoming stimuli (Sternberg 1999). Simple stimuli require only a small number of resources, while the remaining resources can be used to pay attention to other stimuli simultaneously. Difficult material, requiring more resources, will limit our ability to divide attention as readily among various tasks. Practice reduces the number of resources required to attend to a task, making additional resources available for simultaneous multi-tasking.

Additionally, Attentional Resource theorists point out that the number of processessing resources available is not consistent across populations and situations. A tired person, having fewer resources available, has a reduced ability to pay attention to complex stimuli. According to other Attention theorists, students will also have difficulty paying attention to verbal material when they are trying to read and listen simultaneously because when they read, they are transforming a visual format into an acoustic format (Best 1999). It follows that the acoustic processing in reading could displace the acoustic processing in listening, a physiological dynamic that needs to be considered when designing multimedia instructional projects. Students should not be expected to read blocks of PowerPoint text and listen to an instructor at the same time, anymore than they should be expected to read handouts during a live lecture.

Because changes in attention levels are subject to the above as well as to so many other variables, instructors must continually vary delivery methods. One common way to effect variance is to increase or decrease delivery pace. The bottleneck theories in cognitive research (Broadbent 1958; Moray 1993; Treisman 1964) indicate that a "bottleneck" occurs in the presence of excessive stimuli, and information that gets stuck in the bottleneck doesn't get processed. Complex verbal material requires slow-paced delivery because it needs time to "get through the bottleneck" and (in the Attentional Resource theorist's context), because more cognitive resources are required to understand it.

When the delivery pace is *too* slow, however, students often use their "left over" resources to daydream and to drift away from the course material. Retention usually improves when delivery rate is increased, an expected result of the speech/thought speed differential: 125-175 spoken words per minute to 400-500 words processed through listening per minute. When learners have less opportunity to let attention lapse, comprehension and retention rates improve (Wines 1998). And, as Kevin Harrigan has pointed out, learners can listen to speech compressed at as much as 50% without loss of comprehension or retention (Harrington 1999). Thus, theoretically, arbitrary timing of online verbal material that would force the user to process at faster paces would focus and sustain attention simply by not giving the user an opportunity to drift.

Given the many variables that affect Attention, however, a design which gives pace control to users instead of instructors is a better option for designers who emphasize the importance of user choice and control. Many who e-design educational projects argue that the more actively engaged user learns more and learns better, and that most students have some awareness of their metacognitive processes, their learning potentials, and their limitations. Learners can, therefore, be taught to consider variables such as complexity of material and emotional and physical states, and to adjust their listening pace accordingly. They can then optimize their learning experience by deciding how to control the flow of information.

Software that gives users this control has already been developed. The DUKES computer application is a good example (Harrigan). Created to let e-designers build in variable-speech speed options, this application could be invisibly integrated into an online lecture segment, giving students the option of choosing different listening rates, e.g., remedial, slow, medium, fast paced. Questions on comprehension and tracking mechanisms could be integrated into the design to help the instructor evaluate student-learning styles and to better assess learning outcomes.

In applying Attention (in relation to listening as just discussed, as well as viewing and reading) and other cognitive principles and concepts to the e-design of multimedia instructional projects, we hope to achieve better learning results as well as a more quantitative assessment of learning outcomes.

References

Best, J. B. (1999). *Cognitive Psychology.* Belmont, CA: Wadsworth.

Broadbent, D. E. (1958). *Perception and Communication.* New York: Pergamon.

Harrigan, K. A. (1998). DUKES: Creating Real-Time Variable-Speed Speech for Use in Educational Multimedia, *AACE 1999 Hawaii Conference Proceedings.*

Moray, N. (1993). Designing for Attention. In A. Baddeley and L. Weiskrantz (Eds.) *Attention: Selection, Awareness, and Control* (pp. 111-134). Oxford: Clarendon Press.

Sternberg, R. J. (1999). *Cognitive Psychology.* Fort Worth: Harcourt Brace College Publishers.

Treisman, A., (1964). Monitoring and Storing of Irrelevant Messages and Selective Attention, *Journal of Verbal Learning and Verbal Behavior*, 3, 449-459.

Wines, J. F. (1998). Using Technology to Improve the Quality of Student Research in the Literature Classroom, *A Worldwide Network of Learning: Opportunities, Challenges, and Contrasts.* Proceedings of the Fifteenth International Conference on Technology and Education, Sante Fe, 69-71.

Got Hack? Strategies to Reduce Online Cheating

Dr. Joseph Winslow
Coastal Carolina University

The purpose of this paper is to report findings from an empirical study investigating the degree to which three popular WBT development systems—scripting, authoring and enterprise—are susceptible to student "hacking." Three questions were of primary interest to the researchers—(1) are there any differences in the number of technology-centric cheating methods students can discover between the three WBT development environments, (2) which technology-centric cheating methods are most common, and (3) what attitudes do students exhibit regarding technology-centric cheating? As WBT development tools continue to evolve, and as individual faculty take greater responsibility in the development of their own custom assessments for online delivery, answers to these questions are critical to the derivation of specific strategies to reduce online cheating.

Methods

The sample used in this study comprised all students (n=76) enrolled in multiple sections of an undergraduate Education Technology course required of Education majors at a medium-sized public suburban university. Sixty-eight percent of the participants were female; all students were either freshmen or sophomores and new admits to the teacher- education program. Students were randomly assigned to take one of three online vocabulary quizzes, one created with the web-editor and scripting application, *Coursebuilder for Dreamweaver* (Macromedia), another by the icon-based authoring program, *Authorware Pro Attain* (Macromedia), and the last with the enterprise-level integrated learning system, *WebCT.*

The setting for each administration was a technology classroom housing 25 Internet-enabled PCs. Each student accessed his or her individual quiz by entering an appropriate URL in a Netscape web browser. Each of the three quiz versions presented the same multiple choice items in the same order, with only minor interface design differences. Students marked their answers by clicking appropriate graphic buttons with their mouse and then submitted them for automatic grading by clicking a "Score My Quiz" button. For each administration, students were challenged to discover as many different ways possible to use technology to "cheat" on their assigned quiz. Cheating was operationally defined as either 1) quiz file and item theft, or 2) "hacking" the system to extract the correct answers, and students were asked to focus their cheating efforts accordingly. To avoid prompting, no examples were provided.

Students were given thirty minutes to discover various cheating methods and asked to generate a list describing each in specific detail. At the conclusion of the allotted time, students were surveyed for perceived proficiency and attitude. All data were coded, blind-scored, and analyzed in Excel and SPSS.

Results

Descriptive statistics indicate that students in this study (n=76) had a mean of just over 4.5 years of computing experience, with reported values ranging from one to fifteen years, but the majority within one standard deviation. On a five-item scale of computer proficiency, students estimated their own skills with a mean score of 2.8, between "basic" (2) and "intermediate" (3).

One-way ANOVA and subsequent pairwise analyses yielded significant differences between groups assigned to the three WBT development environments. Students assigned to the script-developed quiz discovered significantly more methods to cheat than students assigned to either of the other groups. Differences between the enterprise group and the authoring group were not significant.

Students discovered six different technology-centric cheating methods. The most common method used by 61% of all participants was to retake the quiz over and over until the desired score was achieved. Saving the quiz file to disk (26%) or emailing the file (21%) to a valid address were the next most popular methods. Using instant-messaging (text chat) to relay quiz answers between different student workstations was an effective option discovered by 20% of participating students. Fewer students (11%) realized that the internet address for the quiz file, the URL (uniform resource locator), could be used to steal the file outside of class. Only a handful of students found that the javascript source code could be parsed for correct answers. The authoring quiz file had the least number of total cheating occurrences (22); students were unable to save it, email it, or view its source code.

Almost 40% of all students in this study reported that they would cheat using one of the methods discovered if they thought they could "get away with it." Of those students, most cited the need for a grade as justification for cheating. Others explained that the ease of the technology made the temptation too great to resist. A few students reported that they would cheat simply because they could.

Discussion and Conclusion

More than 80% of students (across groups) discovered at least one cheating method. It is interesting to note that, according to the data, the authoring quiz was the most difficult to extract or hack; students were unable to save the file, email the file, or manipulate its source code. This discrepancy is easily explained by its non-standard, proprietary file format, which can only be displayed in a web browser with the appropriate *Authorware* plug-in. Unlike *WebCT* and *Dreamweaver*, which generate a single file for downloading, *Authorware* segments the quiz file into smaller pieces, each of which is arcanely named and not individually viewable. In addition, the text rendered in the *Authorware* file is not editable, unlike that in *WebCT* and *Dreamweaver*, which allow a student to copy and paste text quiz items into a word processor or emailer. Neither are there menus at the top of the window prompting students to save the file to diskette or email it to an address. Finally, *Authorware* does not make its proprietary source code available for display in the browser; the other programs place a "0,1,1,1" next to each correct response in the javascript code.

Perhaps the real value of this study is that from these methods specific design strategies can be derived to reduce the probability of technology-centric cheating occurrences. WBT developers might consider the following:

1) Open the file in a window without menus and toolbars. Creating the quiz link to open in a new window without navigation buttons, toolbars and menus inhibits students from copying the URL, emailing the file, saving the file, and viewing the source code. *2) Limit time and scoring.* Setting the score quiz value to <1> and retaining unlimited tries per question allows a student to change his or her mind about an answer, yet preserves only one opportunity for submitting the quiz for scoring. Setting a time limit, and including a visual timer on the page, may discourage users from discovery cheating. *3) User authentication.* Preventing users from logging in and retaking web-based assessments can be accomplished through sophisticated user authentication schemes. WebCT has this capability "out of the box," whereas Dreamweaver and Authorware require the use of middleware applications such as Cold Fusion or ASP to port quiz data to a parent database. *4) Disable right-click.* Deactivating the right mouse button is another way to prevent a user from viewing source code or accessing edit commands like <Copy>, <Paste> and <Save>. *5) Use an index file.* Assigning a default index file (for example, index.htm) to the root directory containing the quiz file(s) inhibits a user from accessing all objects in that directory. If a user tries to explore by truncating a URL to a parent directory (for example, www.yourschool.edu/yourname/quiz1/), the index file automatically loads, instead of listing all available files in that directory. *6) Policies and proctoring.* Obvious but essential, stipulating specific policies and active (mobile) proctoring may decrease the propensity for some students to cheat, especially those who would use instant-messaging, email or other internet communications.

As online education initiatives continue to burgeon, the need for secure WBT development tools, and the empirically validated design principles guiding their effective use, will be imperative. The data from this study strongly suggest that the three WBT development environments used are vulnerable to security issues that facilitate cheating. The design strategies derived from these issues warrant future investigation.

Full paper and references available at www.coastal.edu/education/faculty/winslow.htm

Can We Address Learning Styles of Students in Traditional And Web-Based Courses: Perceptions of Faculty Members and Preservice Teachers

Yasemin G. Yigit
Department of Computer Education and Instructional Technology
Faculty of Education
Middle East Technical University
gulbahar@metu.edu.tr

Soner Yildirim
Department of Computer Education and Instructional Technology
Faculty of Education
Middle East Technical University
soner@metu.edu.tr

Abstract

The present study explored faculty members' and preservice teachers' perceptions on addressing learning styles in different instructional environments, namely in traditional classroom and web-based instruction. This study used data from faculty members and preservice teachers at a state university in Turkey. This study reports both faculty members' and preservice teachers' perceptions on considering individual differences while designing a course for both traditional setting and web-based instruction.

Introduction

In our daily teaching practices, we observe that some students can learn easier than others and therefore they perform better on tests. This fact underlines the principle that instructional, contextual, and individual characteristics come into play during learning. In their study, Jonassen and Grabowski (1993) point out the importance of a similar principle by advocating, "student learning differs because student learning traits differ, and because the thinking process differs depending on what the student is trying to learn." (p. 3).
If the learning traits, aptitudes for learning, willingness to learn and preferences for processing information differ dramatically, we need to recognize the need for alternative design approaches that address these differences.
Consequently, the instructional design approach is of a great value for providing learners with opportunities to learn better and effectively.

Background of the Problem

Since the advancement of technology in education, World Wide Web (WWW) has become one of the most popular tools for delivering instruction over the Internet. Such capabilities of the Web as handling text and picture as well as audio and video, promoted itself as a powerful tool for delivering instruction.
Although there is a number of instructional design models that propose prescriptive approaches for Web-based instruction, only a few considers individual learning differences at appropriate level. Therefore, there exits a need for an alternative design model that conveys and considers such characteristics as learning differences, learning goals and objectives, content, user interface and so on that have a tremendous effect in web environment.

Purpose of the Study

Web-based instruction has been commonly used in distance education, especially as a supplementary delivery method for instruction for traditional courses. Hence, there is a lack of contemporary instructional design approach that fully addresses learning styles of individuals.
Learning style is not fixed to an individual, a situation or a task; it can vary by time, motivation, and learner's psychology or by other conditions of learners. Being aware of individual differences, it is

important to continuously evaluate all aspects of Web-based teaching and learning if the promise of Web-based instruction is to be fulfilled. Therefore, designing a web-based instruction by considering all variables of the instructional environment would result in more effective instruction.

The purpose of this study is to examine the perceptions of faculty members and 4th year preservice teachers of Computer Education and Instructional Technology department in a state university of Turkey. This study examined participants' perceptions and their preferences of learning styles in both traditional and web-based instruction.

Research Context:

The learning styles theory was championed by Carl Jung, who is usually credited with first defining learning style theory. Myers and Briggs have also applied Jung's work and this work lead to a new field, understanding the differences in learning, for researchers (as cited in Silver and Strong, 1997).

The learning styles theory implies that individuals have different ways of perception, and one style doesn't represents all the individuals. So, instruction must be presented in different ways respecting these differences.

In their study of the effect of end user learning style and method of instruction on end user learning outcomes, Bohlen and Ferratt (1993) concluded, ". . . the method of instruction alone and in combination with learning style makes a difference in some, but not all measures of achievement, efficiency and satisfaction" (p. 280-81).

In the study conducted by Bostrom, Olfman and Sein (1988), the importance of individual differences in end-user training has been criticized from the learning styles point of view. The findings of this study suggested, "...in the design of training, it is essential to match training methods to individual difference variables" (p. 133).

Another study by Chuang (1999) investigated the presentation effects of text, oral narration, and computer animation implemented in an instructional lesson, and individual differences, which affect students' learning in a multimedia computer environment. Chuang (1999) cocluded that "subjects performed significantly better on the posttest in the animation+text+voice version, which was also the favorite interface design chosen by most of the subjects".

Assuming that technology is most effectively used in the classroom when students use technology as a cognitive tool, Cohen (1997) conducted a research about learning style in a technology-rich environment and concluded, "a technology-rich environment impacts the written and unwritten curriculum of a school. Schools should be sensitive to students' learning styles when adopting an instructional methodology that will be used extensively throughout the curriculum".

In their studies Gilbert and Han (1999) stated, "an approach to achieve "A Significant Difference" is to provide several different instruction methods". (p. 433) So, they have developed a Web-based instruction system they called as "Arthur" which provides adaptive instruction. As an opposite view to traditional system, which defines one-to-many presentation of the lecture, this system takes several different styles of instruction from several different instructors and makes them available to each learner, which defines a many-to-one relationship. Here the web-based instruction is presented to the student by using different methods like audio, visual and text, which is expected to result in accommodating individual learning styles.

Contradictory to the findings of previous studies, Shih and Gamon (1999) found that "student learning styles and student characteristics did not have an effect on their Web-based learning achievement". They also concluded that "students with different learning styles and backgrounds learned equally well in Web-based courses and learning styles did not affect student motivation and use of learning strategies" and that "motivation and learning strategies seemed to be the most important factors in Web-based learning".

Snyder (2000) developed an instrument that teachers could easily administer to their classes to learn more about the learning needs of their students and by using this tool she investigated the relationships between academic achievement and the learning styles/multiple intelligences in her study. The results of this study showed that "many relationships emerged as being dependent" and the researcher concluded, "to be successful in our classrooms, we need to be more aware of how our students learn".

Research Questions:

This research particularly focused on the following main research questions:

1. What are the perceptions of faculty members on addressing learning styles in different instructional environments (traditional vs. web-based)?

2. What are the perceptions of 4th year preservice teachers in terms of considering learning styles in different learning environments (traditional vs. web-based)?

Research Methods:

This study used qualitative research methods for two specific reasons. First, qualitative research is an adequate method for disclosing underlying attitudes, thoughts, and perceptions when the literature suffers from lack of research on the phenomenon (learning styles and web-based instruction, which this study investigates). Second, a detailed description about the research content is needed in order to provide a complete and revealing picture to see what is going on. That's why, this study is a 'case study' since the participants were selected from only one department at a state university and it is needed to present a holistic portrayal of the phenomenon (Patton, 1987).

Subjects

The subjects of this study included 3 faculty members and 13 preservice teachers of department of Computer Education and Instructional Technology (CEIT) at a state university. Since main concern of this study is to understand the phenomenon about the consideration of learning styles in traditional and Web-based instruction, we have to explore the phenomenon from multiple perspectives. To attain this goal, the subjects of this study were selected from Computer Education and Instructional Technology (CEIT) Department keeping these two issues in the mind;

1. The department is the one, which uses Web-based instruction most frequently as a supplementary to traditional courses among the departments of faculty of education in one State University,
2. For its accessibility.

Data Sources

This study extracted data from the following main sources:

1. Three faculty members
2. Thirteen preservice teachers
3. Document Analysis

Structured interviews were conducted with Faculty members of CEIT in order to understand their perceptions. These interviews were conducted according to a 'interview guide' which was developed and pilot tested by the researchers. All of the interviews were tape-recorded with the consent of the participants.
Preservice teachers were asked to fill out a 'questionnaire' in order to access a wider population. This questionnaire had parallel questions with the interview guide developed for the faculty members. The questionnaire was prepared and pilot tested by the researchers in order to ensure its validity.
To obtain a more detailed vision of the preservice teachers towards the topic, a structured interview guide is prepared for preservice teachers including parallel questions with the questionnaire. For the recording of interviews, a tape recorder was used.
Finally, as the document analysis part of the study, the researchers did a comprehensive literature review.

Procedures

In this study, data was collected in the following manner:

1. Structured interviews were held with 3 faculty members.
2. Open-ended questionnaire was administered to all preservice teachers (totally 49 students of 4th year) of Computer Education and Instructional Technology Department. Of 20 students volunteered to participate the study.
3. After the analysis of results of previous step, 13 students were selected out of 20, in order to conduct more in-depth interviews. 3 focus group interviews were held with 4 students in two groups and 5 students in one group respectively.

Data Analysis:

The results obtained from interviews and questionnaire were analyzed, in order to explore faculty members' and preservice teachers' perceptions.
The data collected were analyzed inductively after the collection period is completed. The analyses were triangulated in terms of sources of data. According to Maxwell (1996), triangulation "reduces the risk of chance associations and of systematic biases due to a specific method and allows a better assessment of the

generality of the explanations that you develop" (p. 93). Furthermore, other researchers validated each interview transcript and interpretation.
Multiple perspectives will yield people approaching situations from different point of views. Therefore, it is important for the reader to see the case from multiple perspectives and think about or judge the case by his/her own ideas.
The results obtained from interviews were analyzed separately, in order to understand faculty members' and preservice teachers' perceptions. Interview data were transcribed precisely and coded inductively. The similar patterns and/or themes were outlined. After creating coding categories for the analyzed data, coding of the data was repeated according to these coding categories. Finally, the results were reported both from the views of faculty members and preservice teachers, separately.

Findings:
Throughout this section, illustrative opinions of faculty members and preservice teachers from structured interviews highlights the results.

Faculty members:

Theme 1: Faculty Members' Perceptions on learning styles in traditional learning environments:

All faculty members agreed that every student has different characteristics and talent. Every student has individual preferences coincided with their learning process. Two faculty members provided a definition for learning styles that parallels with learning theories. They also advocated that differences in learning styles could especially be tracked down by observing one's study habits or behaviors in the learning environment. When faculty members were asked about how they determine their teaching style, they all stated that such decision mainly relies on the content to be taught.

Theme 2: Perceptions of faculty members on instructional materials and strategies used in the classroom:

All faculty members reported that preferring certain teaching strategies in the classroom requires utilization of variety of teaching materials and learning tasks. Additionally, all faculty members reported that if one intends to accommodate students' learning styles in the classroom, s/he has to utilize a number of appropriate teaching strategies and techniques as possible.

Theme 3: Faculty members' perceptions on learning styles in web-based instruction:

Faculty members stated the lack of "face-to-face interaction" and "presence of immediate feedback" on the web as the most distracting feature for instruction. They also recognized the inefficiency of interactivity among all parties on the web. They also mentioned the value of utilizing all possible cognitive tools while designing a web-based instruction in order to address students' varying learning styles.

Theme 4: Perceptions of faculty members for addressing different learning styles in a web-based instruction:

Faculty members stated that the most important issue in addressing learning strategies in a web-based instruction is to consider such learning theories as cognitivism and constructivism. According to the faculty members, designing an instruction on the web is a dynamic process and this dynamism should be conveyed by the feedback provided by students.

Preservice Teachers:

Theme 1: Preservice teachers' opinions about their learning preferences in traditional learning environments:

The most common learning preferences of students in traditional classrooms could be classified from most used one to least used as; note taking, asking questions and listening to the instructor, discussion, learning in cooperative groups, reading course material and individual study.

Theme 2: Perceptions of preservice teachers about instructional strategies used in the classroom:

The most preferred instructional strategy by preservice teachers was "discussion". Learning by doing, project-based learning, cooperative learning, questioning, discovery learning and problem solving were the other strategies favored by preservice teachers respectively. All preservice teachers also addressed that they have to be an active participants of the learning environment. Unlike other focus groups, one of the groups reported that they prefer a mix of different learning methods, and learning environment must be a representative of real life cases. Surprisingly, 14 students out of 20 ranked books as the most favored medium of instruction.

Theme 3: Preservice teachers' perceptions about web-based instruction and their learning preferences:

All groups agreed that a web-based instruction should offer texts in different formats such as html, word, pdf and so on. They also reported that they should be able get print out of those pages whenever needed. Using different types of media such as audio, visuals, video and so on are also preferred in a web-based instruction by the preservice teachers if those features are available whenever they want.

Theme 4: Preservice teachers' perceptions about how to adopt their learning preferences to a web-based instruction:

Preservice teachers' responses to this question varied. For example, two of the groups addressed that web-based assessment is less valid than traditional assessment in terms of authenticity of student responses on a test and other security issues regarding to access. They also advocated that web-based instruction limits social interaction among the participants. Of 2 focus groups addressed that the sequence of instruction should be in accordance with their performance and learning pace. Navigation structure of the web-based instruction is another important future that preservice teachers emphasized. Finally, they reported that web-based instruction is more suitable for adult learners.

Discussion and Conclusion

The purpose of this study was to examine participants' perceptions and their preferences of learning styles in traditional and Web-based instruction. Sixteen participants (3 faculty members, 13 preservice teachers) were the main focus of this study.

One of the most important findings of this study is that all faculty members recognize the importance of utilization of a number of teaching materials and learning activities in favoring certain teaching strategies for effective instruction. They also underlined the necessity for adopting appropriate and a variety of teaching strategies and techniques as possible to address students' differing learning styles in the class. On the other hand, faculty members considered web-based instruction as a weak format for presenting content in terms of its inadequacy in providing face-to-face interaction and immediate feedback. Therefore, they suggested that all possible cognitive tools should be integrated into web-based instruction to overcome such obstacles. This finding parallels with the related literature as well (Yildirim & Kiraz, 1999). Finally, faculty members reported that web-based instruction should provide adaptive instruction to address students' differing learning styles. Brusilovsky and his associates (1999) also reported similar concerns; "To support the student navigation through the course, the system uses adaptive annotation. . ." (p. 257).

When preservice teacher were asked to identify their preferences of learning strategies in traditional classroom settings, they reported "note-taking, questioning, discussion, and learning in cooperative groups" as the most preferred strategies. Preservice teachers also favored learning by doing, problem solving and problem-based learning for effective learning. Surprisingly, most preservice teachers ranked books as the most preferred medium of instruction, yet they were majoring in computer education and were advanced on using computers. Similar to faculty members, preservice teachers also advocated that different type and format of presentation should be present on the web. They also stated that active participation is a key activity to learn effectively and different formats and medium of presentation on the web should have them actively participate in instruction. In conjunction with the faculty members' perceptions, preservice teachers also stated that web-based instruction should provide instruction in accordance with their learning pace and performance. Additionally, they underlined the importance of navigation structure on a web-based instruction. Finally, in contrast to faculty members' perceptions, preservice teachers viewed web-based instruction as more suitable for adult learners.

References:

Bohlen, G. A. and Ferratt, T. W. (1993). The effect of learning style and method of instruction on the achievement, efficiency and satisfaction of end-users learning computer software. Proceedings of the 1993 conference on Computer personnel research , Pages 273 – 283.

Bostrom, R. P., Olfman, L. and Sein, M. K. (1988). The importance of individual differences in end-user training: The case for learning style. Proceedings of the ACM SIGCPR conference on Management of information systems personnel, Pages 133 – 144.

Brusilovsky, P. & Schwarz, E. & Weber, G. (1999). Electronic textbooks on the world wide web: From static hypertext to interactivity and adaptivity. In B. H. Khan (4th Eds.), *Web-Based Instruction* (pp. 255-61). Englewood Cliffs, NJ: Educational Technology Publications, Inc.

Chuang, Y. (1999). Teaching in a multimedia computer environment: A study of the effects of learning style, gender, and math achievement. Interactive Multimedia Electronic Journal of Computer-Enhanced Learning, 1(1). URL: http://imej.wfu.edu/articles/1999/1/10/index.asp. Last visited 10.10.2000.

Cohen, V. L. (1997). Learning styles in a technology-rich environment. *Journal of Research on Computing in Education*, 29(4), 338-50.

Gilbert, J. E. and Han, C. Y. (1999). Arthur: Adapting instruction to accommodate learning style. In P. Bra and J. Leggett (Eds.), Proceedings of WebNet 99 – World Conference on the WWW and Internet, (pp. 433-438). Charlottesville, VA: Association for the Advancement of Computing in Education.

Jonassen, D. H. and Grabowski, B. L. (1993). *Handbook of individual differences, learning, and instruction.* Hillsdale, NJ: Lawrence Erlbaum Associates, Inc. Publisher.

Maxwell, J. A. (1996). *Qualitative research design: An interactive approach.* Thousand Oak, CA: SAGE Publications, Inc.

Patton, Q. P. (1987). *How to use qualitative methods in evaluation.* Thousand Oak, CA: SAGE Publications, Inc.

Shih, C. and Gamon, J. (1999). Student learning styles, motivation, learning strategies, and achievement in web-based courses. URL:http://iccel.wfu.edu/publications/journals/jcel/jcel990305/ccshih.htm. Last visited 11.29.2000.

Snyder, R. F. (2000). The relationship between learning styles/multiple intelligences and academic achievement of high school students. *High School Journal*, 83(2), 11-20.

Silver, H. and Strong, R. (1997). Integrating learning styles and multiple intelligences. *Educational Leadership*, 55(1), 22-27.

Yildirim, S. and Kiraz, E. (1999). Obstacles in integrating online communication tools into preservice teacher education: A case study. *Journal of Computing in Teacher Education*. 15(3), 23-28.

Putting Assessment in Perspective: Successful Implementation in Educational Technology and Curriculum Integration

Robert Z. Zheng
Educational Studies Division
Marian College
United States
rzheng@mariancollege.edu

Kris M. Giese
School Library and Media Center
Chegwin Elementary School
United States
Kristine_M_Giese@fonddulac.k12.wi.us

Abstract: This paper focuses on how to use assessment tool to effectively integrate educational technology into curriculum. The authors examine the current practices in educational technology and curriculum integration and point out that successful integration of educational technology and curriculum depends on a sound system of quality assessment. An assessment model is proposed with a focus on the various stages of designing, developing and implementing the model that will enhance the integration of educational technology and curriculum in schools. Examples and case studies are discussed to illustrate how to use this model for K-12 educational technology integration. Limitations and suggestions are included for further study.

Introduction

Concern regarding how to effectively integrate educational technology into curriculum is at a high point in K-16 settings (Jones & Paolucci, 1999). School board members, policy makers, and the media are saying that educators have spent millions of dollars on technology for classrooms without being able to measure its effects on student learning. Some parents, even teachers themselves, become skeptical about the role of technology played in teaching and learning. To avoid the pessimistic forecast that the technology will simply become a passing fad in education, attentions must be paid to defining the goals for the use of technology, developing a strategic plan for technology and curriculum integration, and measuring the progress made. Sun (2000) in a recent article points out that the challenge that educational technology faces today is not what software and hardware we need to invest in our schools, but rather how to "create realistic evaluations of IT's effect on students and their academic achievement" (p. 34).

What to assess and how to assess still remain critical issues in educational technology evaluation. Studies indicate that current practices in educational technology evaluation mainly fall into three categories: (1) assessing the use of educational technology in specific content area, (2) assessing the use of educational technology in assessment itself, and (3) assessing the use of educational technology in specific learning strategies or approaches. The first category focuses on the relationship between the technology and a single subject, that is, on the effectiveness of the use of various technologies including multimedia and hypermedia in specific subject areas such as math, reading, writing, ESL education, special education (Dugdale, et al., 1998; Lindsay, 1999; Zhang, 2000). Such assessment limits itself to a specific learning situation within a single subject and hardly goes beyond its subject domain, failing to address the issue of integrating technology into curriculum as a whole. Therefore, it does not meet the needs for general purpose evaluation. The second category zeros in on the use of technology in assessment. That is, how to use technology to enhance the efficacy of assessment. Assessment under this category examines the role of online testing and computer-assisted assessment in learning (Gretes & Green, 2000; Titus & Martin, 2000). Again, it fails to address the issue of an overall planning for effective integration of technology into curricula. The third category has in recent caught the attention of educators as performance-based learning, authentic learning and other types of constructivist learning approaches become the fad in education (Bonnie, 1994; Carlson, 1998; Russell & Butcher, 1999). The role of technology has been examined to create an authentic, real life situation in which learners can engage in meaningful and constructive learning. Although assessments in the above three categories have contributed to the understanding of the relationship between assessment and technology, they, nonetheless, fail to provide a holistic picture of how technology can be effectively applied to subjects across the curricula. In other words, what is the common denominator with which educators are able to evaluate their practice in educational technology and curriculum integration? Evaluating educational technology should consider variables that are common to all subjects and that are applicable to integration across all curricula.

Current practices in educational technology tell us that what teachers need most is not how to use technology, but rather how to use it *effectively*. Oftentimes, efforts to integrate educational technology into curriculum fail to yield desired results because such efforts are not garnered by a sound system of quality assessment. The term "quality assessment in educational technology" means using appropriate assessment tools and methods to evaluate various stages in educational technology and curriculum integration. This paper will, therefore, address the following issues which are vital to our current practices in integrating educational technology into curriculum: (1) The needs for using assessment as an effective tool to enhance integration of educational technology into curriculum; (2) Ways of using various assessment methods to align educational technology with curriculum standards; and (3) Ways of teacher using assessment to create an effective learning environment with educational technology.

Needs for Assessment in Educational Technology

With the rapid introduction of computers into schools, routine access to multimedia and hypermedia resources by instructors becomes possible. Among many of technology users, three types of users typically represent those who are currently using the technology in today's classrooms. They are: (1) follow-the-national-and-state-mandate users, (2) follow-the-fashion users, and (3) self-initiated users. The first type of users are passive in using the technology, simply follow the national and state mandate and use the technology in teaching as required by the school or the district. The technology therefore plays a very limited role in instruction under these circumstances. The second type of users are characterized by an "overnight" enthusiasm for the use of technology. Urged by their colleagues or peers who have integrated technology into teaching, they become enthusiastic about the technology and begin to use technology in their classrooms. However, their enthusiasm for technology is a short one and wanes quickly as they encounter difficulties in the process of using the technology. The third type of users are adamant about putting technology in their classrooms. This is a type of "I want to do it" users. Yet their technology and curriculum integration lacks a systematic planning and is not garnered by a sound system of assessment. Oftentimes, they found themselves in a situation where the result was only worth half of the efforts made. Obviously, if technology is going to play a positive role in teaching and learning, if learners are going to benefit from technology in their learning, if teachers want to create a creative and constructive learning environment, it is imperative to establish a sound system of quality assessment that evaluates "how teachers are using technology in the classroom and the general academic achievement that results from their instructional technology (IT) practices" (Moersch, 1999, p.41).

The National Educational Technology Standards for Teachers (NETS•T) Standards IV states that teachers "apply multiple methods of evaluation to determine students' appropriate use of technology resources for learning, communication, and productivity" (ISTE, 2000). The challenges that we all face today are: how do we use methods of evaluation to determine students' use of technology? And how do we know that teacher's use of technology in classroom is working? There are various models that address the issue of integrating technology into curriculum. Bowens (2000) introduced a technology-integration model known as The RAC Model which consists of three phases: Research, Analysis, and Communication. The RAC Model starts with engaging students in gathering information by researching through various media including traditional textbooks, film/videos, Internet, then involving them in various higher level thinking activities such as analyzing and categorizing information, and finally using variety of technology to communicate the results. Although the Model discusses the role of technology in higher level cognitive learning, it fails to establish the connection between curriculum objectives and the use of technology. In Bowens's model the functions of technology are not examined to provide a strong rationale for its use in curriculum implementation. What has happened is that the users moves directly from the stage of curriculum objectives to the stage of technology activities, that is, using the technology without understanding exactly why a particular piece of technology is used and what the functions are that will ensure the successful implementation of the curriculum objectives.

Morrison et al. (1999) proposed an Integrating Technology for Inquiry (NTeQ) model which addresses the issue of technology functions in curriculum integration. Morrison et al.'s model provides an excellent tool for teachers to integrate educational technology into curriculum. Yet their model regards assessment as a separate entity. The assessment is placed at the last stage of the NTeQ model. In other words, NteQ Model adapts a summative approach rather than a formative one in assessing technology and curriculum integration. However, the authors believe that the assessment should be an ongoing process which must be built into every stage of technology and curriculum integration.

Model of Assessment

Being aware of the challenges that teachers face in their technology and curriculum integration and realizing that successful technology and curriculum integration depends on a sound system of quality assessment, we start to develop an assessment model which is based on five guiding principles: (1) student-centered, (2) focus on standards and objectives, (3) focus on students' ability to construct knowledge, (4) encourage higher level thinking, and (5) encourage reflective thinking. After an extensive study on national and state standards, we defined two types of knowledge and three types of skills as the basic knowledge framework for evaluating teachers' use of technology and students' performance in a technology-integrated curriculum. The knowledge and skills include: (1) Declarative knowledge, (2) Procedural knowledge, (3) Complex thinking skills, (4) Effective communication skills, and (5) Collaboration/Cooperation skills. We believe the types of knowledge and skills we defined are applicable to subjects across all curricula.

Our assessment model (EEAER Model) contains five stages: (1) Evaluate objectives, (2) Examine technology functions, (3) Assess technology-rich activities, (4) Evaluate learning outcomes, and (5) Reflect on learning experience (Figure 1).

Various Stages In Assessing Educational Technology and Curriculum Integration

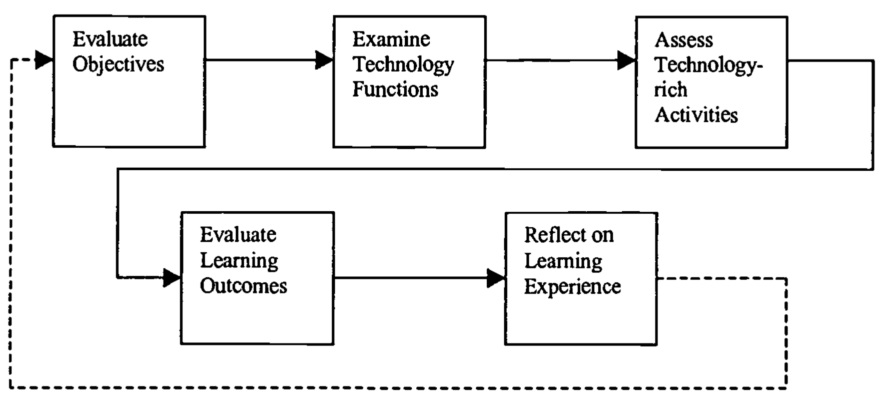


Figure 1: EEAER Model of Assessment

Evaluate Objectives Successful implementation of technology and curriculum integration starts with careful planning which clearly defines the curriculum objectives. Assessment is to ensure that curriculum objectives meet the standards. The evaluation of objectives, therefore, focuses on: (1) alignment with standards, (2) the role of technology in instruction, (3) the role of technology in learning, and (4) knowledge and skills covered. We used assessment tools such as checklist, matrix, questionnaire, Likert's rating scale to assess whether the objectives are aligned with various standards and criteria.

Examine Technology Functions Technologies which apply well in one learning situation may not work well in other learning situations. Some students may benefit from a specific computer software whereas others may not benefit from it at all. The complexity of various functions of technology determines that the process of implementing a technology-integrated curriculum must be a complex one. Therefore, teachers need to identify the functions of technology and understand what software to use and how to use. For example, teachers may look at the functions of educational software by examining the role it plays in learning, whether it belongs to a productivity tool or a mindtool (Jonassen, 2000). If it is a mindtool, what specific function does it have? Is it a concept mapping tool, or a data processing, or a graphic/data processing tool? How well does it meet the curriculum objectives?

Assess Technology-rich Activities The technology-rich activities stage consists of three sub-stages: (1) *Pre tech-rich activities*. Students identify problems, plan how to collect, analyze, and categorize data; (2) *Tech-rich activities*. Students learn to use technologies and engage in higher level thinking activities via technology; (3) *Post tech-rich activities*. This is the enrichment stage where students engage in peer review, exploring other forms of content delivery, and examine how their knowledge becomes transferable to other learning situations.

Evaluate Learning Outcomes Four learning outcomes are essential for evaluating technology and curriculum integration: (1) Core technology skills (Coughlin & Lemke, 2000), (2) Cognitive and metacognitive skills, (3) Social skills, and (4) Attitudes. Coughlin and Lemke (2000) defined core technology skills as hardware, network, information tools, application tools, and multimedia/presentation. Cognitive and metacognitive skills include reasoning, analyzing, synthesizing, creating, constructing, problem solving (Marzano et al., 1994) and self-awareness, goal setting, and strategic planning. Social skills consist of collaboration, communication, contribution to group goals, etc. Finally, attitudes means students' motivation and disposition to learning, interest in using technology, and ability to face challenges in learning. Again, rubrics, portfolio, checklist, questionnaire, interview, observation are viable tools for assessing learners' learning outcomes.

Reflect on Learning Experience Oftentimes, assessment is a teacher-dominate process. Our assessment model tries to include students in the evaluation process. This will create in students a sense of ownership and motivate them to learn. In this stage students reflect on the technology and content learning, the technology and cognitive skills, and the transferability of knowledge to other learning situation via technology.

The EEAER assessment model is a dynamic, self-generating model in that each stage is a on-going, formative assessment process that detects and self-corrects errors in its integration of technology into curriculum. For example, when an assessment tool like checklist is used to assess the software functions and finds that the software selected is not the right tool for carrying out the objectives, other software will be chosen from the checklist to meet the requirements. Thus the assessment tool is not a passive tool that simply inspects, it is, instead, a dynamic tool that helps to form instructional decision based on standards. The five stages in the EEAER Model are an on-going, cyclic process in which the stages are interwoven and interacting with each other. For instance, the technology-rich activity stage may provide some feedback to the objectives stage which will be revised and which will, in turn, further affect the use of technology and the role of technology in learning and teaching.

Case study: the implementation of technology and curriculum integration with EEAER model

We have applied the EEAER model to several undergraduate and graduate courses. The results are positive. The students feel they understand better the functions of the technology, the relationship between technology and curriculum, therefore, are better users of technology in teaching and learning. A typical example is a graduate course we offered in the summer of 2000 in which we applied the EEAER model to integrate technology into curriculum.

The course is a graduate seminar entitled "Bridge building between community and school using educational technology." It was designed to help the students become aware of the issues regarding school and community collaboration, explore ways to bridge school and community via technology, and appreciate the benefits of using technology as an effective tool to collaborate school with community. Fourteen graduates enrolled in the seminar. Among them eleven from elementary schools and three from junior high. Except one graduate student who was at administrative level, the rest were teaching at various grade levels in the subject areas of language arts, reading, math, science, social studies, etc. The course objectives focused on integration of technology into the content area. The students were to use Web technology to create an instructional Web page which served as the link between the school and the community. The functions of Web technology were examined and assessed to determine if it fit the objectives and met the purpose of teaching and learning. Students also engaged in brain storming, discussing pros and cons related to the use of Web technology as a tool for school and community collaboration. They planned how to design and developed their Web pages. The instructors taught the basics in Web construction. But it was the students who decided what information should go into their Web pages and how their Web pages should be designed and developed. The students examined each other's Web pages and engaged in an informal peer evaluation which became part of their valuable learning experience. Finally, students presented their projects before their peers. Comments were made regarding the content, the design and the techniques of their Web pages. In an aftermath course evaluation the students reflected that they learned a lot, understood better the content and issues and were able " to create a nice Web page." Others commented they saw " the possibilities available to teachers for use in the classroom." The EEAER model was integrated into the various stages of course design and development. Various assessment tools were used to align objectives with standards, examine the functions of technology chosen, garner the activities in which technology-integrated curriculum was implemented, and evaluate the learning outcomes by checking students' performance in a technology-rich learning environment. By incorporating EEAER assessment model into the technology-rich curriculum we find that

(1) instructors are able to align the use of the technology with standards; understand better the relationship between technology and curriculum, and use technology more effectively to achieve curriculum objectives;
(2) students who use the technology become more goal oriented and know how to use technology as an effective tool to enhance their learning;
(3) the use of model motivates the instructor to teach and the student to learn as the instructor knows better how to successfully integrate technology into curriculum and the student knows better how to learn more effectively with technology.

The EEAER assessment model is applicable to any subject. The model empowers the teachers by allowing them to easily and appropriately incorporate technology in their classrooms, assessing the students' academic strength and weakness as well as their abilities to collaborate and communicate in a technology-rich learning environment. It also enables the teachers to evaluate how well they use technology in the classrooms.

Conclusion

The EEAER assessment model is a useful tool for K-12 teachers who are eager to but do not know how to infuse technology into curriculum. It is a tool that can be applied to subjects across all curricula. It provides the framework for teachers to go beyond the mere acquisition of technology for their classrooms to addressing the bigger question: How can technology be used to effect change and improve student learning and achievement?

Realizing that the model has a potential for helping teachers to improve their use of technology in classrooms, we also notice that the study is still in its fluid stage. It needs to be implemented in a more diverse population and learning setting so that the model can reach beyond its present study scope to generate findings that are significant at a more general level. We hope that our study will serve as a stepping stone which will attract those who are interested in building a sound system of quality assessment that will garner teachers' use of technology in classrooms and their integration of technology into curricula.

References

Bonnie, K.M. (1994). Technology in authentic assessment. Portfolio: addressing the multiple dimensions of teaching and learning. ERIC#: ED376117.

Bowens, E.M. (2000). Research, analysis, communication: meeting standards with technology. *Learning & Leading with Technology*, 27(8), 6-17.

Carlson, R.D. (1998). Portfolio assessment of instructional technology. *Journal of Educational Technology Systems*, 27(1), 81-92.

Coughlin, E.C., & Lemke, C. (1999). *Professional competency continuum: professional skills for the digital age classroom*. Santa Monica, CA: Milken Family Foundation.

Dugdale, S., LeGare, O., Matthews, J.I., & Ju, Mi-Kyung (1998). Mathematical problem solving and computers: a study of learner-initiated application of technology in a general problem-solving context. *Journal of Research on Computing in Education*, 30(3), 239-253.

Gretes, A.J., & Green, M. (2000). Improving undergraduate learning with computer-assisted assessment. *Journal of Research on Computing in Education*, 33(1), 46-54.

International Society for Technology in Education (2000). National Educational Technology Standards for Teachers. Available at ISTE Website: http://cnets.iste.org/teachstandintro.html.

Jonassen, D. H. (2000). *Computers as mindtools for schools*. Upper Saddle River, NJ: Prentice Hall-Merrill.

Jones, R.H., & Paolucci, R. (1999). Research framework and dimensions for evaluating the effectiveness of educational technology systems on learning outcomes. *Journal of Research on Computing in Education*, 32(1), 17-27.

Moersch, C. (1999). Assessing Current Technology Use in the Classroom. *Learning & Leading with Technology*, 26(8), 40-49.

Morrison, G., Lowther, D.L., & DeMeulle, L. (1999). *Integrating Computer Technology into the Classroom*. Upper Saddle River, NJ: Prentice Hall-Merrill.

Lindsay, M. (1999). Designing assessment tasks to accommodate students' cognitive skills in a technology-based mathematics course. *International Journal of Mathematical Educational in Science and Technology*, 30(5), 169-97.

Sun, J. (2000). How do we know it's working? *Learning & Leading with Technology*, 27(7), 32-49.

Titus, A., & Martin, L. (2000). Education research using Web-based assessment systems. *Journal of Research on Computing in Education*, 33(1), 28-43.

Zhang, Yuehua (2000). Technology and the writing skills of students with learning disabilities. *Journal of Research on Computing in Education*, 32(4), 467-77.

Acknowledgements

The authors would like to express their thanks for the support from Goals 2000 Preservice Teacher Development Grant which helped shape this study.