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ABSTRACT

This document contains the six papers that were presented at a business education and information systems special interest group meeting. The six papers were selected through a review process, with one paper being selected for the "outstanding paper" award. The award-winning paper is "The Importance of Desktop Computer Presentation Competencies as Perceived by Secondary Vocational Business Teachers and Business Professionals" (Lonnie J. Echternacht). The other papers are as follows: "Executives' Expectations of Administrative Support Personnel: Implications for Business Education" (Marcia A. Anderson-Yates, Angela Penny); "The Human Factors Effects of Using a Mouse Device for Computer Input" (Lonnie J. Echternacht, Donna R. Everett); "Case Studies to Evaluate a Computer-based Model for Cost-Benefit Analysis of Flexible Delivery Options in Australian Vocational Education and Training" (Charles R. Hopkins, Roy Lundin, Rod Gerber); "The Computer Ability Scale: A Replication and Extension Involving College Computer Literacy Students" (Brian N. Smith, James R. Necessary); and "A Descriptive and Interpretive Study: The Intellectual Development of Adults" (Barbara A. Wilson). (KC)

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BUSINESS EDUCATION AND INFORMATION SYSTEMS RESEARCH

SPECIAL INTEREST GROUP

PROCEEDINGS

American Educational Research Association

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1996 Annual Meeting
New York, NY

April 8-12, 1996

Donna H. Redmann,
Editor

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SIG Program Chair and Proceedings Editor
Louisiana State University

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NOTES FROM SIG PROGRAM CHAIR

The 1996 American Educational Research Association (AERA) Annual Meeting was held in New York City, April 8-12. The theme for the AERA Conference was *to educate today's students to become tomorrow's productive members of a democratic society requires fundamental and comprehensive change in American education. This transformation--already in progress--involves reinventing teaching and learning so that schools become human-scale learning communities for adults as well as students, providing intellectually challenging environments for a diverse population. To accomplish this transformation, it will be necessary to develop and provide knowledge from research that informs policy and serves practice.*

The AERA Business Education and Information Systems Research Special Interest Group (SIG) had two sessions: two paper presentation sessions and a business meeting. A copy of the SIG program agenda is provided on page iv. The eight papers selected for the conference were selected through a blind, peer refereed process. There were a total of nine reviewers, with each proposal being read by three reviewers. The six papers contained herein are from all the authors who presented their papers at the conference.

OUTSTANDING PAPER AWARD. At the 1995 meeting in San Francisco, the SIG membership voted to have an award for the outstanding paper. The top five rated proposals were selected as candidates for the award. Using a blind a second review process, the completed full papers were reviewed by four reviewers from four different universities in four different states. The winner of the Outstanding Paper for the 1996 AERA Business Education & Information System Research SIG Conference was Dr. Lonnie J. Echternacht, University of Missouri-Columbia, for his paper, entitled, "The Importance of Desktop Computer Presentation Competencies as Perceived by Secondary Vocational Business Teachers and Business Professionals." A plaque was given to Dr. Echternacht.

Donna H. Redmann, Program Chair and Proceedings Editor
Business Education and Information Systems Research SIG
1996 AERA Annual Meeting

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1996 AERA Annual Meeting
New York, New York
April 8-12, 1996

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ID No. S-15-2; Session No. 18.44

Date/Time: Tuesday, April 9, 4:05-6:05 p.m.
Location: Sheraton, Liberty 3, 3rd Floor

Chair: Donna H. Redmann, Louisiana State University

PRESENTATIONS:

The Importance of Desktop Computer Presentation Competencies as Perceived by Secondary Vocational Business Teachers and Business Professionals. Lonnie J. Echternacht, University of Missouri-Columbia

The Computer Ability Scale: A Replication and Extension Involving College Computer Literacy Students. James R. Necessary, Brian N. Smith, Ball State University

Case Studies to Evaluate a Computer-based Model for Cost-Benefit Analysis of Flexible Delivery Options in Australian Vocational Education and Training. Charles R. Hopkins, University of Minnesota; Roy Lundin, Rod Gerber, Queensland University of Technology, Queensland, Australia

Discussant: Marcia A. Anderson-Yates, Southern Illinois University at Carbondale

PRESENTATIONS:

The Human Factors Effects of Using a Mouse Device for Computer Input. Lonnie J. Echternacht, Donna R. Everett, University of Missouri-Columbia

Business Students' Attitudes Toward the Use of Electronic Communications Within Course Assignments. Randy L. Joyner, East Carolina University; Mary Jean Lush, Delta State University; Jerry Kandies, Delta State University; Dr. Allen D. Truell, California State University--San Bernardino; Vivian Arnold, East Carolina University; Robert M. Bacchus, Morehead State

Discussant: Vivian Arnold, East Carolina University

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ID No. S-15-1 Session No. 20.14

Date/Time: Tuesday, April 9, 6:15 - 7:45 p.m.
Location: Sheraton, Liberty 3, 3rd Floor

PRESENTATION: Executives' Expectations of Administrative Support Personnel: Implications for Business Education. Marcia A. Anderson-Yates, Southern Illinois University at Carbondale; Angela Penny, College of Arts, Science, & Technology, Kingston, Jamaica, West Indies

Discussant: Judy J. Lambrecht, University of Minnesota

PRESENTATION: Age, Education, and Intellectual Development of Technical College Instructors. Barbara A. Wilson, California State University at Northridge

Discussant: Ken Martin, University of Cincinnati

BUSINESS MEETING

President: Donna H. Redmann, Louisiana State University

Secretary: Wanda L. Stitt-Gohdes, University of Georgia

OUTSTANDING PAPER AWARD

The

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THE IMPORTANCE OF DESKTOP COMPUTER PRESENTATION COMPETENCIES AS PERCEIVED BY SECONDARY VOCATIONAL BUSINESS TEACHERS AND BUSINESS PROFESSIONALS

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Abstract

Effective communication has always been an integral part of business. Desktop computer presentation programs help the user create high-impact business presentations. This study was conducted to determine the importance of desktop computer presentation competencies as perceived by secondary vocational business teachers and business professionals. Areas of both agreement and disagreement exist among and between the perceptions of secondary vocational business teachers and business professionals concerning the importance of the competencies. While both groups tend to have high perceptions regarding the importance of the competencies, secondary vocational business teachers tend to rate the competencies more important than business professionals. Significant differences were found in the responses of the two groups regarding the perceived importance of the competencies.

The information explosion has placed a premium on effective communication--getting the right information in front of the right people at the right time, and in the right format. Increasingly, effective communication relies on visual presentation including text, diagrams, graphs, maps, clip art, photographs, animation, videos, and replicas. Research shows that visuals boost audience retention and learning, heighten interest and enjoyment, and significantly influence communication outcomes. Also, easy-to-use computerized presentation software enables the user to be able to generate at the desktop high-quality visuals and related printouts.

Anderson (1992) surveyed business managers and reported that they planned to greatly increase their use of computer presentation and graphics programs to create professional looking charts, graphs, and diagrams by 1995. Anderson concluded that interpreting data would be the most important skill for business graduates in 1995. Griffin (1995) stated that computer presentation software puts complete control in the hands of the presenter. He recommended that college and university business majors be taught to use these tools effectively and focus on the basics--accuracy, legibility, simplicity, and clarity. Cosgrove (1992) pointed out that while presentation software can generate various types of charts and graphs, the creator still has to choose the information to be presented and the best way to do so.

Graves (1995) concluded that presentation software is not only an invaluable tool for teachers to use to prepare visuals for their classroom presentations but these programs can also be tremendous tools for teaching communication concepts--concise writing, color use, typography emphasis, graphic enhancements, and presentation of typical numeric and text information in a graphical format. Kizzier, Pollard, and Ford (1991) studied the specific information processing technologies needed at the secondary level and found that nearly 85% of the educators reported that graphics should be taught at the secondary level.

Currently, desktop computer presentation software offers text and graphic templates and libraries of clip art to increase the presenter's efficiency and effectiveness. Preparing individuals to work with this technology is a challenge because there is not a clearly defined role for computerized presentations in the work place environment. In addition, many secondary vocational business programs have yet to define the role of desktop computer presentations in their curricula. Do secondary vocational business teachers and business professionals perceive that computer presentation competencies are important for business employees entering the work place? What is the perceived importance of computer presentation competencies by secondary vocational business teachers and business professionals?

Purpose of the Study

The purpose of the study was to determine the importance of desktop computer presentation competencies for business workers as perceived by secondary vocational business teachers and business professionals. This information should help vocational business educators modify their preparatory curriculum to enable individuals to enter into and make satisfactory progress in the work place--assisting students transition from school to work and closing the gap between the classroom and the work place. In addition, this information should assist business educators and trainers provide relevant inservice experiences that enable workers to adjust to the technological demands of the changing work place.

This descriptive study is designed to answer the following research questions:

1. What is the perceived importance of desktop computer competencies by secondary vocational business teachers and business professionals?
2. Are there any significant differences in the perceived importance of desktop computer presentation competencies between secondary vocational business teachers and business professionals?

Methodology

Data for the study were collected by a survey questionnaire. The questionnaire included desktop computer presentation competencies that had been identified by a panel of experts using a modified Delphi technique (Echternacht, 1996). The 46 desktop computer presentation competencies were divided into six domains: Planning Computerized Presentations (6), Selecting the Presentation Look (8), Creating Text Slides (6), Creating Graphs/Charts (10), Enhancing Presentations with Graphics and Media (6), and Viewing the Presentation (10). A seven-point Likert-type scale for responding to each of the computer presentation competencies, ranging from "Very Important" (7) to "Not Important" (1), was used.

The population consisted of secondary vocational business teachers in Missouri secondary schools as well as area vocational schools and business professionals who use desktop computer presentation systems in the work place. A randomly selected sample of 100 secondary vocational business teachers and 100 business professionals were sent questionnaires. Usable responses were received from 73 of the secondary vocational business teachers and 62 of the business professionals.

Means, percents, and rankings were used to describe the data obtained in the study. To allow statistical analysis of the data, the "Not Important" ratings through "Neutral" ratings (from 1 to 4) were combined. The chi-square test of independence was used to determine if significant differences existed between the responses of secondary vocational business teachers and business professionals. The .05 level of significance was used.

Findings

A summary of the responses of secondary vocational business teachers and business professionals relative to their importance ratings of the desktop computer presentation competencies is presented in Table 1. The importance ratings of the computer presentation competencies were high. The average rating of importance for the 46 competencies, using a 7.0 scale, was 5.62 for secondary vocational business teachers and 5.31 for business professionals. All 46 competencies were rated above 5.0 in importance by secondary vocational business teachers, and 31 of the 46 competencies were rated above 5.0 by business professionals. Thirty-two of the competencies were rated more important by secondary vocational business teachers; the remaining 14 competencies were rated more important by business professionals.

Secondary vocational business teachers and business professionals rated the six domains of desktop computer presentation competencies similarly. The Creating Text Slides Domain of competencies was rated most important by both groups. Secondary vocational business teachers' mean rating for the Creating Text Slides Domain was 5.97; business professionals' mean rating of the domain was 5.84. The same domain, Planning Computerized

Presentations, was rated least important by both groups--5.35 mean rating by secondary vocational business teachers and 4.69 mean rating by business professionals.

Analysis of the two groups' perceptions of the importance of the 46 competencies revealed that both groups tended to perceive the same competencies as being most important and least important (Table 2). A comparison of the nine top-ranked competencies by both groups revealed that seven of the same competencies (D3-1, D3-2, D3-3, D3-4, D4-1, D4-2, and D4-3) appeared on each group's list. Also, seven of the nine competencies that were ranked least important by both groups were the same (D1-4, D1-5, D1-6, D4-9, D6-8, D6-9, and D6-10). Competency D2-2, "Modify/customize preformatted slide templates," of the Selecting the Presentation Look Domain had the greatest difference in ranking; it was ranked 9 by business professionals and 33 by secondary vocational business teachers.

A summary of the responses of secondary vocational business teachers and business professionals indicating the extent to which desktop computer presentation competencies are perceived as important by each group is presented in Table 3. The desktop computer presentation competencies on which there was a pronounced disagreement between the two groups are easily detected. The greatest differences occurred in the perceived importance of 23 competencies, distributed across all six domains, that were significant at the .01 level (D1-2, D1-4, and D1-6 of the Planning Computerized Presentation Domain; D2-2, D2-5, and D2-8 of the Selecting the Presentation Look Domain; D3-1, D3-5, and D3-6 of the Creating Text Slides Domain; D4-6, D4-7, D4-8, and D4-10 of the Creating Graphs/Charts Domain; D5-4, D5-5, and D5-6 of the Enhancing Presentations with Graphics and Media Domain; D6-1, D6-2, D6-6, D6-7, D6-8, D6-9, and D6-10 of the Viewing the Presentation Domain). The mean ratings of perceived importance of four of these 23 competencies (D2-2, D3-1, D4-6, and D6-1) were higher for business professionals while the remaining 19 were rated higher by secondary vocational business teachers (Table 1).

Significant differences at the .05 level were found in the responses of the two groups regarding the importance of an additional four competencies: D1-3 (Planning Computerized Presentations Domain), D2-1 and D2-3 (Selecting the Presentation Look Domain), and D3-3 (Creating Text Slides Domain). Business Professionals rated three of these competencies (D2-1, D2-3, and D3-3) higher while secondary vocational business teachers rated the other one (D1-3) higher (Table 1).

Conclusions

Areas of both agreement and disagreement exist among and between the perceptions of secondary vocational business teachers and business professionals regarding the importance of desktop computer presentation competencies. The data revealed that both secondary vocational business teachers and business professionals have high perceptions regarding the importance of desktop computer presentation competencies. Secondary vocational business teachers tend to rate the competencies higher in importance than business professionals.

Both groups, secondary vocational business teachers and business professionals, tend to identify the same competencies as being most important. Competencies considered most important are predominantly from the Creating Text Slides Domain and Creating Graphs/Charts Domain. Likewise, both groups tend to identify the same competencies as being least important--competencies from the Planning Computerized Presentations Domain, Creating Graphs/Charts Domain, and Viewing the Presentation Domain.

Secondary vocational business teachers and business professionals tend to differ greatly in their perceptions of the importance of desktop computer presentation competencies (27 of the 46 were significantly different). The competencies that were rated differently by the two groups were distributed across all six domains: Planning Computerized Presentations (4), Selecting the Presentation Look (5), Creating Text Slides (4), Creating Graphs/Charts (4), Enhancing Presentations with Graphics and Media (3), and Viewing the Presentation (7).

Recommendations

Since the importance attached to desktop computer presentation competencies by secondary vocational business teachers and business professionals can be identified, special or added attention needs to be given to developing appropriate instructional/learning strategies that insure these competencies are developed by business students preparing to enter the work place. Business programs need to address the teaching of desktop computer presentation competencies for both prospective workers and those already employed in the work place.

Business teachers need to devise ways to incorporate the development of desktop computer presentation competencies into the continually evolving, already crowded vocational business curriculum. Most states require a minimum number of days of seat-time based school instruction and secondary programs tend to reflect these minimums. Thus, successful strategies for teaching desktop computer presentation competencies need to be shared with business teachers, program administrators, and business teacher educators.

Secondary vocational business teachers need to help students connect the skills, knowledge, and attitudes learned in classrooms to the work place so they comprehend typical applications and real-world uses of the concepts and procedures being studied. These connections need to be made intellectually explicit with an emphasis on teaching skills and knowledge in context. Teaching in context implies that students are provided opportunities to apply their computer presentation competencies in real-life situations or authentic simulations--problems or projects closely related to work place situations as well as internships, mentorships, and "shadowing" workers on the job bring relevancy to learning activities.

Along with the increasing emphasis on learning in context, secondary vocational business teachers need to implement instructional strategies that focus on students becoming more responsible for and active in their own learning. Student competency statements specifically describe what the student should know and be able to do. Student performance expectations in school should mirror what is expected in the work place so students are able to transition from school to work successfully.

The perceived importance of desktop computer presentation competencies by secondary vocational business teachers and business professionals has significant implications for business trainers who assist employees meet the growing demands of the work place and increase their productivity. Effective communication has always been an integral part of business; competency in the use of desktop computer presentation programs enable individuals to create more effective high-impact business presentations.

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Table 1

Importance Ratings of Computer Presentation Competencies by Secondary Vocational Business Teachers and Business Professionals

Computer Presentation Competency	Vocational Bus. Tchrs.' Mean Rating	Business Professionals' Mean Rating
Domain 1--Planning Computerized Presentations		
D1-1 Demonstrate presentation strategies that accommodate the major types of learning styles and individual needs present in audiences.	5.30	5.16
D1-2 Analyze business situations to determine when computerized presentation software may be used advantageously.	5.77	4.98
D1-3 Identify advantages and disadvantages of computerized presentation software programs.	5.25	4.84
D1-4 Describe how input/output devices and media may be used in computerized presentations.	5.36	4.56
D1-5 Illustrate how computerized presentations may be used to enhance participants' critical thinking and problem solving.	5.37	4.29
D1-6 Apply criteria for selecting computerized presentation software and hardware.	5.07	4.29
Domain 2--Selecting the Presentation Look		
D2-1 Create slides by keying information directly into selected template slides.	5.75	6.19
D2-2 Modify/customize preformatted slide templates.	5.48	5.87
D2-3 Select the types of slides that are most appropriate for different kinds of information.	5.63	5.82
D2-4 Identify a presentation's premise, purpose(s), major points, supporting information, summary, and action using the outline feature.	5.63	5.81
D2-5 Create slide templates.	5.58	5.52
D2-6 Evaluate the appropriateness of preformatted slide templates.	5.42	5.40
D2-7 Create slides using the outline feature.	5.38	5.37

(Table Continued)

Computer Presentation Competency	Vocational Bus. Tchrs.' Mean Rating	Business Professionals' Mean Rating
D2-8 Describe the functions of the different types of slides (e.g., title, bulleted lists, tables, graphs, charts,		
Domain 3--Creating Text Slides		
D3-1 Spell check electronically the text used in slides.	6.15	6.40
D3-2 Edit and change text attributes.	5.90	6.08
D3-3 Select text for slides and handouts that encapsulate the key ideas of presentations.	6.04	6.06
D3-4 Create title, bulleted, multiform, and free-form text slides.	6.05	6.03
D3-5 Enhance the appearance of text with special effects (e.g., formatting into shapes, shading with colors, adding shadows, stretching, flipping, and rotating).	5.96	5.58
D3-6 Create "build" slides.	5.70	4.90
Domain 4--Creating Graphs/Charts		
D4-1 Select the type of graph that is most appropriate for a particular data set (e.g., bar, line, pie, area, and scatter).	5.88	5.97
D4-2 Enhance the readability of graphs (e.g., headings, titles, labels, legends, grids, and text notes	5.85	5.95
D4-3 Create columnar table slides.	5.86	5.89
D4-4 Create graph (chart) slides.	5.77	5.82
D4-5 Import data from other software application programs and/or files into presentations.	5.75	5.66
D4-6 Create organizational chart slides.	5.53	5.58
D4-7 Define terms associated with graphs (e.g., x and y axes, grid, scale, labels, legends, titles, shading, color, exploding, 3-D, pictorial symbols, and chartjunk).	5.84	5.47
D4-8 Use standard guidelines for displaying numerical data graphically on slides.	5.70	5.39
D4-9 Describe how Object Linking and Embedding (OLE) is used to maintain current information in presentations.	5.25	4.63

(Table Continued)

Computer Presentation Competency	Vocational Bus. Tchrs.' Mean Rating	Business Professionals' Mean Rating
D4-10 Export data from presentations to other software application programs and/or files.	5.56	4.39
Domain 5--Enhancing Presentations with Graphics and Media		
D5-1 Select visual objects to replace text and convey ideas (e.g., images, charts, graphs, diagrams, and pictures).	5.77	5.69
D5-2 Analyze the use of color in slides for coding purposes, affecting the presentation mood, and improving readability.	5.64	5.68
D5-3 Create slides that incorporate strategically placed graphics to enhance communication.	5.78	5.61
D5-4 Use drawing tools to create geometric shapes and special effects (e.g., boxes, circles, lines, symbols, and shadows).	5.56	5.27
D5-5 Use scanners to create graphic files to enhance presentations (e.g., line art, pictures, and photos).	5.70	4.97
D5-6 Use media clips to enhance presentations (e.g., line art, photos, videos, and sound).	5.68	4.69
Domain 6--Viewing the Presentation		
D6-1 Use "slide sorter" feature to rearrange the order of slides.	5.59	5.74
D6-2 Produce printed materials to supplement computerized presentations (e.g., full page, speaker notes, outline, and multiple-slide handouts).	5.90	5.47
D6-3 Use screen highlighters to focus participants' attention or augment information on slides during presentations (e.g., mouse and laser light).	5.58	5.45
D6-4 Preview individual and groups of slides as well as entire presentations.	5.73	5.35
D6-5 Control the advancement and sequence of slides (e.g., manually and automatic).	5.78	5.24

(Table Continued)

Computer Presentation Competency	Vocational Bus. Tchrs.' Mean Rating	Business Professionals' Mean Rating
D6-6 Incorporate slide transition effects to enhance computerized presentations (e.g., replace, overlay, wipe, scroll, fade, weave, open, close, iris, rain, blind, and curtain).	5.47	4.73
D6-7 Develop multiple-slide linear computerized presentations.	5.47	4.61
D6-8 Develop continuously looping computerized screen shows.	5.26	4.40
D6-9 Generate "runtime" files of presentations for use on other computers.	5.14	4.31
D6-10 Develop multiple-slide nonlinear (branching/interactive) computerized presentations.	5.11	3.97

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Table 2
Rankings of Computerized Presentation Competencies--Secondary Vocational Business Teachers vs. Business Professionals

	Vocational Business Teachers		Business Professionals	
Rank	Competency	Mean	Competency	Mean
1	D3-1	6.15	D3-1	6.40
2	D3-4	6.05	D2-1	6.19
3	D3-3	6.04	D3-2	6.08
4	D3-5	5.96	D3-3	6.06
5	D3-2	5.90*	D3-4	6.03
6	D6-2	5.90*	D4-1	5.97
7	D4-1	5.88	D4-2	5.95
8	D4-3	5.86	D4-3	5.89
9	D4-2	5.85	D2-2	5.87
10	D4-7	5.84	D2-3	5.82*
11	D6-5	5.78*	D4-4	5.82*
12	D5-3	5.78*	D2-4	5.81
13	D1-2	5.77*	D6-1	5.74
14	D4-4	5.77*	D5-1	5.69
15	D5-1	5.77*	D5-2	5.68
16	D2-1	5.75*	D4-5	5.66
17	D4-5	5.75*	D5-3	5.61
18	D2-8	5.74	D3-5	5.58*
19	D4-4	5.73	D4-6	5.58*
20	D3-6	5.70*	D2-5	5.52
21	D4-8	5.70*	D4-7	5.47*
22	D5-5	5.70*	D6-2	5.47*
23	D5-6	5.68	D6-3	5.45
24	D5-2	5.64	D2-6	5.40
25	D2-3	5.63*	D4-8	5.39
26	D2-4	5.63*	D2-7	5.37
27	D6-1	5.59	D2-8	5.35*
28	D2-5	5.58*	D6-4	5.35*
29	D6-3	5.58*	D5-4	5.27
30	D4-10	5.56*	D6-5	5.24
31	D5-4	5.56*	D1-1	5.16
32	D4-6	5.53	D1-2	4.98
33	D2-2	5.48	D5-5	4.97
34	D6-7	5.47*	D3-6	4.90
35	D6-6	5.47*	D1-3	4.84
36	D2-6	5.42	D6-6	4.73
37	D2-7	5.38	D5-6	4.69
38	D1-5	5.37	D4-9	4.63
39	D1-4	5.36	D6-7	4.61
40	D1-1	5.30	D1-4	4.56
41	D6-8	5.26	D6-8	4.40
42	D1-3	5.25*	D4-10	4.39
43	D4-9	5.25*	D6-9	4.31
44	D6-9	5.14	D1-6	4.29*
45	D6-10	5.11	D1-5	4.29*
46	D1-6	5.07	D6-10	3.97

*Competency mean scores are tied, thus indicated ranks may need to be adjusted.

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Table 3

Percent of Secondary Vocational Business Teachers and Business Professionals Indicating Different Degrees of Importance of Computerized Presentation Competencies

Computer Presentation Competency	Vocational Business Teachers' Responses# (N=73) 4	5	6	7	Business Professionals' Responses# (N=62) 4	5	6	7	Chi Square
Domain 1--Planning Computerized Presentations									
D1-1	24.7	26.0	39.7	9.6	40.3	19.4	24.2	16.1	6.85
D1-2	13.7	19.2	38.4	28.8	41.9	30.6	9.7	17.7	24.50**
D1-3	21.9	37.0	27.4	13.7	29.0	53.2	9.7	8.1	9.09*
D1-4	16.4	32.9	37.0	13.7	24.2	56.5	14.5	4.8	14.35**
D1-5	21.9	32.9	26.0	19.2	38.7	33.9	19.4	8.1	6.79
D1-6	17.8	47.9	24.7	9.6	58.1	14.5	17.7	9.7	27.21**
Domain 2--Selecting the Presentation Look									
D2-1	16.4	12.3	42.5	28.8	8.1	14.5	27.4	50.0	8.05*
D2-2	17.8	21.9	41.1	19.2	14.5	27.4	14.5	43.5	15.39**
D2-3	13.7	13.7	53.4	19.2	19.4	8.1	33.9	38.7	9.04*
D2-4	12.3	26.0	37.0	24.7	11.3	24.2	27.4	37.1	2.73
D2-5	17.8	24.7	31.5	26.0	22.6	6.5	53.2	17.7	12.05**
D2-6	17.8	23.3	45.2	13.7	14.5	33.9	41.9	9.7	2.10
D2-7	16.4	28.8	38.4	16.4	27.4	17.7	40.3	14.5	3.71
D2-8	9.6	19.2	49.3	21.9	14.5	53.2	8.1	24.2	30.71**
Domain 3--Creating Text Slides									
D3-1	8.2	12.3	31.5	47.9	6.5	16.1	8.1	69.4	12.03**
D3-2	6.8	21.9	37.0	34.2	8.1	22.6	22.6	46.7	3.68
D3-3	8.2	12.3	41.1	38.4	4.8	29.0	21.0	45.2	9.89*
D3-4	5.5	13.7	46.6	34.2	11.3	17.7	27.4	43.5	5.75
D3-5	9.6	17.8	34.2	38.4	24.2	27.4	14.5	33.9	11.15**
D3-6	12.3	20.5	41.1	26.0	58.1	8.1	9.7	24.2	37.02**
Domain 4--Creating Graphs/Charts									
D4-1	8.2	20.5	38.4	32.9	8.1	9.7	59.7	22.6	6.98
D4-2	8.2	19.2	43.8	28.8	8.1	8.1	61.3	22.6	5.41
D4-3	6.8	21.9	47.9	23.3	8.1	21.0	43.5	27.4	0.45
D4-4	9.6	20.5	45.2	24.7	9.7	24.2	40.3	25.8	0.40
D4-5	12.3	21.9	39.7	26.0	11.3	30.6	24.2	33.9	4.19
D4-6	9.6	32.9	43.8	13.7	29.0	17.7	9.7	43.5	34.60**
D4-7	6.8	27.4	37.0	28.8	19.4	24.2	46.8	9.7	11.18**
D4-8	5.5	26.0	50.7	17.8	29.0	17.7	33.9	19.4	14.70**
D4-9	30.1	20.5	32.9	16.4	40.3	27.4	17.7	14.5	4.71
D4-10	21.9	16.4	41.1	20.5	58.1	19.4	8.1	14.5	26.33**

(Table Continued)

Computer Presentation Competency	Vocational Business Teachers' Responses# (N=73) 4	5	6	7	Business Professionals' Responses# (N=62) 4	5	6	7	Chi Square
Domain 5--Enhancing Presentations with Graphics and Media									
D5-1	9.6	23.3	42.5	24.7	9.7	35.5	30.6	24.2	2.99
D5-2	13.7	24.7	37.0	24.7	14.5	21.0	46.8	17.7	1.74
D5-3	8.2	21.9	45.2	24.7	8.1	37.1	40.3	14.5	4.59
D5-4	16.4	20.5	49.3	13.7	30.6	9.7	29.0	30.6	13.42**
D5-5	17.8	12.3	43.8	26.0	45.2	21.0	17.7	16.1	18.49**
D5-6	9.6	28.8	41.1	20.5	59.7	8.1	21.0	11.3	39.30**
Domain 6--Viewing the Presentation									
D6-1	19.2	16.4	42.5	21.9	27.4	8.1	21.0	43.5	12.54**
D6-2	9.6	15.1	42.5	32.9	14.5	43.5	22.6	19.4	16.62**
D6-3	17.8	20.5	43.8	17.8	16.1	19.4	46.8	17.7	0.14
D6-4	12.3	16.4	46.6	24.7	21.0	27.4	30.6	21.0	5.78
D6-5	16.4	9.6	47.9	26.0	25.8	22.6	33.9	17.7	7.69
D6-6	20.5	13.7	45.2	20.5	53.2	17.7	19.4	9.7	19.69**
D6-7	19.2	21.9	42.5	16.4	50.0	24.2	8.1	17.7	24.54**
D6-8	20.5	28.8	38.4	12.3	56.5	17.7	14.511 3		20.37**
D6-9	24.7	28.8	37.0	9.6	61.3	9.7	16.1	12.9	22.61**
D6-10	21.9	35.6	38.4	4.1	75.8	11.3	8.1	4.8	41.60**

#Column No. 4 indicates percent of respondents who indicated the combined ratings from 1 to 4 (*Not Important* to *Neutral*); No. 5 and No. 6 indicates those who responded between *Neutral* and *Very Important*; and No. 7 indicates those who responded *Very Important*.

*P < .05.

**P < .01.

PAPERS

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EXECUTIVES' EXPECTATIONS OF ADMINISTRATIVE SUPPORT PERSONNEL: IMPLICATIONS FOR BUSINESS EDUCATION

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Abstract

The purpose of this study was to determine the nontechnical skills needed by administrative support and the perceived importance of nontechnical skills as compared to technical skills.

Corporate executives in Illinois' service-produce firms were asked to rate the importance of 54 nontechnical skills on a four-point Likert scale. Six statements were used to determine the perceived importance of nontechnical skills.

Findings indicated both technical and nontechnical skills are equally important for administrative support work. The five most important nontechnical skills are: dependability and responsibility, confidentiality and loyalty, following oral and written instructions, cooperativeness, and prioritizing work.

Introduction

Rapid changes in technology, organizational restructuring, and increased competition in the global market environment have affected the nature of work and the competencies required of administrative support workers. Office work has become more complex and intellectually demanding (Hayes, 1992). Observers note that effective performance in today's high-performance work environment requires proficiency in technical skills and nontechnical competencies alike. While technical skills developed in office education programs are known, little information is available on the nontechnical or workplace competencies developed (Buck & Barrick, 1987). Employers may be willing to provide on-the-job training but this is not enough to give workers the skills and abilities they need in a high-performance work environment. It is essential that the training begin as soon as possible in the education process. Employers now want employees who can solve problems, have good interpersonal, negotiation and organizational skills, and the ability to work in teams (Bartholome, 1991).

Objectives of the Study

This study sought to determine: (1) the nontechnical competencies corporate executives desire most from administrative support workers, and (2) whether corporate executives' perceptions of critical nontechnical competencies are influenced by characteristics of their administrative support person, their own characteristics, or that of the organization.

Literature Review

Administrative office support positions are becoming more challenging. In addition to traditional task-oriented functions, these office support professionals are now called upon to support more than one executive, schedule work for others, and engage in managerial activities, such as conducting research, making decision about equipment purchase, and training and supervising other clerical staff (Department of Labor, 1994; Moon, 1991; Zekis 1993). Performing these complex responsibilities requires possession of skills and attributes necessary to contribute to organizational productivity (Jaffee, 1991). Skills and attributes now desired by employers include good communication skills, flexibility and adaptability, willingness, listening effectively, teamwork capability, and ability to get along with people, working without supervision, setting priorities (Hayes, 1992; Perrigo & Gaut, 1994).

Schools must now provide students with knowledge, skills and attributes needed to achieve success in a changing work environment. Emphasis must now be given to not only technical and technological skills but now, more than ever, to nontechnical competencies (Gustafson, Johnson, & Hovey, 1993; Fordham, 1994; Jaderstrom, White, & Ellison, 1992, Policies Commission, 1994). Business educators at all levels are being urged to commit themselves to provide students with the nontechnical skills needed to meet the challenges of the high-performance workplace.

Research Procedure

The study population was 230 corporate executives in Illinois service-sector firms with 500 or more employees. These firms were identified from the listing in the Illinois Services Directory (1995) and categorized according to the Standard Industrial Codes for services (70 - 89). Schools, college, and universities were eliminated. Otherwise, selection was not influenced by service classification.

Fifty-four nontechnical competencies divided into six categories (professional characteristics, communication skills, intercultural communication skills, human relations/ motivation skills, time management, and problem-solving/decision-making skills) were identified from the literature review for the data-gathering instrument. Importance of each competency item was rated by executives on a 5-point Likert scale. The mean score of each competency was used to rank order the competencies and determine those that were considered "most important" and those deemed "important".

A survey packet was mailed to all 230 executives. Eleven executives declined to participate, 6 instruments were undeliverable, and 2 were returned incomplete. Ninety-one useable instruments were returned for a 43% response on the adjusted sample of 211.

Collected data were subjected to both descriptive and inferential analyses. Percentages and frequencies were determined for the demographic information variables and statement responses. Analysis of variance was used to determine relationships among identified demographic factors and executives' perception of critical competencies. The Scheffe post hoc comparisons procedure was used to locate differences when statistically significant differences were found from the analysis of variance tests.

Competency items receiving a mean score of 3.51 or higher were considered most important while items with a mean of 2.51 to 3.50 were considered important. Competency items were rank-ordered according to their mean scores.

Analysis of Results

Demographic Information

Slightly over half (53.8%) of respondents were executives in organizations providing health services. The number of respondents in other service firms were less than 10 in each type. Forty-seven (51.6%) respondents were executives in firms with less than 1000 employees at that site; 59 (64.8%) were male, and 30 (33%) were female. Two did not indicate gender. Twenty-two (24.2%) held the title of President with 18 (19.85) using titles relating to Vice-President. Director was the title for 14 (15.4%), and 9 (9.9%) were CEOs.

A majority of respondents (56 or 61.5%) indicated they have held an executive position for more than 11 years. Less than 5% had under two years of experience in an executive position. For this sample, approximately 75% were being supported by one female administrative worker.

Nontechnical Skills Most Important for Administrative Support Workers

Using the criteria established, 25 skill items received means of 3.51 or higher and were considered to be most important, while 24 items received means of 2.51 to 3.50 and were regarded as important. Table 1 shows the category, rank order, item mean and standard deviation of the 10 highest ranked competency items. The highest rated competency was "dependability and responsibility" (Mean=3.93) in the professional characteristics category. Skill items relating to communication skills and professional characteristics shared the 10 highest rankings, with the exception of 2 items. Five of 6 items associated with communication skills, and 10 of 13 professional characteristics were perceived as most important.

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TABLE 1

NONTECHNICAL SKILLS RATED AS MOST IMPORTANT FOR ADMINISTRATIVE SUPPORT WORKERS

Cat.*	Rank	Nontechnical skill	Mean	SD
1	1	Display dependability and responsibility	3.93	.29
1	2	Display confidentiality and loyalty	3.90	.37
2	3	Follow oral and written instructions	3.86	.38
1	4	Display cooperativeness	3.84	.45
5	5	Prioritize work	3.80	.50
1	6	Display initiative	3.80	.48
2	7	Exercise accuracy in all aspects of work	3.78	.49
2	8	Listen effectively	3.78	.47
1	9	Display good work ethics	3.78	.44
4	10	Be a team player	3.77	.50

Note: * Categories were assigned a number: 1=Professional Characteristics; 2=Communication Skills; 3=Intercultural Communication Skills; 4=Human Relations and Motivation Skills; 5=Time Management; 6=Problem-Solving/ Decision-Making

As indicated in Table 2, of the 10 highest ranking skill items perceived as important by respondents, the top rated item was "control emotions under pressure" (Mean=3.49). Rankings illustrate that 5 of the 10 competency items perceived as important related to problem-solving and decision-making.

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TABLE 2

NONTECHNICAL SKILLS RATED AS IMPORTANT FOR ADMINISTRATIVE SUPPORT WORKERS

Cat.*	Rank	Nontechnical skill	Mean	SD
4	1	Control emotions under pressure	3.49	.64
6	2	Minimize occurrence of problems	3.47	.66
6	3	Recognize, analyze and solve problems where possible	3.42	.67
5	4	Manage the company's time and resources effectively	3.41	.77
5	5	Ask for help and delegate work	3.40	.65
4	6	Willing to help others to learn	3.39	.68
6	7	Accept responsibility for both successes and failures	3.38	.71
6	8	Acquire new information and skills and apply to the job	3.38	.70
6	9	Make decisions quickly and accurately	3.36	.66
4	10	Provide or respond to praise or criticism constructively	3.36	.59

Note: * Categories were assigned a number: 1=Professional Characteristics; 2=Communication Skills; 3=Intercultural Communication Skills; 4=Human Relations and Motivation Skills; 5=Time Management; 6=Problem-Solving/ Decision-Making

Importance of Nontechnical Skills as Compared to Technical Skills

For the 6 statements used to determine respondents' perceived importance of nontechnical versus technical skills, points on the 5-point scale were collapsed to 3: Agree (strongly agree and agree), Not Sure (remained the same), and Disagree (strongly disagree and disagree), to indicate an agreement or disagreement with each statement.

As illustrated in Table 3, a majority of respondents (59 or 64.8%) disagreed that employers desired more technical skills than nontechnical skills. Only 36 (39.6%) respondents agreed that technical, more so than nontechnical, skills allowed administrative support personnel to respond to the challenges of the office. Eleven (12.1%) indicated uncertainty. However, almost 90% of the respondents agreed with the statement, "technical skills and nontechnical skills are equally essential for effective job performance." Less than 12% of respondents agreed that only administrative support workers at the very top need to possess nontechnical skills.

TABLE 3

IMPORTANCE OF NONTECHNICAL SKILLS AS COMPARED TO TECHNICAL SKILLS

Statement	D	N	A
Technical, more than nontechnical, skills allow administrative support workers to respond to the challenges of the office.	44 48.4%	11 12.1%	36 39.6%
Employers need administrative support personnel with more technical than nontechnical skills.	59 64.8%	20 22.0%	12 13.2%
Technical more than nontechnical skills are important for advancement and promotion to more responsibility.	58 63.7%	12 13.2%	21 23.1%
Lack of desired technical skills would lead to termination more than lack of nontechnical skills would.	37 40.7%	29 31.9%	25 27.5%
Nontechnical skills are only required of administrative support workers at the very top.	78 85.7%	3 3.3%	10 11.0%
Technical and nontechnical skills are equally essential for effective job performance.	5 5.5%	7 7.7%	79 86.8%

Note: D=Disagree, N=Not Sure, A=Agree

Influence of Identified Variables on Perceptions

According to Table 4, the communication skills category (F value = 3.64) indicated a statistically significant relationship with executives' gender and their perception. Post hoc comparisons using Scheffe indicated that no significant difference existed between the groups.

Examination of data showed that female executives believed these skills to be of greater importance than did male executives. Table 4 also shows that F values for executives' years of experience and title/position were not statistically significant with their perception.

TABLE 4

EFFECT OF RESPONDENT GENDER, EXPERIENCE, AND TITLE/POSITION ON PERCEPTION OF SKILL CATEGORIES

		F-Value	
Category	Gender	Experience	Title
Professional Characteristics	1.60	.17	.24
Communication Skills	3.64*	.07	1.60
Intercultural Communication Skills	.00	.93	.44
Human Relations and Motivation Skills	1.40	.10	.17
Time Management	3.08	.74	.30
Problem-Solving/Decision-Making	1.23	.34	.19

* Significant at $p<.05$

Only one skill category was found to have a significant relationship with the type or size of firm. The intercultural communication skills category with $F = 2.12$, $p<.05$ indicated a statistically significant relationship with the type of company, as shown in Table 5. The Scheffe post hoc comparison identified no specific group with significant differences.

Perusal of the data indicated that executives in hotels, advertising and accounting firms perceived nontechnical skills identified to be of greater importance than did other executives.

Analysis of variance for the 6 statements designed to determine whether technical skills are considered to be more important than nontechnical skills produced statistically significant relationships on 4 of the 6 statements. A statistically significant relationship with executives' title/position and perception was found for 2 statements as reflected in Table 6. The Scheffe post hoc comparison found no significant differences among title categories.

TABLE 5

EFFECT OF COMPANY TYPE AND SIZE ON PERCEPTION OF SKILL CATEGORIES

Category	F-Value Type	F-Value Size
Professional Characteristics	.33	1.93
Communication Skills	1.05	.01
Intercultural Communication Skills	2.12*	.30
Human Relations and Motivation Skills	.83	.13
Time Management	.52	.32
Problem-Solving/Decision-Making	.95	.02

* Significant at $p<.05$

Review of the data revealed that CEO's, presidents and vice-presidents disagreed that employers desired more technical than nontechnical skills. Other executives were unsure. Directors and division managers disagreed that the lack of desired technical skills would lead to termination more than lack of nontechnical skills; other executives were unsure.

Table 7 reveals that a statistically significant relationship existed between executives' years of experience and 2 statements, at or below the .05 probability level. The use of Scheffe post hoc comparisons reflected no significant differences among the groups.

Review of the data indicated that executives with less than 11 years of experience were more likely to disagree that only administrative support workers at the top need to possess nontechnical skills than were executives with over 11 years of experience.

TABLE 6

EFFECT OF RESPONDENT TITLE/POSITION ON PERCEIVED IMPORTANCE OF NONTECHNICAL SKILLS

Statement	F	p
Employers need administrative support personnel with more technical than nontechnical skills.	2.34	.0389*
Lack of desired technical skills would lead to termination more than lack of nontechnical skills would.	2.30	.0418*

* Significant at p<.05

TABLE 7

EFFECT OF RESPONDENT EXPERIENCE ON PERCEIVED IMPORTANCE OF NONTECHNICAL SKILLS

Statement	F	p
Nontechnical skills are only required of administrative support workers at the very top.	4.27	.0073*
Technical more than nontechnical skills, are important for advancement and promotion to higher levels of responsibilities.	2.63	.0552

* Significant at p<.05

One statement was found to have a significant relationship with gender with an F value of 9.14, $p<.05$, as shown in Table 8. The Scheffe post hoc comparisons revealed that female executives (Mean=3.57) had a significantly higher mean than male executives (Mean=2.95). In general, female executives disagreed that the lack of technical skills would lead to termination more so than lack of nontechnical skills. Male executives basically expressed uncertainty.

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TABLE 8

EFFECT OF RESPONDENT GENDER ON PERCEIVED IMPORTANCE OF NONTECHNICAL SKILLS

Statement	F	p
Lack of desired technical skills would lead to termination more than lack of nontechnical competencies.	9.14	.0033*

* Significant at $p<.05$

Analysis of variance tests for the influence of organization type and size found no statistically significant relationship with executives' perception on the six statements.

Discussion and Conclusions

Findings indicate that corporate executives, in Illinois' service-producing sector, regardless of organization size or service type, the characteristics of their administrative workers, or their own characteristics, believe that competencies relating to personal/professional characteristics, communication skills and time management are essential for successful job performance in an administrative support role.

Forty-nine of the 54 nontechnical skills identified were regarded as important for administrative support workers. Skill items relating to intercultural communication skills did not receive high ratings as the sample was service-oriented and probably did not engage in international trade. At the same time, with communication skills and professional characteristics categories receiving the highest importance ratings, executives in general believe these skills are essential for successful job performance in an administrative support role. Skills in the professional (and personal) characteristics and communication skills areas have been identified as important in several studies (e.g., Ewing, 1992; Rodriquez-Marrero, 1989; Perrigo & Gaut, 1994; Miller & Wesley, 1994; Fordham, 1994; Davis, 1992).

Almost 90% of the executives regarded both technical and nontechnical skills to be equally important and are needed by administrative support personnel to respond to the challenges of the office. This confirms findings published in reports such as SCANS (1992) on the skills wanted by employers.

Findings of this study indicate that corporate executives in service producing firms believe that nontechnical skills relating to professional characteristics and communication skills are most important for effective administrative support. Furthermore, these executives need administrative support personnel who are dependable and responsible, confidential and loyal, cooperative, team players, effective listeners, and who possess a positive attitude, display professionalism, exercise good judgement, display good work ethics, and can work without close supervision. And regardless of the size and type of organization, their gender, years of experience, or title/position, corporate executives have similar views of the importance of nontechnical skills and those needed for successful administrative support.

As rapid changes continue to take place in offices, corporate executives are acknowledging that a mastery of technical skills alone will not suffice. Equally important now is a mastery of nontechnical skills for office support workers at all levels in the organization. Both are needed to enable support workers to cope with the challenges of the high-performance workplace.

Recommendations

Business educators and educational administrators should determine if current office education programs incorporate at least those nontechnical skills perceived as most important by corporate executives. The business educator, as an individual, can integrate those identified skills desired by employers into existing courses, in a planned curriculum, using such methods as modeling, case studies, role playing, simulation exercises, and projects.

This study should be replicated in different business sectors obtaining a larger response to provide additional information on nontechnical skills desired by employers.
The business education curriculum should be examined and upgraded to ensure that students seeking entry-level positions as well as continuing education students are prepared for the challenges of an evolving profession and a changing work environment.

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THE HUMAN FACTORS EFFECTS OF USING A MOUSE DEVICE FOR COMPUTER INPUT

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Abstract

The objectives and specific aims of this study seek to create awareness and knowledge and offer techniques and skills which should be taught by business educators related to ergonomic and medical issues (specifically, carpal tunnel syndrome) of the mouse as an input device. In addition, this research seeks to find out what selected industries, students and office workers know and do about ergonomic factors and physical stresses related to prolonged use of the mouse.

When the mouse as an input device was introduced with the Macintosh® personal computers, it was touted as a unique way to imput data and text into the computer. The "point, click, and drag" feature of the mouse was hailed as ist finest feature. It was also the source of many computer jokes. In fact, serious computer users did not see its lasting value. It has lasted and been improved. And there are many shapes, sizes, and uses. Therein lies the rub: The mouse and the traditional keyboard as input devices are being cited in medical, legal, formal researach, and business literature as causes of compter-related injuries, specifically, cumulative trauma disorders (CTD), repeititve stress injuries (RSI), and carpal tunnel syndrome (CTS)

This project sought to use descriptive, experimental, and survey research methods to accomplish the objectives of the study. The survey instrument utilized in this study was constructed so that responses were anonymous and confidential. Dureing the experimental phase of the study, videotaping focus only on arms, necks, wrists, hands, and fingers; no participant can be identified. Each of the participants was asked to sign a release form after understanding the nature and scope of the study. Interviesees (doctors, ergonomists, managers, and workers) are not identified unless permission to quote them or use materials which they provided was obtained. Care was taken to provide credit for materials and other data which were provided to the researchers in this project.

Based on the results of this study, the following conclusions are offered for consideration: Teachers most often teach work habits to alleviate the stress of repetitive stress disorders,

vary class assignments to provide time away from the computer, and provide adjustable computer monitors or adjustable chairs to help students relieve the stress of working at the computer or using input devices.

Pain and stiffness in hands, wrists, arms, or shoulders appear to be the effects most often observed in or the complaints heard from students when using the computer. However, many teachers mentioned that they had had no complaints from students due to several factors: minimal use of or exposure to the mouse and short class periods.

Teaching relaxation techniques toalleviate physical stress ***while*** *using the computer appears to be the technique most often used by teachers, followed by teaching an ergonomics unit, and teaching relaxation techniques* ***as they are needed****. To a lesser degree, teaching keyboarding techniques* ***prior*** *to using the computer appears to be used, also. Teachers also mentioned providing a handout to students on carpal tunnel syndrome as a technique.*

User acceptance of an prefrernce for the three different peripheral input devices revealed that the traditional mouse is preferred. Familiarity with design, ease of use, size, and comfort are the reasons most frequently cited for the preference. Users play a critical role in product design and development because they generally "mold" the characteristics and features of a product and ultimately determine its permanence.

The general consensus of researchers, medical practitioners, engineers, and users is that the neutral posture position is recommended for keyboarding and using input devices. The hand, wrist, and finger positions are much more dynamic than the overall posture of indididuals when a computer keygoard and peripheral input devices are used. During computer keyboarding, many parts of the arms and hands are moved. The interrelationships of these movements with the actual locations of the keyboard and the peripheral input device highlight the importance of the individual's being able to adjust the workstation to conform to his her needs and preferences.

Teachers should continue to teach the symptoms of repetitive stress injuries and carpal tunnel syndrome. Students will take this knowledge with them into the workplace and make them more informed and healthier users of technology.

OBJECTIVES AND NEED FOR THE STUDY

The business education literature has remained relatively quiet about the mouse as an ergonomic issue. Therefore, the objectives and specific aims of this study seek to create awareness and knowledge and offer techniques and skills which should be taught by business educators related to ergonomic and medical issues (specifically, carpal tunnel syndrome) of the mouse as an input device. In addition, this research seeks to find out what selected industries, students, and office workers know and do about ergonomic factors and physical stresses related to prolonged use of the mouse. Specifically, the following research questions are addressed:

1. What ergonomic factors related to input devices are being taught by business educators? What noticeable effects, if any, have business educators observed in students after prolonged use of the mouse?

2. What kinds of techniques related to the use of the mouse are being instituted by business educators to avert computer-related injuries?

3. What noticeable effects, if any, have managers in business and industry observed in office workers after prolonged use of the mouse? What kinds of measures are being instituted to counteract the effects of cumulative trauma disorders with specific attention to carpal tunnel syndrome?

4. How aware are students and/or office workers of the risk of carpal tunnel syndrome in using the mouse to enter exercises or tasks? What kinds of self-monitoring techniques do students or workers use to avoid the risk of carpal tunnel syndrome?

5. What conclusions and recommendations can be made to business educators and others to heighten awareness and knowledge of health risks using the mouse? What techniques can be implemented in the classroom (and the workplace) to alleviate the effects of prolonged usage of the mouse and to enhance the preparation of prospective office workers or computer users?

THEORETICAL FRAMEWORK FOR THE STUDY

When the mouse as an input device was introduced with the Macintosh® personal computers, it was touted as a unique way to input data and text into the computer. The "point, click, and drag" feature of the mouse was hailed as its finest feature. It was also the source of many computer jokes. In fact, serious computer users did not see its lasting value. It has lasted and been improved. And there are many shapes, sizes, and uses. Therein lies the rub: The mouse and the traditional keyboard as input devices are being cited in medical, legal, formal research, and business literature as causes of computer-related injuries, specifically, cumulative trauma disorders (CTD), repetitive stress injuries (RSI), and carpal tunnel syndrome (CTS). Lack of regard for ergonomics (defined by Gilbert [1990, p. 45] as an applied science combining engineering, medicine, and psychology to improve human performance and health) appears to contribute to these injuries. For the purposes of this study, the mouse refers to a class of computer peripheral input devices which have been described as "an extension of the human hand, fingers, and mind" (*On Line*, p. 3, 1990).

Medical Literature. Carpal tunnel syndrome is a degenerative nerve disorder caused by the compression of the median nerve as it passes through the carpal tunnel in the bones of the wrist (Pagnanelli, 1989, p. 20). Prolonged, repetitive use of the keyboard and the mouse can produce stiffness, pain, and eventual loss of mobility in the wrist. Extensive physical therapy and/or surgery may prove to be a remedy but not a cure. As a result of these injuries, business and industry have experienced rising costs in insurance and workers' compensation claims, OSHA citations and fines, and employee absenteeism.

Business and Industry. By the year 2000, experts estimate that 50% of all Americans will be operating video display terminals at work (LaBar, 1992). Working in front of a computer terminal places new demands on the way people work and on their work environment. A search of the literature from 1987 to the present related to ergonomics and human engineering factors reveals a dramatic rise in the number of workers' compensation claims related to carpal tunnel syndrome. A sampling of specific research reveals the following:

> In 1988, repetitive motion injuries, such as carpal tunnel syndrome, accounted for 48% of the 240,900 workplace illnesses reported in private industry. In 1989, approximately 284,000 new cases were reported; about one-half of these cases were associated with repeated trauma. Carpal tunnel syndrome accounted for 60% of work-related injuries in 1990. It is anticipated that computer-related injuries will continue to be the work-related illness of the '90s and may affect an estimated one-half of the workforce by the year 2000. The estimated costs in terms of lost wages and medical services have been estimated conservatively at $40 billion (Verespej, 1994; Kerr, 1993; Dembe, 1991; Bulletin of the American Society for Information Science, 1991; LaBar, 1991; Hackey, 1991; Susser, 1989; Falkenburg, 1988; Eckenfelder, 1987).

In response to these trends, government and industry are taking steps to establish ergonomics standards for employers: A committee of ANSI, sponsored by the National Safety Council, is working to draft a national consensus standard concerning the control of cumulative trauma disorders (Dembe, 1991). The Occupational Safety and Health Agency (OSHA) has begun the process of creating a general industry standard for ergonomics management (Atkinson, 1991; Smith, 1993). The National Institute for Occupational Safety & Health (NIOSH) also is developing ergonomics prevention strategies (LaBar, 1991). Industry is continuing to institute measures to counteract and/or prevent computer-related illnesses. These measures might include ergonomics inspections, more variety of work duties, rest breaks, massages and exercises, and education and training.

Business Education. Teaching keyboarding techniques has been the specific domain of business education. Keystroking technique focuses on the way motions are made, not to the keys struck (West, p. 59, 1983). The two kinds of motions used in keyboarding are fixed movements (where complete control is exerted) and ballistic movements (where freedom of movement is determined by momentum). Keystroking requires ballistic motions, where the fingers are "thrown" at a key through momentum and are then relaxed when brought back to rest in "home row" (West, pp. 59-60). The ballistic movements provide physiological freedom and relief for the fingers, wrists, and hands through fast motions. This allows the muscles in the fingers, wrists, and hands to come to rest (momentarily) between keystrokes.

When using the mouse as an input device, however, fixed movements appear to prevail. That is, the fingers, hand, and wrist lie in the same position for long periods of time between movements. Additionally, the same finger movements are employed when manipulating the mouse; these movements do not allow for the freedom from muscular tension created in ballistic movements. This study sought to discover what techniques, methods, and/or practices may be suggested to create awareness and avoidance of the potential physical effects of prolonged use of the mouse.

Research Studies. Numerous research studies related to ergonomic issues in the workplace have been undertaken, revealing a variety of interest in this area. Several of these studies (notably, Barker, Harman, Smutz, and Lopez) appear to have significance to the present study.

RESEARCH METHODS EMPLOYED IN THE STUDY

This project sought to use descriptive, experimental, and survey research methods to accomplish the objectives of the study. For each of the research questions addressed in this study, the following methods were employed:

a. An in-depth analysis of research studies related to ergonomic issues was completed; a review of medical literature also was undertaken.
b. An experiment was conducted to examine the effects of three peripheral input device configurations--the mouse, the trackball, and the touchpad--on potential stress factors, such as performance, posture, and physical discomfort.
c. A survey was mailed to business educators to answer the research questions.
d. Telephone interviews with managers, ergonomists, and workers of selected business, industry, and government sites where ergonomic programs have been implemented were undertaken to answer the research questions.
e. The data collected from the experiment, surveys, interviews, and observations were analyzed using descriptive statistics. The relationship among variables will be described by the use of correlational techniques.

DESCRIPTION OF HUMAN SUBJECTS INVOLVED

The survey instrument utilized in this study was constructed so that responses were anonymous and confidential. During the experimental phase of the study, videotaping focused only on arms, necks, wrists, hands, and fingers; no participant can be identified. Each of the participants was asked to sign a release form after understanding the nature and scope of the study. Interviewees (doctors, ergonomists, managers, and workers) are not identified unless permission to quote them or use materials which they provided was obtained. Care was taken to provide credit for materials and other data which were provided to the researchers in this project.

PRESENTATION AND ANALYSIS OF DATA

The specific aims of this study were to create awareness and knowledge and to suggest techniques and skills which should be taught by business educators related to ergonomic and medical issues (specifically, carpal tunnel syndrome) of the mouse as an input device. In addition, this research sought to find out what selected industries, students, and office workers know and do about ergonomic factors and physical stresses related to prolonged use of the mouse. Each of the following sections focuses on summary results from the survey and the experiment.

Results of the survey. To accomplish partially the aims of the study, a survey was sent to the members of the National Association for Business Teacher Education (NABTE). In all, 162 surveys were mailed in the fall of 1995. Two surveys were sent to each member, asking that the second copy of the survey be passed on to a colleague or a secondary business teacher. A total of 151 surveys (46.6%) were returned, seven (7) of which were unusable. The responses from the 144 surveys (44.4%) and responses of 20 teachers included in a pilot study results in a total of 164 responses utilized to present findings from the survey. The 164 respondents represented college and university teachers (74.4%) and secondary school teachers (25.6%).

Answers to the first research question, What ergonomic factors related to input devices are being taught by business educators?, revealed that teachers most often teach work habits to alleviate the stress of repetitive stress disorders, vary class assignments to provide time away from the computer, and provide adjustable computer monitors or adjustable chairs to help students relieve the stress of working at the computer or using input devices. Comments from respondents focused mostly on the need for ergonomic equipment and furniture, but recognized that there was a lack of resources to provide ergonomic furniture and equipment.

Responses to the next research question, What noticeable effects, if any, have business educators observed in students after prolonged use of the mouse?, focused on pain and stiffness in hands, wrists, arms, or shoulders as the effect most often observed in or complaint heard from students when using the computer.

Responses to the third research question included in the survey, What kinds of techniques related to the use of the mouse are being instituted by business educators to avert computer-related injuries?, show that employing relaxation techniques to alleviate physical stress **while** using the computer keyboard was used most often by teachers, followed by teaching an ergonomics unit and teaching relaxation techniques **as they are needed**. To a lesser degree, teaching keyboarding techniques **prior** to using the computer appears to be used, also.

Results of the experiment. Twenty students, who were enrolled in an introductory computer literacy course at the University of Missouri-Columbia, participated in the experimental phase of the study. The subjects (17 females and 3 males) ranged in age from 17 to 21 years. The subjects performed a simple keyboarding task from a popular keyboarding textbook using a standard keyboard and three different peripheral input device configurations--mouse, trackball, and touchpad. Video pictures of the subjects keyboarding and using the peripheral input devices were taken from two fixed side positions, one focusing on body posture and the other on arm/wrist/hand movement.

The subjects were provided ample time to acquaint themselves with the peripheral input devices and adjust the workstation arrangement and seating before each keyboarding session began. Following each keyboarding session, a questionnaire was administered to assess the user's acceptance and preferences concerning the peripheral input device used. Using a five-point Likert-type scale, the questionnaire asked the subjects to rate the features of the peripheral input device and its effect on comfort and posture. Open-ended questions concerning the best and worst features of the input device also were included.

Although selected features of each of the peripheral input devices received high ratings, the preferred input device was the traditional mouse. Acceptance of the other two input devices appeared to be reduced due to problems with comfort, ease of use, and size of device. The trackball also was rated considerably lower in the areas of general design, shape, and finger position. However, both the touchpad and trackball received high ratings from the subjects relative to ease of learning. The familiarity of the traditional mouse design was most frequently cited as the reason for its high ratings.

The postural demands of the peripheral input devices were examined by systematically viewing the videotapes of the keyboarding sessions. The use of all three peripheral input devices affect body posture and increase shoulder, arm, elbow, wrist, and hand movements. The three peripheral input devices were clearly different in terms of posture, arm, hand, wrist, and finger movements required to operate the devices. Greater wrist movements were apparent when the mouse and trackball were used. The fixed location of the touchpad in relation to the keyboard tended to affect the neutral posture position of the subjects and increase shoulder, arm, and wrist movements.

CONCLUSIONS AND RECOMMENDATIONS

Data from the survey instrument and experiment enable the researchers to formulate conclusions and make recommendations to business educators and others to heighten awareness and knowledge of health risks of using the mouse and to suggest classroom techniques that prepare computer users to avoid computer-related injuries. Based on the results of this study, the following conclusions are offered for consideration:

Teachers most often teach work habits to alleviate the stress of repetitive stress disorders, vary class assignments to provide time away from the computer, and provide adjustable computer monitors or adjustable chairs to help students relieve the stress of working at the computer or using input devices. Comments from respondents focused on the need for ergonomic equipment and furniture (and the lack of resources to do so) and the need to teach and emphasize proper keyboarding techniques.

Pain and stiffness in hands, wrists, arms, or shoulders appear to be the effects most often observed in or the complaints heard from students when using the computer. However, many teachers mentioned that they had had no complaints from students due to several factors: minimal use of or exposure to the mouse and short class periods.

Teaching relaxation techniques to alleviate physical stress **while** using the computer appears to be the technique most often used by teachers, followed by teaching an ergonomics unit, and teaching relaxation techniques **as they are needed**. To a lesser degree, teaching keyboarding techniques **prior** to using the computer appears to be used, also. Teachers also mentioned providing a handout to students on carpal tunnel syndrome as a technique.

User acceptance of and preference for the three different peripheral input devices revealed that the traditional mouse is preferred. Familiarity with design, ease of use, size, and comfort are the reasons most frequently cited for the preference. Users play a critical role in product design and development because they generally "mold" the characteristics and features of a product and ultimately determine its permanence.

The general consensus of researchers, medical practitioners, engineers, and users is that the neutral posture position is recommended for keyboarding and using input devices. The hand, wrist, and finger positions are much more dynamic than the overall posture of individuals when a computer keyboard and peripheral input devices are used. During computer keyboarding, many parts of the arms and hands are moved. The interrelationships of these movements with the actual locations of the keyboard and the peripheral input device highlight the importance of the individual's being able to adjust the workstation to conform to his/her needs and preferences.

The conclusions from the study and the comments offered by the respondents make the following recommendations compelling:

Regardless of the subject taught and the amount of time spent completing work on the computer, knowledge of repetitive stress injuries and carpal tunnel syndrome should be included in the instruction. Teachers should continue to teach the symptoms of repetitive stress injuries and carpal tunnel syndrome. Students will take this knowledge with them into the workplace and make them more informed and healthier users of technology.

When, where, and if possible, attention to providing ergonomic furniture and equipment should be part of any classroom or office layout. Administrators, technology specialists, and managers in education and industry must be educated about the risks and costs of repetitive stress injuries. Awareness and prevention are the keys to avoiding painful injuries and lost work time.

Business teachers should continue to stay informed about repetitive stress injuries so that they are able to recognize the symptoms and offer immediate solutions to their students. Providing varied assignments that take students away from the mouse or keyboard, teaching good work habits, reinforcing proper keyboarding techniques, and teaching relaxation exercises appear to be some of the techniques which will alleviate the physical stress associated with working with technology. Teachers are the *key* to providing employers with prospective employees who are aware of and sensitive to specific work habits which will enhance their productivity.

Attention should be given to students' being able to adjust the arrangement of their workstations and the locations of the keyboard and the peripheral input device in order to assure their preferences and comfort.

POTENTIAL CONTRIBUTION TO THE FIELD

Very few studies have focused specifically on prolonged use of the mouse. It is timely to consider whether specific techniques can be taught to circumvent the stress and pain related to repetitive use of the mouse as an input device and whether prospective office workers are receiving the education and training to deal with ergonomic issues they will confront in the workplace. The results of this study have the possibility of long-range contributions to the business education literature, as well as human factors engineering literature.

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CASE STUDIES TO EVALUATE A COMPUTER-BASED MODEL FOR COST-BENEFIT ANALYSIS OF FLEXIBLE DELIVERY OPTIONS IN AUSTRALIAN VOCATIONAL EDUCATION AND TRAINING

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Background

The Australian national Flexible Delivery Working Party adopted and published a set of goals, targets, and strategies in 1992 titled Flexible Delivery: A National Framework for Implementation in TAFE. That document recommended the production of six resources to support the implementation of flexible delivery by vocational education and training providers one of which was to focus on cost-benefit analysis. Through competitive tender during 1992, the Flexible Delivery Working Party commissioned a project to develop a computer-based Cost-Benefit Model for Flexible Delivery which could be used by training providers (Hudson, Mitchel, & Zeleny, 1993a and 1993b).

Cost analysis for flexible delivery has been addressed in a number of documents. For example, Harrold (1982) provides a detailed analysis of economic evaluation in education and Rumble (1986 and 1987) provides account charts and formulae for the analysis of flexible delivery methods. Levin (1983) differentiates among the following cost analysis methods: cost effectiveness, cost benefit, cost utility and cost feasibility in his book Cost-Effectiveness: A Primer. Crabb (1990), Rumble (1986), and Lundin et al (1993) all suggest that for cost analysis to be useful, the purpose must be determined first of all. The purpose will determine what kinds of data will be used and how they will be reported to achieve the desired outcomes.

The purpose of the cost-benefit model for flexible delivery, as identified by its authors, is to project tangible costs and benefits for new courses or new developments for existing *courses using flexible delivery options. That is, it is to be used to forecast and compare costs and benefits of different delivery methods for the same course to assist in determining the most cost-beneficial mode of delivery. The computer model is based on Excel software (4.0A for IBM and Version 4 for Macintosh) which provides spreadsheet and calculation facilities. It is, therefore, restricted to tangible costs and benefits, but users are guided in determining intangible costs and benefits which are also to be used in the decision-making process.*

This current study, commissioned by the national Flexible Delivery Working Party of Australia, was designed to test and demonstrate the previously identified computer-based cost-benefit analysis model. The intent was not to study and compare the various cost analysis options as identified by Crab, nor was it to make judgements vis a vis the choice of delivery options and their implementation by the participating institutions.

Objectives

This overall purpose of the study was to develop case studies which would test and demonstrate a computer-based cost-benefit analysis model, Cost-Benefit Model for Flexible Delivery, in "live" settings with a view to helping users and potential users of the model to understand the concepts involved and the potential ways in which they might apply the model to their own circumstances. More specifically the objectives were to:

(1) identify strengths and weaknesses of the model and possible enhancements that might be made;

(2) evaluate the perceived usefulness of the model as seen by case study participants;

(3) identify deficiencies in the availability of data in Australian vocational education and training systems necessary for application of the cost-benefit model;

(4) provide information about the tangible costs and tangible benefits of the specific cases;

(5) identify barriers to the model's successful application by vocational education and training practitioners; and

(6) identify the intangible factors which influenced the decision to use a particular mode of delivery.

Methodology

It was specified in the consultancy agreement between the project team and the national Flexible Delivery Working Party that a case study methodology would be used. It was also agreed that this would be a retrospective case study approach even though the model had been designed for projecting costs and benefits as delivery options were considered and decisions made. There were several reasons for this decision. The commercial version of the package had already been given to a number of people at a launch in mid-1993 although the external case study evaluation of the model did not begin until two months later. Further, the project team could find no known sites where it was being applied as either a planning or decision-making tool. In addition, the consultants who produced the computer software had used retrospective case analyses to demonstrate its applicability. The criteria used for selection of cases was prepared by the Project Team and discussed with the project's Steering Committee at its first meeting. Criteria included such items as delivery mode, type of provider, geographic location, type of client/student, course content, size of group, type of study, level of study, availability of appropriate records, and availability of intangible information. Members of the Flexible Delivery Working Party were asked to recommend, from their knowledge of training programs across Australia, those that would provide fruitful analysis in terms of the cost-benefit model. Over 20 programs were suggested and from these six were selected through the application of the criteria and discussion with the Steering Committee. A specific "course" or subject or module in each of the larger courses was later identified for detailed cost-benefit analysis. A telephone call was made to each of the sites to confirm their selection and to outline a procedure for conducting the case studies. A follow-up letter, a briefing sheet for the course administrators and interview questions for staff and students were produced as advance organizers. Also, a hard copy of the actual costing tables from the computer program were provided to the relevant staff to guide the discussion and collection of data. The matter was then discussed by that person with other relevant staff involved in the course to be studied at a particular site. Then the Project Team held an audio conference with each of the contact people and other site staff to clarify what was needed and confirm the procedures, meetings, interviews and data required during the on-site visit. This proved to be a very effective and efficient method of proceeding and it resulted in much of the information and arrangements being in place before the on-site visits which were conducted by the team members and were of two to three days in length. These were followed by further telephone calls to clarify some of the data.

The case studies were then produced in draft form and sent to each site contact person for review and comment. The cases were then revised and produced in final form and included as part of the final report. For each case, attempts were made to apply the computer-based cost-benefit model using the tangible costs and benefits financial data provided by site.

Data Source

As noted, six case sites and courses/programs were selected through the application of the criteria and discussion with the project's Steering Committee. The selected cases identified and used as data sources were:

Field Placement in the Associate Diploma of Education (Child Care); Queensland Distance Education Center; Brisbane, Queensland (TAFE Distance Education)

Legal Office Studies; Achievers Business College; Brisbane, Queensland (Private Training Provider)

Hand Tools in the Certificate of Panel Beating; Croydon Institute; Adelaide, South Australia (TAFE)

Instrumentation and Control in Process Plant Operation; Australian Newsprint Mills (ANM), Open Learning Unit; New Norfolk, Tasmania (Private Industry)

Open Learning Office Skills; South West College of TAFE; Warrnambool, Victoria (TAFE)

Managing for Quality; OTEN (Open Training and Education Network); Sydney, New South Wales (TAFE plus industry and government)

At each site, tangible cost-benefit data were gathered from appropriate financial officers, administrators, instructors, and program managers. Non-tangible cost-benefit data were gathered from these same individuals as well as current and former students and work-based supervisors as appropriate.

Conclusions and Discussion

There were a number of matters which arose during the project which provided some difficulties in terms of fulfilling all of the requirements of the project contract. Major among them were that:

(1) the courses recommended for the case studies were already underway so the assumption made that to apply the model retrospectively to these cases would provide an adequate test of its applicability was not entirely in line with the purpose of the cost analysis software;

(2) there was some conflict between determining the strengths and weaknesses of the model and the description of the cases which could be used as training exemplars for those purchasing the package. That is, because deficiencies in applying the model

were found in every case it would be counterproductive to provide these cases as training exemplars with the package as it was marketed;

(3) the computer software had many technical inadequacies which proved frustrating when the data were entered into it for each of the cases;

(4) the model seemed to fit much of the costing data in the TAFE sector, the fit for private companies seemed far less adequate.

All providers of training, both TAFE and private, already have comprehensive computer programs for financial management and cost projects. It was not seen as useful to introduce a small project management program which would not slot into the major existing program. To do this would simply mean extra work in terms of attempting to determine and recalculate the data in a different form and then re-keying it into the cost-benefit model. None of the case study institutions thought they would adopt the model.

Because of the technical difficulties in operating the software, because of the lack of fit of the cases into the model, and because the relevant staff involved in the case studies said it was very unlikely that they would find this model useful in their decision-making, the Project Team concluded that the cost-benefit analysis model and package did not represent a product which would be purchased or adopted widely, and certainly did not represent a usable product in its present form. The Project Team recommended that the national Flexible Delivery Working Party consider discontinuing further distribution to vocational and training providers either as a service or as a commercial product.

Educational Importance of Study

One of the important contributions of this study was to remove from the market a computer-based model for doing cost-benefit analysis that was not effective. As noted previously, it was redundant in the input and manipulation of tangible cost-benefit data, and it was difficult to learn to use. Further, it is important to note that non-tangible factors seemed to be as important as tangible factors in making the delivery mode decision. In every case it was some set of intangible factors which led to a program being implemented in a certain way, rather than cost considerations alone. Examples of intangible factors which were most influential included: the research and development element of a new flexible delivery option, innovative motives, drive to show leadership, competitiveness with other providers/institutions, needs identified in niche markets, and equitable extension of training opportunities to students. These appeared to be more powerful in making decisions than the particular cost implications. It appears that the economic advantage, not the financial account aspects, are more important. Vocational education and training administrator and leadership development programs should consider this in their programs.

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THE COMPUTER ABILITY SCALE: REPLICATION AND EXTENSION INVOLVING COLLEGE COMPUTER LITERACY STUDENTS

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Abstract

The self-perceived computer literacy of 316 undergraduate students was examined using the Computer Ability Scale (CAS), a computer literacy instrument, developed by Kay (1993) to assess four distinct components of ability to use computers: software ability, awareness, programming skill, and perceived control. In the present study, the internal reliability coefficient for the full measure was .96. Computer ability was significantly related to a number of respondent demographic variables, especially computer experience. Results indicate that claims of demographic differences on computing literacy may be confounded by an interaction effect with subject computer-related experience.

Introduction

For students and business persons alike, exposure to computers is nearly unavoidable (Larson & Smith, 1994). According to the U. S. Bureau of Census in 1989, seventy-five million Americans reported using a computer in some way, up considerably from the 47 million reported in 1984. (U. S. Department of Labor 1992-93). According to Griffin (1989), three of every four people in the U.S. workforce will be required to use the computer to handle new technology by year 2000.

Computers play a key role in business, and the question of what constitutes computer literacy is more crucial than ever. At the same time, the rapid pace of technological advances in the computer industry has forced businesses to reorganize, to acquire the latest systems, and demand a computer-literate workforce (Porter & Miller, 1985).

Computer literacy has been defined as "an understanding of computer characteristics, capabilities, and applications, as well as an ability to implement this knowledge in the skillful, productive use of computer applications suitable to individual roles in society" (Simonson, Maurer, Montag-Toradi, & Whitaker, 1987, p 233). To use computers in applied settings, students need to master at least some level of computing literacy. Unfortunately, some students may possess a degree of computer anxiety (Maurer &

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Simonson, 1984) which could inhibit their attainment of computing literacy. Indeed, a student's perception of computers seems to be related to their willingness to attain computing literacy. Specifically, studies have suggested that computer experience is positively related to attitudes and interest in computers (Arnez & Lee, 1990; Chen, 1986; Loyd & Loyd, 1988). Furthermore, a number of studies have investigated the impact of demographic variables on gender, age, and computer experience.

Regarding gender, a number of studies have investigated the relationship between gender and computer attitudes, and generally have reported that males have more positive attitudes toward computers (Anderson, 1987; Nickell & Pinto, 1986). The relationship between gender and computer attitudes is viewed by many as important since it has been proposed that failure to acquire computer literacy may become a barrier to women's advancement in certain careers (Miura & Hess, 1983). In regard to age, Anderson (1987) reported a significant relationship between the age of college students and computer attitudes. Finally, it has been demonstrated that computer experience may have a moderating effect on computer attitudes. Specifically, both Anderson (1987) and Arndt, Clevenger & Meiskey (1985) in their studies of college students showed a significant correlation between computer experience and weekly computer usage. Further, Siann and Durnell (1988) found that gender difference in computer literacy seemed to diminish with increased computer experience. Finally, Omar (1992) found a significant correlation between college student's computer experience and their attitudes toward computers.

Purpose

The purpose of this study is to investigate college students' computer literacy levels and their attitudes toward computers based on specific demographic variables such as gender, age, computer experience, overall knowledge of computers, computer ownership, and weekly computer usage. Additionally, this research will replicate and extend the work of Kay (1993) who operationalized computing literacy according to reviews of the literature and current trends in computing technology.

Method

Subjects. The subjects for this study were 316 undergraduate college students (172 males and 144 females) enrolled in business courses at a large midwestern university. Of the 316 subjects, 83% (n=261) were classified as traditional students (age < 23) and 17% (n=55) were classified as traditional students (age > 23). All participants voluntarily participated in this study and were assured that their responses would be anonymous and confidential. The number years of computer experience ranged from less than 1 year (n=20) to four or more years experience (n=170). Of the 316 subjects, 44% owned a personal computer, of which 21% had owned their computer for three or more years. Approximately 45% (n=125) of those who did not own a computer indicated they plan to purchase a personal computer within the next two years. Table 2 contains additional demographic breakdowns for the sample studied.

Instrument. This study employed Kay's (1993) Computing Ability Scale (CAS), a 22 item Likert-type instrument, with three subscales: Software Knowledge/Awareness, Programming Knowledge, and Perceived Control. Internal reliability for the CAS was reported at œ = .96. Subscale reliabilities were also high Software Knowledge/Awareness (œ = .94), Programming Knowledge (œ = .93), and Perceived Control (œ = .89).

In addition, a number of demographic and computer related variables were assessed. These included gender, age, number years computer experience (< 1, 2-3, and 4+ years); hours per week of computer use (< 1 to 9 or more); overall knowledge of computers (no knowledge (1) to extremely knowledgeable (5)); and personal computer ownership.

Procedure. Students enrolled in computer and management classes in a college of business at a major university were given the research survey. Students were briefly instructed on how to complete the questionnaire and were informed of their participation rights (participation was based on voluntary consent). The survey took approximately 20-30 minutes to complete.

Results

The internal consistency estimates for the CAS were computed for the entire survey (œ = .96), and for each subscale: Software Knowledge/Awareness (œ = .91), Programming Knowledge (œ = .94), and Perceived Control (œ = .91). These estimates were very close to those reported by Kay (1993). Table 1 contains a copy of the CAS instrument, as well as a number of item statistics.

Statistical information for other computer related was also assessed. Specifically, statistics were calculated for computer ownership, computer use per week, years of computer experience, and student perceived knowledge of computers. Results indicate that students who owned their own computer ($M = 96.6$) scored significantly higher ($F(1,308) = 55.5$, $p = .000$) on the CAS than did students who did not ($M = 78$). Likewise statistically significant differences were found for computer use per week ($F(5,309) = 39.1$, $p < .000$), years of computer experience ($F(3,311) = 33.8$, $p < .000$), and student perceived knowledge of computers ($F(4,311) = 88.2$, $p < .000$). Table 2 contains a complete breakdown of independent variable comparisons made using CAS scores.

Multiple n-way analysis of variance (ANOVA) procedures were used to determine where specific interaction effects existed among the independent variables studied. A specific two-way interaction ($F(3,299) = 3.29$, $p = .021$) effect did exist between gender and computer experience.. Table three contains specific ANOVA information for this significant interaction effect.

Table 1

Means, Standard Deviations, and Item Correlations for Computer Ability Survey (N=302)[e]

Mean	Sd[a]	Ic[b]	Item	Awareness of computers in Society
5.5	1.[illegible]	.51	1	Use a word processor to create documents.
4.6	1.3	.67	4	Use a disk operating system (DOS).
4.5	1.5	.63	7	Identify basic parts of computers and their functions.
4.4	1.4	.73	3	Learn a software package you never use before.
4.3	1.4	.57	2	Use computer-aided instruction.
4.2	1.5	.79	5	Teach someone to use a computer software package.
4.1	1.3	.68	9	Elaborate on the social and economic impact of computers.
4.1	1.4	.78	8	Elaborate on various computer applications in society.
3.7	1.5	.78	6	Discuss strengths and weaknesses of various software packages.
3.3	1.4	.59	10	Discuss history of computers.
		.91[c]		Total Subscale

Mean	Sd[a]	Ic[b]	Item	Awareness of computers in Society
3.4	1.7	.83	12	Read a computer program.
3.2	1.8	.75	11	Write a computer program in BASIC or Logo.
2.6	1.9	.88	13	Write a computer program in a high-level language (e.g.) Pascal. C, PL/1.
2.5	1.9	.85	15	Debug or correct a computer program.
2.5	1.9	.89	14	Write a complex computer program.
		.94[c]		Total Subscale

Mean	Sd[a]	Ic[b]	Item	Awareness of computers in Society
4.7	1.5	.74	19	I can make the computer do what I want it to do.
4.6	1.6	.76	21	If I had a problem using the computer. I could solve it one way or another.
4.3	1.8	.69	16[d]	I do not need an experienced person nearby when I use a computer.
4.3	1.8	.72	17[d]	I do not need some one to tell me the best way to use a computer.
4.3	1.6	.79	20	I am in complete control when I use the computer.
4.2	1.8	.77	18	I could probably teach myself most of the things I need to know about computers.
3.6	1.8	.65	22	I would prefer to learn new computer software packages on my own.
		.91[c]		Total Subscale

a. Standard deviation. b. Item-total correlations. c. Cronbach alpha coefficient for subscale. d. Item was worded negatively in original survey. e. 14 subjects had missing data. Consistent with previous research (Fetler. 1985; Rosen. Sears, & Weil. 1987) indicating that males have more positive attitudes toward computers. males ($M = 90.6$) scored significantly ($F(1,314) = 10.8$, $p = .001$) higher on the CAS instrument than did females ($M = 81.8$). Additionally. non-traditional students ($M=93.8$) scored higher on average ($F(1,314) = 6.03$, $p = .01$) than did traditional students ($M = 85.1$).

Table 2

Analysis of Computer Ability Survey (CAS) by Selected Demographic Characteristics

Characteristic		Mean	SD	F	
Gender					10.83**
	Females	(n=144)	81.8	21.8	
	Males	(n=172)	90.6	25.2	
Age					6.03*
	< 23 years old	(n=261)	85.1	22.7	
	23+ years old	(n=55)	93.8	28.8	
Computer Experience					33.81***
	< 1 year	(n=20)	60.7	21.0	
	1 year	(n=29)	68.7	15.2	
	2-3 years	(n=96)	79.5	18.9	
	4+ years	(n=170)	96.7	22.9	
Weekly Usage					39.07***
	< 1 hour	(n=35)	63.7	19.2	
	1-2 hours	(n=80)	75.0	16.7	
	3-4 hours	(n=69)	85.2	17.8	
	5-6 hours	(n=47)	87.8	18.9	
	7-8 hours	(n=30)	101.3	16.0	
	9+ hours	(n=54)	111.8	24.1	
Computer Knowledge					88.17***
	No knowledge	(n=2)	26.0	1.4	
	Little knowledge	(n=60)	63.9	18.0	
	Knowledgeable	(n=178)	83.7	16.0	
	Very knowledgeable	(n=54)	107.7	15.7	
	Extr. knowledgeable	(n=22)	125.4	19.1	
Own Computer					55.49***
	Yes	(n=135)	96.6	22.9	
	No	(n=175)	78.0	20.8	

* Significant at p<.050
** Significant at p<.010
*** Significant at p<.001

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Table 3

Analysis of Variance: Interaction Effects Among Gender, Age, And Computer Experience Use The Computer Ability Survey (CAS)

Source	SS	DF	MS	F
Main Effects	50901	5	10180	24.675*
Gender	2895	1	2895	7.018*
Age	1727	1	1727	4.118*
Experience	42693	3	14231	34.493*
2-Way Interactions	6467	7	925	2.242*
Gender X Age	1011	1	1011	2.449
Gender X Experience	4072	3	1357	3.290*
Age X Experience	1392	3	464	1.125
3-Way Interactions	671	2	336	.813
Gender X Age X Exp.	671	2	336	.813
Explained	58048	14	4146	10.050*
Residual	123360	299	413	
Total	181408	313	580	

* $p < .05$

Discussion

The present research used Kay's (1993) CAS instrument to measure computing literacy in students at a large midwestern university. The present research replicates Kay's findings with college students rather than preservice teachers. Kay's research seems unique to the extent that it presents an operalization of computing literacy that is broken into subscales, of which two of the three scales are related to computer skills and experience. Other researchers have argued that possession of computer related skill is not directly related to computing literacy and that personal needs play a significant role in computing literacy (Lonstreet & Sorant, 1985; Rhodes, 1985). Yet, Kay's knowledges and skills are statistically related to individual's scores on other cognitive and behavioral attitude scales (Kay, 1993).

The present research indicates that experience with computers (e.g., years of use; weekly use; etc.) leads to higher CAS scores. In fact, in the present study, those students with many hours of weekly computer use, or those that have many years of experience accounted for the most variance in CAS scores. Further, this research demonstrates that non-traditional students score significantly better on the CAS, than their younger counterparts, despite Parker's (1993) report that non-traditional students feel inadequate in regard to computers. Therefore, it may be that exposure to computers accounts for higher CAS scores than subject attitudes regarding computers.

Furthermore, this research underscores the complexities of studying the computing literacy construct in relation to demographic variables. Though the present study did find significant effects for gender, this finding needs to be clarified in relation to computer-related experience. A significant interaction effect between gender and computer experience (Table 3) suggests that gender distinctions made about males and females on computing literacy may not be valid. For example, it may be that females score lower on computing literacy than their male counterparts because they have less computer-related experience, yet their scores may increase markedly as they are gain training.

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A DESCRIPTIVE AND INTERPRETIVE STUDY: THE INTELLECTUAL DEVELOPMENT OF ADULTS

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Abstract

The purpose of this study was to compare the intellectual development among technical college instructors between the ages of 35 and 65 with different levels of education. the sample included 60 technical college instructors representing three levels of education (masters, baccalaureate, and nonbaccalaureate) and gender subgroups. The learning Environmental Preferences (LEP) was used to measure the intellectual development of the subjects. There was a significant difference in intellectual development between instructors with a master's degree and instructors with either a baccalaureate or less than a baccalaureate degree. Women scored significantly higher on the LEP than men.

William Perry (1968) developed the Scheme of Intellectual and Ethical Development that identifies stages of development where knowledge structures have different epistemological frameworks. Epistemology is the belief system held by an individual about a particular content or knowledge base which affects learning. For instance, some students may believe that a computer application course is simply a discipline that requires rote memorization of declarative knowledge, other students may believe that application and problem solving are the basis of knowledge. Each student's belief systems affects how that student will learn.

Statement of the Problem

Research shows that education and age are related to intellectual development. As students age and progress through their college years, intellectual development progresses also. To test education and age as separate variables, traditional- and nontraditional- aged students have been used. *Traditionally-aged students* have been consistently defined in the literature as 18 years old (freshman) to 22 years old (seniors). However, the definition of *nontraditionally-aged students* has varied. Three studies have defined *nontraditionally-aged students* under 30 years of age (Lawson, 1980; Schmidt, 1983; Strange, 1978). Three other studies have used students between 22 and 55 years of age;

although, the age distributions were not reported (Glatfelter, 1982; Mentkowski et al., 1983; Shoff, 1979). The inconsistent definition of *nontraditionally-aged students* and the lack of data on the age distribution of the subjects makes it difficult to extrapolate the influence of education and maturation on intellectual development. As Terenzini and Pascarella (1990) state, "The absence of rigorous research on the effects of college on . . . older students [nontraditional] is particularly embarrassing to the higher education research community."

Purpose of the Study

The purpose of this study was to compare the intellectual development among technical college instructors between the ages of 35 and 65 with different educational backgrounds.

Among technical college instructors the research questions were:

1. Is there a difference in intellectual development among levels of education (nonbaccalaureate, baccalaureate, and master's degree)?
2. Is there a difference in intellectual development between males and females?
3. What are the relationships between intellectual development and age, education, and gender?

The expectations were that (a) there would be significant differences among levels of education, (b) there would be no significant gender differences, and (c) there would be a significant relationship between intellectual development and education, not with age and gender.

Overview of the Perry Schema

William Perry's Scheme of Intellectual and Ethical Development (1968, 1979 & 1981) is divided into four different epistemological frameworks regarding knowledge--Dualism, Multiplicity, Relativism, and Commitment. Table 1 shows there are nine positions representing the four epistemological frameworks. Positions are static (stationary) and development is defined as movement towards the next higher position.

Dualism, Position 1, begins with the belief that there is <u>one</u> right authority. In Position 2, True authorities are right and others are frauds. In Dualism, there are two realms--Good versus Bad--and knowledge is quantitative. The learners view themselves as a receptacle absorbing Truth. Consequently, learners have difficulty when confronted with conflicting viewpoints or when asked for their own personal opinion.

Early Multiplicity, Position 3, says we are still waiting for the real Truth to explain uncertainties. Position 4 begins with everyone having a right to their own opinion where

Authorities don't know the right answer. In Multiplicity, the learner acknowledges different viewpoints. Judgment of these viewpoints, however, is made on the basis of quantity. Therefore, the learner has difficulty justifying their opinions.

Table 1

William Perry's Schema of Intellectual and Ethical Development

Positio	Description
Dualism	
1	Knowledge is absolutely certain and received from Authorities. Beliefs are a direct reflection of reality and do not need justification.
2	True Authorities are Right and others are Wrong. Problems have one Right answer.
Multiplicity	
3	There is absolute certainty about some things and temporary uncertainty about some things. Uncertainty implies the legitimacy of multiplicity of answers.
4	Opinions are being developed independently, mostly unsupported.
Relativism	
5	Individuals can compare conflicting ideas across different contexts, abstract common elements of ideas and criteria across different perspectives for evaluation, test ideas and as umptions, and synthesize perspectives.
6	The individual begins to apprehend the necessity of orientating oneself in a relativistic world by making a personal commitment.
Commitment	
7,8,9	The individual begins by making one commitment in Position 7, several commitments in Position 8, and finally shows strong beliefs in their values in Position 9.

Note. Adapted by Barbara Wilson from Perry, W. (1970). Forms of Intellectual and Ethical Development in the College Years: A Scheme. New York: Holt, Rinehart and Winston.

Position 5 moves all thinking to Relativism. Learners perceive knowledge and values as contextual and relativistic. Dualistic functions take a subordinate status, also in context, of a special case. Analysis, synthesis, and judgment are present, as well as metacognitive processes. In Position 6, comes the realization that learners must make their own decisions in this uncertain world. The learner begins to apprehend the necessity of orientating oneself in a relativistic world by making a personal commitment. In Relativism, all knowledge is disengaged from the concept of Dualism--absolute Truth and "good" versus "bad." The learners see themselves alone in a chaotic world and feel the loss of simpler, dualistic guidelines. Now the learners must create their own "truth" based on their own experiences.

Position 7, begins with making one commitment. Position 8 moves to making several commitments. Finally, Position 9 shows strong beliefs in one's values. In Commitment, judgment is evident from patterns for analysis and comparison. Diversity is welcomed and respected. Life is an ongoing dialectical process. Knowledge is qualitative and dependent on contexts.

Perry's Schema of Intellectual and Ethical Development (1970) is based on adaptation which accounts for change and growth in epistemological development. Assimilation and accommodation are principles of adaptation. In assimilation, an individual has a mental structure for a belief about knowledge and truth. Here it is important to note that the process of assimilation does not involve change in the mental structure, rather new knowledge is assimilated into the existing structure. In accommodation, new knowledge is encountered, and the existing mental structure is modified.

In Positions 1 to 4, the mental structure is Dualism. Modifications are made during each transition where the individual assimilates Multiplicity to the assumptions of Dualism with minimal accommodation. Multiplicity is first assimilated as a difference of opinion, which is quite temporary, and progresses to an unavoidable uncertainty where individuals independently develop opinions. Up to this point, individuals are able to assimilate new knowledge into a fundamentally dualistic structure with minimal accommodation.

In Positions 5 to 9, the mental structure is Relativism. New context is dominant and Dualism becomes subordinate. Dualistic ideas become special cases in the new relativistically structured context. This represents a major change or accommodation to the epistemological structure. Meaning and truth depend on context. There are many truths, but they must be judged within a context and its rules of inquiry and evidence. Each individual and society must discover what is true or right relative to that individual or society.

Review of the Literature

Research shows that movement on Perry's Scheme of Intellectual and Ethical Development is related to age and education. Older subjects with more education reason at higher stages of intellectual development than do their counterparts with less education (Kitchener & King, 1981; King, Kitchener, Davison, Parker, & Wood, 1983; King, Kitchener, & Wood 1985; Schmidt, 1983; Mentkowski, Moeser, & Strait, 1983; Welfel, 1982).

Age and education have been tested separately by comparing traditional- and nontraditional-aged groups of students with the same education. Five out of six studies found college experience, not age, to be critical to intellectual development (Mentkowski et al., 1983; Reisetter Hart, Rickards, & Mentkowski, 1995; Schmidt, 1983; Shoff, 1979; Strange, 1978). One study (Glatfelter, 1982), using all women, found age to be more critical than education. Another study (Lawson, 1980) did not find age or education significant because education was confounded by the fact that four years of education was the mode in the study. The generalizability of the findings in the studies investigating age is limited, however, to definition of *nontraditional* as discussed in the problem statement.

The differences in intellectual development between men and women has also proved inconsistent. Some studies found no gender differences in intellectual development (King et al., 1983; Welfel, 1982; Welfel & Davison, 1986). However, when King et al. (1983), statistically removed the effects of verbal ability, the intellectual development of men was significantly higher than women. Other studies have also found the intellectual development of men significantly higher than women (King, Wood, & Mines, 1990; Strange, 1978; Shoff, 1979; Lawson, 1980). One study, however, found the intellectual development of women higher than men (Schmidt, 1983).

Method

Population

One institution was selected as the population to test the differences in intellectual development among educational levels. Subjects between the ages of 35 and 65 with varying levels of education were tested. This was an attempt to broaden the theory of intellectual development by investigating age and maturation on a limited basis in a controlled environment. The assumption was that the findings from this study would generate more research questions on the theory of intellectual development and the study would be replicated in other environments.

The context in which the instrument is administered is important. The instrument is designed for an educational environment where the subject is a student in a learning situation. Instructors at this technical college had been participating in a special program of coursework through a large midwestern university since the fall of 1990.

Coursework was being offered through a special Carl Perkins grant for participation on accommodation teams to better serve special-needs students. Courses were offered onsite at the technical college for university credit. Tuition was paid for through the grant.

Instructors could use the college coursework towards a degree if they desired. This technical college was chosen for the study because 102 staff members out of 120 had participated in the coursework offered by the university over the last three years. Two instructors out of 120 were under the age of 35 and were removed from the population.

Sample

The 118 faculty members in the population were divided into the following populations: men with a master's degree, women with a master's degree, men with a bachelor's degree, women with a bachelor's degree, men without a bachelor's degree, and women without a bachelor's degree. Sixty technical college instructors were randomly selected from six the populations to assure that educational experience and gender were represented equally in groups and subgroups. In a 3 x 2 factor design, three groups of educational experience (no baccalaureate degree, baccalaureate degree, and master's degree) were represented with 20 subjects in each group; each group had 10 males and 10 females. Information on age, gender, and educational level were obtained from the human resource department of the technical college.

The size of the groups was influenced by past research and a power test. Of the 23 studies in the literature review, 10 compared groups. The size of groups ranged from 14 to 30 subjects in the following studies: Kurfiss (1977)--14 subjects per group; Strange (1978), Glatfelter (1982), and Welfel (1982)--16 subjects per group; Kitchener and King (1981), Lawson (1980), King et al. (1990), King el al. (1983)--20 students per group; and Brabeck (1983)--30 subjects per group.

A power test was calculated for a two-sample, two-tailed study from data for first-year graduate students (30 students per group) using Brabeck (1983) and for master's students (20 students per group) using Lawson (1980). Power was calculated to be 95 percent. This means that there was a 5 percent chance of making a Type II error of not finding a difference that was there. Therefore, it was reasonable to use 20 subjects per group.

The age frequency distribution for technical college instructors is shown in Table 2. The largest frequency of technical college instructors was between 41 to 49 years of age, representing 50 percent of the distribution. The next largest frequency was between 53 to 61 years of age, representing 30 percent of the distribution. Since concentration of instructors was in the 40s and late 50s, this was a good sample for expanding the theory of intellectual development on a limited basis. Also, the mean ages for levels of education and gender indicate that the general trend of the instructors' ages were similar for all groups. In Table 3, the mean age was 48 for nonbaccalaureate, bachelor's degree and master's degree. Overall, the mean for males was 49.7 and 47.7 for females.

Table 2

Age Distribution of Technical College Instructors

Age	f	% f
35-37	4	7
38-40	2	3
41-43	14	23
44-46	9	15
47-49	7	12
50-52	4	7
53-55	5	8
56-58	4	7
59-61	9	15
62-65	2	3
N = 60	100%	

Table 3

Summary Statistics of Age for Level of Education and Gender

Groups	Mean	SD	n
Nonbaccalaureate	48.9	8.80	20
Male	50.0	9.40	10
Female	47.7	8.50	10
Bachelor's Degree	48.7	7.90	20
Male	47.7	7.18	10
Female	49.6	8.85	10
Master's Degree	48.[illegible]	6.89	20
Male	51.3	7.08	10
Female	45.7	5.69	10
Male	49.7	7.83	30
Female	47.7	7.71	30

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Instrument

William Moore developed an objective measure, The Learning Environmental Preferences (LEP), based on the Perry scheme which was used for this study. Internal consistency of the LEP instrument was completed by performing an item factor analysis using Cronbach's alpha. The reliability coefficients for each position were as follows: Position 2, .81; Position 3, .72; Position 4, .84; and Position 5, .84. The LEP was then compared to the Measure of Intellectual Development created by Mentkowski and associates (1983). (The MID is an open-ended interview measure with a standard set of questions.) An ANOVA was calculated for the LEP means across class (freshmen, sophomore, junior, and senior) and the $F = 4.55$, $p > .01$. indicating significant differences among the subgroups with a consistent upward trend by class paralleling the MID results.

The Learning Environmental Preferences (LEP) is a survey consisting of five domains related to epistemology and approaches to learning: (1) view of knowledge and course content, (2) role of the instructor, (3) role of the student and peers in the classroom, (4) the classroom atmosphere, and (5) the role of evaluation. Each domain presents a list of 13 specific statements beginning with the least complex items followed by a mixture of more complex items. Participants are asked to rate each statement in terms of its significance or importance using a rating scale from (1) not at all significant to (5) very significant.

The (LEP) measures the intellectual portion of Perry's scheme, Positions 1-5 (Dualism--Positions 1 and 2, Multiplicity--Positions 3 and 4, and Relativism--Position 5). Position one is ignored, however, because it rarely exists at the college level. Beyond Position 5, there is a shift in focus from intellectual to ethical development, however, it is very difficult to measure ethical development (Commitment--Positions 7-9) using an objective survey instrument. Each statement in the five domains represents a position in Perry's Scheme.

Procedure

Instructors in the sample received a memo asking them to participate in the study. Three different dates and times to complete the instrument were offered. The researcher administered each session. Instructors were given the consent form, data sheet, and LEP instrument to complete.

Respondents were asked to rate each item with respect to its importance to them in an ideal learning environment. The instrument takes most participants 30-45 minutes to complete. Subjects need to be reminded that they should be thinking of their ideal learning environment and not be bound by any specific course or type of course.

Data Analysis

Scoring of the LEP was conducted by the Center for the Study of Intellectual Development (CSID). An LEP score report was provided by CSID listing the cognitive complexity index (CCI)--the primary score index for the LEP measure which reflects a single numerical index along a continuous scale of intellectual development from 200 (Position 2) to 500 (Position 5). The LEP score corresponds with the positions in Perry's (1981) Scheme as shown in Table 4.

Table 4

LEP Scores and Corresponding Positions of Intellectual Development

Position and Score	Position Description
Dualism	
Position 2 200-240	True Authorities must be Right, the others are frauds. We remain Right. Others must be different and Wrong. Good Authorities give us problems so we can learn to find the Right Answer by our own independent thought.
Transition 241-284	But even Good Authorities admit they don't know all the answers yet!
Multiplicity	
Position 3 285-328	Then some uncertainties and different opinions are real and legitimate temporarily, even for Authorities. They're working on them to get to the Truth.
Transition 329-372	But there are so many things they don't know the answers to! And they won't for a long time.
Position 4 373-416	In certain courses Authorities are not asking for the Right Answer; They want us to think about things in a certain way, supporting opinion with data. That's what they grade us on.
Transition 417-460	But the "way" seems to work in most courses, and outside them.
Relativism	
Position 5 461-500	Then all thinking must be like this, even for Them. Everything is relative but not equally valid. You have to understand how each context works. Theories are not Truth but metaphors to interpret data with. You have to think about your thinking.

A two-way ANOVA was run for research questions one and two with intellectual development the dependent variable and level of education and gender the independent variables. Multiple regression was run for research question three with intellectual development the dependent variable and gender, age, and education the independent variables.

Qualitative Inquiry and Methodology

A second level of inquiry followed the quantitative procedures. Four focus groups were used to provide insights about the meaning and interpretation of the findings. Prior to the research, Richard Krueger (1988) was consulted about the number of focus groups, the composition of the groups, and the script. Two groups were formed with participants having the lowest scores. Another two groups were formed with participants having the highest scores. Each group consisted of six subjects including males and females.

A date, time, and place was set for each group and subjects were invited to participate. Selection of subjects was according to the distribution of scores on the LEP. Starting with the lowest and highest scores, instructors were personally invited by the researcher until the groups were formed. A choice of two times was offered. A memo was sent to each participant confirming the date and time.

At the beginning of the focus groups, it was explained that the purpose of the focus group was to help explain the findings. Diversity of individuals' perceptions, attitudes, feelings, opinions, and manner of thinking would be encouraged throughout the discussion rather than consensus. The following questions represent the script:

1. In the literature, there are different definitions of critical thinking. What does the concept critical thinking mean to you?

2. In your experience as an instructor, what are some of the ways your students learn critical thinking skills?

3. With the acceleration of change, how do we prepare students for work situations where they do not have the answers?

4. In the next 3-5 years, what changes do you foresee in your classrooms? . . . How do you see yourself changing?

5. What influenced your decision to become a teacher? . . . What do you like best about your job? . . . What do you like least about your job?

6. What influences your decision whether or not to take a college course? . . . What should be the purpose of college courses?

Following discussion of the six questions, the findings were briefly presented for the research questions in the study. Reaction to the findings was invited, as well as, participants' insights for explanations. The groups were told which framework (Stage 3 or 4 of Multiplicity) of intellectual development the members of the group collectively represented. The preferred learning environment for that group was presented and validated through discussion.

The focus groups were approximately one hour in length and were taped. Analysis included: (a) reading the summaries at one sitting and making notes of potential trends and patterns, (b) reading each transcript, and (c) reading the transcripts concentrating on one question at a time with consideration for the words, the content, internal consistency, specificity of responses, big ideas, and the purpose of the focus groups (Krueger, 1988).

Results and Discussion

Distribution of Intellectual Development

In Table 5, the frequency distribution of intellectual development by level of education shows 72 percent of technical college instructors in this study in Multiplicity, Positions 3 and 4. Position 5 (Relativism) was not represented. The intellectual development of technical college instructors in this study can be compared to two other studies. In the first study, Beers and Bloomingdale (1983) investigated epistemological and instructional assumptions of college teachers from a small liberal arts college in the east. They found 45 percent of the faculty in Relativism which was the mode. In the second study, Simpson, Dalgaard, and O'Brien (1986) investigated faculty assumptions about the nature of uncertainty in medicine and medical education at the University of Minnesota. Sixty percent of faculty members who participated in the study were in Multiplicity. Comparing representation in the categories of intellectual development in this study to these two studies should be done with caution because levels of education may differ between studies and sample size may not be representative.

Education and Intellectual Development

In testing for differences in intellectual development among levels of education (nonbaccalaureate, baccalaureate, and masters), level of education was found significant. Table 6 shows the summary statistics of LEP scores for education and gender, and Table 7 shows the ANOVA table with alpha at .05. Education was significant with $F(2,54) = 9.14$, $p < .001$. Follow-up comparison tests using the Tukey test with alpha at .05 showed that those with a master's degree scored significantly higher in intellectual development than those with either a baccalaureate or less than a baccalaureate. No significant difference was found between groups with a baccalaureate and without a baccalaureate. Finding a significant difference in educational level was consistent with

Table 5

LEP Score Frequency Distribution of Technical College Instructors by Level of Education

	Frequency		
Score	Nonbac	Bachelor	Masters
Dualism			
Position 2			
200-240			1
Transition 2/3			
241-284	3	4	
Multiplicity			
Position 3			
285-328	9	9	3
Transition 3/4			
239-372	6	4	4
Position 4			
373-416	2	2	8
Transition 4/5			
417-460		1	4
Relativism			
Position 5			
461-500			
N = 60	20	20	20

other studies testing education separately from age (Mentkowski et al., 1983; Reisetter Hart et al., 1995; Schmidt, 1983; Shoff, 1979; Strange, 1978). As the level of education increases, there is movement along the continuum of intellectual development.

Table 6

Summary Statistics of LEP Scores for ANOVA Group Variables

Groups	Mean	SD	Variance	n
Nonbaccalaureate	321.85	36.36	1322.05	20
Bachelor's Degree	323.90	47.47	2253.40	20
Master's Degree	374.00	49.95	2495.00	20
Male	326.47	50.61	2561.37	30
Female	353.39	47.37	2243.92	30

Different themes on learning and teaching voiced in the focus groups helped explain the differences among levels of education.

Learning. The instructors representing Perry's Positions 2/3 and 3, described learning as a hierarchy. During the discussion, lower-level learning was perceived as understanding, application, and transfer. Higher-level learning was perceived as decision making, problem solving, and critical thinking. There was uncertainty about (a) whether or not students had to be at certain levels before higher-level learning would be possible and (b) the generalizability of higher-level skills across disciplines.

The instructors representing Perry's Positions 4 and 4/5, described learning as a process. The focus was on how to think and the ways of thinking--inductive reasoning, problem solving, creativity, analyzing, and metacognition. Learners become active and independent. Students are to be challenged and expected to develop rationale for their decisions. Skills were seen as generalizable within similar contexts.

Teaching. The instructors representing Perry's Position 2/3 and 3 perceived teaching as structured, inflexible, or formal. Most described their teaching environment through absolutes, rules, concrete examples, and practicality. Adapting to changes in technology was seen as difficult.

The instructors representing Perry's Positions 4 and 4/5 perceived teaching as unstructured, flexible, or informal. The emphasis was on the responsibility of the learner through self-directed learning. Students and colleagues with diverse viewpoints were

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important sources for teaching. Interaction and interpersonal skills were necessary in the classroom. Change was viewed and an opportunity.

The instructors representing Perry's Positions 2/3 and 3 seemed to prefer a teacher-orientated learning environment while the instructors representing Perry's Positions 4 and 4/5 seemed to prefer a student-orientated learning environment which is consistent with the theory of intellectual development.

Gender and Intellectual Development

In testing for differences between men and women, women in this study scored significantly higher in intellectual development than men. Table 7 shows that gender had a significant F (1,54) = 5.69, p <.05.

Table 7

Two-Way ANOVA for Intellectual Development by Education and Gender

Source	df	Sum of Squares	Mean Square	F Ratio	F Prob
Education	2	34892.23	174446.12	9.14	<.001*
Gender	1	10854.15	10854.15	5.69	<.05*
Educ/Gender	2	1456.30	728.15	.38	>.05
Within Groups	54	103017.90	1907.74		
Total	59	150220.58			

Usually men have scored significantly higher in intellectual development than women in studies with nontraditional groups (King, Wood, & Mines, 1990; King et al., 1983; Lawson, 1980; Strange, 1978; Shoff, 1979). Only one other study has found females scoring higher than males (Schmidt, 1983). Nontraditional was defined as 23 years of age in Schmidt's study; consequently, generalizations were limited to the definition. In past research, however, the definition of nontraditional has varied in age. This is the first study to compare men and women between the ages of 35 and 65 years of age.

The significant finding for gender must be explained by validation of the instrument, distribution of the variables, or identification of an underlying variable(s). In the reliability and validity studies of the original LEP instrument, no significant difference was found between men and women based on a gender-balanced subsample of 470 subjects drawn randomly. In this study, normal distributions were shown for gender during the testing of the assumptions for running the ANOVA procedure. Thus, focus groups were used to identify any plausible underlying variables to explain gender differences.

From the focus group findings, women were seen as more nurturing, people-orientated, and patient, in addition to having good networking and group decision-making skills. The individualized learning environment at the technical college was perceived to promote more informal relationships where women were viewed as seeking out the students more than men. In addition, the women in the institution were viewed as more liberal, motivated and powerful. Men were seen as choosing to isolate themselves from the students and being defeated in the power structure of the college's organization as the number of male administrators decreased.

These focus group findings on gender are parallel to findings from a study by Belenky, Clinchy, Goldberger, and Tarule (1986) with 135 women which was a replication of Perry's (1970) study with men. In both studies, women were perceived to seek out relationships and nurture others.

Education, Gender, Age, and Intellectual Development

In testing for relationships between intellectual development and education, gender, and age, two variables were found to be significant. Table 8 shows education with $p < .001$ to be more significant than gender with $p < 05$. This was not surprising after finding significant differences between and among groups in research questions one and two. Age did not have a significant relationship with intellectual development. As an independent variable, age had the smallest coefficient of .59. This was an important finding, showing that education rather than age (maturation) was significantly related to intellectual development of technical college instructors in this study.

Table 8

Multiple Regression Statistics for Intellectual Development and Education, Gender, and Age

Variables	B	SE B	Beta	T	Sig T
Education	26.1779	7.0394	.4272	3.72	.0005*
Gender	28.0759	11.5914	.2806	2.42	.0187*
Age	.5879	.7524	.0905	.78	.4378

Multiple R = .51122 Standard Error = 44.5133
R Square = .26135 F-Ratio = 6.605
Adjusted R Square = 44.51330 $P < .0007$

Conclusion

The theory of intellectual development has been expanded on a limited basis. In this group of technical college instructors, education was more critical to intellectual development than age or maturation. Because the age distribution had representation in all age groups between 35 and 65 years of age, the generalizability of education can be extrapolated into older age groups in this study.

More research needs to be done to investigate education and intellectual development in older populations in other environments to further expand the generalizability of the theory. If future research shows education more critical to intellectual development than age, the theory of intellectual development needs to move from a descriptive to a prescriptive theory to better facilitate intellectual development of adults.

In today's global market along with the acceleration of change, trends are towards a more diverse workplace, life-long learning, multiple career changes, and more adults in our educational systems. Some of the questions we need to address are: Should intellectual development be a mission for educating adults in our diverse world? Can educators at a level of Multiplicity challenge students who are in Relativism? What would be the potential for intellectual development of adults if instructional methodologies were designed for moving students towards Relativism and Commitment?

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