# INTERNATIONAL JOURNAL OF INSTRUCTIONAL TECHNOLOGY AND DISTANCE LEARNING


## April 2004

**Volume 1 Number 4**





ISSN 1550-6908


This Journal was established to facilitate collaboration and communication among researchers, innovators, practitioners, and administrators of education and training programs involving technology and distance learning.

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International Journal of
Instructional Technology & Distance Learning

# Table of Contents – April 2004

ISSN 1550-6908

# Editorial

# Computers in Libraries

**Donald G .Perrin**

While government is redirecting funding from social services and education to backfill budget deficits, organizations like the Bill & Melinda Gates Foundation are making significant contributions to under-served populations in areas ranging from Aids in Africa to Computers in Libraries.[1]

The Public Access Computing Project (PACP) at University of Washington conducted a five year nationwide study and consolidated information from a variety of public and private sources. PACP found that several groups rely entirely on public libraries for access to computers and the Internet, including minorities, the unemployed, and those from lower income groups. Patrons use these computers to learn new skills, find jobs and keep in touch with family. Librarians need help to sustain public-access computing for disadvantaged populations:

- 37% of library computer users earn less than $15,000 per year and say their only access to the Internet is at the public library
- 24% of all library computers users say their only access to the Internet is at the public library
- People in low-income neighborhoods report that library computers have helped them find a job, write a resume, get better grades in school, and get information about local events.

"Toward Equality of Access: The Role of Public Libraries in Addressing the Digital Divide," is a 36 page report sponsored by the Bill & Melinda Gates Foundation and developed in partnership with AARP, American Library Association, Beaumont Foundation of America, Benton Foundation, Institute of Museum and Library Services, Leadership Conference on Civil Rights, National League of Cities, and U.S. Chamber of Commerce. [2]

The Pew Internet and American Life Project, research advisor for Gates "Digital Divide" publication is another valuable resource.[3] Be sure to scan the list of **Reports**.

Public and private funded projects provide valuable information to supplement data from the National Center for Educational Statistics. [4] and other government agencies.

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[1] http://www.gatesfoundation.org/Libraries/USLibraryProgram/Evaluation/default.htm

[2] http://www.gatesfoundation.org/nr/Downloads/libraries/uslibraries/reports/TowardEqualityofAccess.pdf

[3] http://www.pewinternet.org/

[4] http://nces.ed.gov/

**Editor's Note**: Explosive growth of online learning made the face of the teacher invisible as institutions abandoned television for low cost web alternatives. This paper reminds us that interactive television is effective for student centered learning. It explores relationships between teaching style, instructor training, teaching experience, interactive classroom type, curriculum and instructional design. The research is based on a large population and a correlational quantitative design. It demonstrates how quality of learning is influenced by preparation, teaching styles and student participation.

# Variables Related to Interactive Television Teaching Style: In Search of Learner-Centered Teaching Styles

**Pamela A. Dupin-Bryant**

## Abstract

As supported by many studies, effective distance education revolves around learner-centered teaching styles that decrease psychological distance and increase student participation in the teaching-learning process. Knowing variables that help explain or predict learner-centered teaching styles will help institutions refine their programs to better serve the needs of students. This study identified variables that account for interactive television teaching style. Interactive television instructors ($N = 203$), representing nine land-grant universities in the United States participated in the study. Regression analysis revealed a six variable model accounted for 37% of the variance in teaching style as measured by the *Principles of Adult Learning Scale* (PALS), including: (a) training in philosophy, history, and/or foundations of adult/continuing education; (b) interactive classroom type; (c) training in psychology of adult development/learning; (d) training in teaching methods for adults; (e) consultation with other distance education instructors; and (f) training in the development of curricula for distance education courses. Correlational analysis found teaching style was also related to education level, academic rank, teaching experience, and training in teaching methods for distance education.|

## Introduction

During the past few decades, distance education has grown to become an established presence in higher education with more than 80% of institutions delivering courses via audio-video interactive conferencing technologies (Lewis, Snow, & Farris, 1999). Although online distance education has received more attention in current literature, interactive television—characterized by multiple classroom sites in which participants see and hear each other simultaneously via audio-video interactive conferencing technology—is a commonly used delivery type that is projected to thrive in the future (Lewis, et al., 1999; McGlothlin, 2001; Mottet, 1998; Ostendorf, 1997).

As students continue to enroll in interactive television courses, effective instruction becomes paramount. Many have postulated that the success and growth of distance education depends on minimizing the psychological distance inherent in most distance education settings (Moore & Kearsley, 1996; Wolcott, 1996). The combination of psychological and physical distance poses many potential problems to effective distance learning (Wolcott, 1996).

To reduce psychological distance many believe that special teaching behaviors are necessary in distance education environments (Moore & Kearsley, 1996; Verduin & Clark, 1991). Wolcott (1996) suggested "one solution to bridging the psychological distance is to adopt a learner-centered approach to distance teaching" (p. 25). The development of learner-centered skills in course planning, delivery, and evaluation are believed to be essential to effective distance

instruction (Belanger & Jordan, 2000; Butcher, 2002; Duffy & Kirkley, 2004; Verduin & Clark, 1991). Effective distance teaching is believed to revolve around a learner-centered system of instruction (Beaudoin, 1990; Dillon & Walsh, 1992; Gehlauf, Shatz, & Frye, 1991) "that demonstrate[s] a bias for direct learner involvement and participation throughout the process" (Ostendorf, 1997, p. 51).

Learner-centered distance educators encourage personal growth and stress facilitation of learning and construction of knowledge rather than diffusion of information (Beaudoin, 1990; Duffy & Kirkley, 2004; Granger & Bowman, 2003). The tenets of learner-centered distance teaching parallel the collaborative, learner-centered teaching styles heralded in adult education literature as the most effective way to teach adults (Gibson, 2003; Verduin & Clark, 1991).

### Purpose of the Study

A primary goal of distance education is to provide quality educational experiences to geographically dispersed individuals. Yet, due to geographic separation students are often socially and psychologically isolated in interactive television classrooms. As the number of students participating in interactive television courses continues to increase it is imperative for institutions of higher education to refocus on the goal of serving the needs of students. To serve students well, it is therefore crucial that interactive television instruction revolves around learner-centered teaching activities that decrease psychological distance and increase student participation in the entire teaching-learning process.

Numerous studies support the assertion that utilizing more learner-centered instructional approaches enhances the effectiveness of the distance learning process (Butcher, 2002; Dillon & Gunawardena, 1995; Dillon & Walsh, 1992; Hackman & Walker, 1990; Silvernail & Johnson, 1992; Wilkes & Burnham, 1991; Zhang & Fulford, 1994). Yet, until variables that relate to learner-centered teaching styles are more clearly identified, instructional changes will not be made and students may continue to remain psychologically isolated and dissatisfied with the distance education experience. This study provided the next step in improving interactive television instruction by answering the research question:

Which variables account for teaching styles of university interactive television instructors?

## Background

Many variables have been hypothesized to be related to interactive television teaching style. Much of the literature on distance teaching was based on the premise that well-designed training programs help instructors shift from teacher-centered to more learner-centered teaching styles. Training topics believed to enhance learner-centered approaches to distance teaching included: (a) the use and application of distance education technologies; (b) the development of curricula for distance education courses; (c) teaching methods for distance education courses; (d) philosophy, history, and/or foundations of adult/continuing education; (e) psychology of adult development and/or learning; and (f) teaching methods for adults (Chin & Horton, 1994; Hoskins, 1998; Jadun, 1998; Kearsley, 1998; Moore & Kearsley, 1996; Wolcott, 1993, 1996). The literature also suggested that consultation with support staff and with other distance education instructors promotes more learner-centered teaching strategies (Armstrong, 1998; Hoskins, 1998). Teaching experience, education level, academic rank, technology type, and distance teaching experience were also noted as variables that may contribute to more learner-centered teaching (Moore & Kearsley, 1996; Wolcott, 1996).

The effect of training, institutional support, and technology on distance education teaching style has been tested in several small qualitative studies (Hoskins, 1998; Armstrong, 1998). These studies identified many variables that foster learner-centered distance teaching strategies, including training in the use and application of technology, training in curriculum development, training in distance teaching methods, consulting with support staff, and speaking with other distance education instructors. No specific studies were found that tested the relationships between teaching experience, education level, academic rank, and teaching style. Although variables that are related to learner-centered teaching styles have been studied in numerous adult education settings, only a few interactive television studies have reported evidence of specific variables that account for learner-centered teaching styles.

## Methodology

This study sought evidence from university interactive television instructors in the United States that would lead to general conclusions about relationships between teaching style, instructor training, teaching experience, interactive classroom type, and other variables using a correlational quantitative research design. A random sample was drawn from the accessible population of interactive television instructors from nine land-grant universities who agreed to participate in this study. The sampling frame included university instructors who had taught via interactive television at Colorado State University, Iowa State University, North Dakota State University, Oregon State University, Purdue University, University of Maine, University of Minnesota, University of Wyoming, and Utah State University. A research questionnaire, including a demographic survey and the *Principles of Adult Learning Scale* (PALS), was used to collect data.

Teaching style is a relative construct representing various identifiable and pervasive traits, characteristics, behaviors, and qualities a teacher exhibits in any given educational setting that reflects the teacher's educational philosophy (Darkenwald & Merriam, 1988). The *Principles of Adult Learning Scale* (Conti, 1990) was used in this study to measure the degree a university interactive television instructor accepts and practices a particular teaching style. In this study, a composite score on the PALS instrument operationally defines teaching style. Teacher-centered teaching style is a construct defined as a style of instruction that is formal, controlled, and autocratic in which the instructor directs how, what, and when students learn. In this study, low composite scores on PALS provided the operational definition of teacher-centered teaching style. Learner-centered teaching style is a construct defined as a style of instruction that is responsive, collaborative, problem-centered, and democratic in which both student and instructor decide how, what, and when learning occurs. In this study, high composite scores on PALS provided the operational definition of learner-centered teaching style.

**PALS** is a highly reliable and valid rating scale (Conti, 1983; Parisot, 1997; Premont, 1989) that consists of 44 items and uses a modified six-point Likert scale to assess the degree to which a respondent accepts and employs principles associated with the collaborative, learner-centered mode for teaching adults (Conti, 1990). PALS has been used in many research studies. In a review of dissertation abstracts international, 74 recent studies were listed as having used PALS as a research tool. Although, PALS was originally designed to measure teaching style in Adult Basic Education settings, it has been widely used in higher education research and has also been used in several studies to assess the teaching style of distance educators.

A limitation of this study was that teaching style assessed by interactive television instructors is in a self-report format. Reliability and criterion-related validity have been established to confirm the assertion that the PALS assesses the actual classroom behaviors of instructors (Conti, 1990). However, whether or not each instructor actually exhibits these styles in the distance education classroom may not be independently discernable in this data.

# Results

## Descriptive Statistics

Three hundred and thirty university interactive television instructors were randomly selected to receive the research survey. A total of 225 surveys were returned for a response rate of 69%. Of those surveys returned, only 22 were deemed unusable due to missing data. These surveys were eliminated from analyses. Thus, a 62% usable survey response rate was achieved. Using the data collected from respondents, descriptive statistics were generated to identify the appropriate group to whom statistical inferences apply.

Interactive television instructors ($N = 203$), representing nine land-grant universities in the United States, participated in the study. Two-thirds ($n = 136$) of the sample were male and one-third ($n = 67$) were female. Three percent reported their highest level of completed education was a bachelor's degree, twenty-four percent a master's degree, while seventy-three percent noted they had completed a doctoral degree. The current academic rank reported by respondents included Graduate Assistant (2%), Adjunct/Other (14.3%), Lecturer/Instructor (14.8%), Assistant Professor (15.8%), Associate Professor (25.6%), and Full Professor (27.6%).

Respondents ranged in years of overall teaching experience from 1 to 48 years, with a mean of 17.64, mode of 20, and median of 15 ($SD = 11.1$). Forty-nine percent ($n = 99$) had taught the majority of their interactive television courses on a Two-Way Audio/One-Way Video system, while fifty-one percent ($n = 104$) experienced teaching interactive television on a Two-Way Audio/Two-Way Video system. The number of courses respondents had taught via interactive television generated a positively skewed distribution with a mean of 6.96, mode of 1, and median of 4 courses ($SD = 8.79$). The maximum number of courses taught was 60 and the minimum modal score was one. The instructors taught various course types including agriculture (2%), education (25.6%), family life (7.9%), social science (22.2%), business (15.8%), engineering (2.5%), humanities and arts (8.4%), science (10.8%), and other (4.9%).

On all but one of the forty-four items in the *Principles of Adult Learning Scale* (PALS), instructor self-ratings ranged from zero to five on the modified six-point Likert scale. Twenty items were recoded to make them amenable to analysis. Omitted items were assigned a neutral value of 2.5 in agreement with PALS scoring procedures (Conti, 1990). Although assigning neutral values has its limitations, this relatively impartial procedure was employed since there were a small number of non-responses.

The item results on PALS were calculated to form a single composite score indicating the instructors overall teaching style. The possible high score was 220. Low scores on PALS are indicative of a teacher-centered teaching style while high scores reflect a learner-centered style. The mean PALS composite rating for the sample of instructors was 128.08 ($SD = 20.26$), with scores ranging from 64.5 to 187. Descriptive statistics for composite PALS scores in relationship to each demographic variable were also calculated and are displayed in Table 1.
Respondents reported they had received training in (a) the use and application of distance education technologies (78%); (b) the development of curricula for distance education courses (45%); (c) teaching methods for distance education courses (59%); (d) philosophy, history, and/or foundations of adult/continuing education (30%); (e) psychology of adult development and/or learning (42%); and (f) teaching methods for adults (41%). A resounding ninety-two percent had consulted with distance education support staff during their interactive television teaching experience. Eight-three percent of the instructors had consulted with other instructors who had taught courses via distance education.

## Table 1

*Mean Composite PALS Scores for each Demographic Variable*

| Demographic Variable | PALS Teaching Style Score | | |
|---|---|---|---|
| | *M* | *SD* | *n* |
| Gender | | | |
| Female | 129.46 | 19.77 | 67 |
| Male | 127.40 | 20.54 | 136 |
| Level of Completed Education | | | |
| Bachelors Degree | 127.50 | 25.98 | 5 |
| Masters Degree | 119.62 | 16.42 | 50 |
| Doctorate Degree | 130.96 | 20.57 | 148 |
| Academic Rank | | | |
| Graduate Assistant | 128.00 | 5.87 | 4 |
| Adjunct/Other | 119.45 | 16.55 | 29 |
| Lecturer/Instructor | 125.15 | 18.71 | 30 |
| Assistant Professor | 128.63 | 21.23 | 32 |
| Associate Professor | 132.76 | 19.69 | 52 |
| Full Professor | 129.48 | 22.40 | 56 |
| Interactive Classroom Type | | | |
| Two-Way Audio/One-Way Video | 121.02 | 16.84 | 99 |
| Two -Way Audio/ Two -Way Video | 134.81 | 21.02 | 104 |
| Course Type | | | |
| Agriculture | 138.13 | 12.15 | 4 |
| Education | 143.48 | 16.12 | 52 |
| Family Life | 127.09 | 16.36 | 16 |
| Social Science | 124.34 | 17.73 | 45 |
| Business | 119.56 | 20.43 | 32 |
| Engineering | 115.20 | 11.65 | 5 |
| Humanities and Arts | 121.76 | 19.23 | 17 |
| Science | 113.30 | 14.80 | 22 |
| Other | 139.40 | 21.31 | 10 |

*Note.* Maximum Score = 220. Higher scores reflect a more learner-centered teaching style.

The means and standard deviations for composite PALS scores on each training and consultation variable are displayed in Table 2.

## Table 2

*Mean Composite PALS Scores for each Training and Consultation Variable*

| Training Type | Training | | | No Training | | |
|---|---|---|---|---|---|---|
| | *M* | *SD* | *n* | *M* | *SD* | *n* |
| Use and Application of DE Technologies | 128.68 | 21.14 | 158 | 126.00 | 16.86 | 45 |
| Development of Curricula for DE Courses | 132.45 | 19.29 | 91 | 124.54 | 20.42 | 112 |
| Teaching Methods for DE Courses | 130.78 | 20.87 | 119 | 124.27 | 18.84 | 84 |
| Philosophy, History, or Found. of Adult/Cont. Ed. | 141.53 | 17.95 | 61 | 122.31 | 18.42 | 142 |
| Psychology of Adult Development and/or Learning | 138.17 | 18.54 | 85 | 120.82 | 18.30 | 118 |
| Teaching Methods for Adults | 138.31 | 18.74 | 83 | 121.01 | 18.21 | 120 |
| | **Consultation** | | | **No Consultation** | | |
| **Consultation Type** | *M* | *SD* | *n* | *M* | *SD* | *n* |
| Distance Education Support Staff | 128.43 | 20.28 | 186 | 124.32 | 20.29 | 17 |
| Instructors who have taught via Distance Education | 129.71 | 20.46 | 169 | 120.01 | 17.39 | 34 |

*Note.* Maximum Score = 220. Higher scores reflect a more learner-centered teaching style.

## Reliability Analysis

Internal consistency reliability for the *Principles of Adult Learning Scale* was estimated by computing a single Cronbach-Alpha reliability analysis based on average inter-item correlation. All forty-four items were included. The test resulted in an acceptable alpha level of .84, which suggested the teacher-centered and learner-centered components of the PALS instrument were sufficiently distinct from each other.

## Correlational Analysis

Correlational analysis was employed to answer the research question–which variables account for teaching styles of university interactive television instructors? Correlations were used to determine relationships between teaching style, as measured by composite PALS scores, and each proposed predictor variable. Examination of the correlations between each of these indicator variables and teaching style revealed numerous variables that relate to teaching style as measured by PALS (see Table 3).

**Training**. Data collected to ascertain whether interactive television instructors had received training in six educational topics revealed statistical correlations between all but one topic and teaching style. Each training variable was measured dichotomously with 1 equal to no and 2 equal to yes. Correlation analysis confirmed the importance of interactive television instructor training in adult education topics. Training in the philosophy, history, and/or foundations of adult/ continuing education ($r$ = .44) alone explained almost one fifth ($r^2$ = .19) of the variance in teaching style. While training in psychology of adult development and/or learning ($r$ = .42) as well as teaching methods for adults ($r$ = .42), each alone explained eighteen percent ($r^2$ = .18). Training in several distance education topics were also related to teaching style, as measured by PALS. Results indicate that interactive television instructors who received training in the development of curricula for distance education ($r$ = .19) and teaching methods for distance education ($r$ = .16) were more likely to employ learner-centered teaching styles. Each of these variables alone explained four percent ($r^2$ = .04) and three percent ($r^2$ = .03) of the variation in teaching style, respectively. These findings are supported by Hoskins (1998) qualitative study, which found training in curriculum development and teaching methods for distance education fostered more student-centered teaching strategies.

## Table 3

***Correlations between Predictor Variables and Teaching Style as measured by PALS***

| Variable | Composite Score ( *r* ) |
|---|---|
| *Highest Level of Completed Education* | |
| Bachelors Degree | -.01 |
| Masters Degree | -.24** |
| Doctoral Degree | .23** |
| *Academic Rank* | |
| Graduate Assistant | -.00 |
| Adjunct/Other | -.17* |
| Lecturer/Instructor | -.06 |
| Assistant Professor | .01 |
| Associate Professor | .14 |
| Full Professor | .04 |
| *Years of Overall Teaching Experience* | .20** |
| *Interactive Classroom Type* | .34*** |
| *Number of Courses Taught via Interactive Television* | .07 |
| *Training in:* | |
| Use and Application of Distance Education Technologies | .06 |
| Development of Curricula for Distance Education Courses | .19** |
| Teaching Methods for Distance Education Courses | .16* |
| Philosophy, History, and/or Foundations of Adult/Continuing Education | .44*** |
| Psychology of Adult Development and/or Learning | .42*** |
| Teaching Methods for Adults | .42*** |
| *Consultation with:* | |
| Distance Education Support Staff | .06 |
| Instructors who have taught via Distance Education | .18* |

*Note.* * p < .05; ** p < .01; *** p < .001

.Of all the training variables proposed in this study only one, training in the use and application of distance education technologies, was not related to composite PALS score ($r$ = .06). This result is interesting when considering the mound of literature that reported most faculty development programs focused primarily on training instructors in the use of technology (Dillon & Walsh, 1992; Moore & Thompson, 1997). These findings support the common held belief that training programs should not focus solely on technology literacy. Rather programs should focus on educational topics believed to enhance the effectiveness of distance teaching such as delivery methods, teaching/learning theory, principles of adult learning, instructional strategies, and curriculum design (Beaudoin, 1990; Gehlauf, et al., 1991; Wolcott, 1993).

***Consultation***. Data concerning instructor consultations was measured dichotomously; 1 = no and 2 = yes. A slight positive correlation was identified between composite PALS score and consultation with instructors who have taught via distance education ($r$ = .19). This result supports Armstrong's (1998) finding that consultation with other distance education instructors was of primary importance to instructors in making the transition to learner-centered distance education settings. This variable alone explained only four percent ($r^2$ = .04) of the variance in teaching style, however this variable is noteworthy when combined with several additional variables (see Regression Analysis section).

***Interactive Classroom Type***. Interactive classroom type was measured dichotomously with 1 equal to Two-Way Audio/One-Way Video and 2 equal to Two-Way Audio/Two-Way Video. A moderate positive correlation ($r$ = .34) was evident between teaching style and interactive classroom type. Results suggest that instructors who taught the majority of their courses via a Two-Way Audio/Two-Way Video interactive television system were more likely to employ learner-centered teaching styles than those who taught via Two-Way Audio/One-Way Video. This variable alone explained twelve percent ($r^2$ = .12) of the variability in composite PALS teaching style scores. This finding supports the belief that instructor teaching style is affected by the teaching environment and the technology employed.

## Regression Analysis

The correlational findings presented above measured the relationship between composite PALS score and individual variables. Each variable alone accounted for only a small percent of the variance in teaching style. Therefore, multiple regression was employed to determine which of these variables combined formed the best prediction of interactive television teaching style, as measured by PALS. Forward stepwise selection was used to identify a descriptive linear model of teaching style.

***Model of Teaching Style.*** The results of the regression analysis procedure suggested that six variables accounted for 37% of the variability in teaching style (see Table 4). Training in philosophy, history, and/or foundations of adult/continuing education; was the first variable selected and on its own accounted for 19% of the variability in teaching style. The next five predictor variables entered the model in the following order: interactive classroom type; training in psychology of adult development/learning; training in teaching methods for adults; consultation with instructors who have taught courses via distance education; and training in the development of curricula for distance education courses. Adding additional predictor variables increased the explained variance by less than 1% each. Thus, the six variable model ($R^2$ = .37) was determined to be the best linear combination of variables that accounted for teaching style, as measured by PALS.

### Table 4

***Summary of Multiple Regression Analysis for Variables Predicting Teaching Style***

| Variable | $R^2$ | $R^2$ Partial |
|---|---|---|
| $X_{1a}$ – Training in Philosophy, History, or Foundations of Adult/Continuing Education | .19 | .19 |
| $X_{2a}$ – Interactive Classroom Type | .26 | .07 |
| $X_{3a}$ – Training in Psychology of Adult Development/Learning | .33 | .07 |
| $X_{4a}$ – Training in Teaching Methods for Adults | .35 | .02 |
| $X_{5a}$ – Consultation with Instructors who have taught courses via Distance Education | .36 | .01 |
| $X_{6a}$ – Training in the Development of Curricula for Distance Education Courses | .37 | .01 |

*Note*. $N$ = 203.

The regression equation for the model was: $Y = (7.07)X_{1a} + (12.10)X_{2a} + (9.66)X_{3a} + (5.70)X_{4a} + (6.09)X_{5a} + (3.57)X_{6a} + 62.52$, were Y is equal to the composite score on PALS and $X_{1a}$ through $X_{6a}$ are predictor variables (see Table 4). For each training/consultation predictor variable, 1 equals no and 2 equals yes. On the interactive classroom type variable, 1 equals Two-Way Audio/One-Way Video and 2 equals Two-Way Audio/Two-Way Video. Relationships between all the predictor variables and the composite score on PALS were examined (see Table 3). The associations ranged from .18 to .44. Although other variables were related to teaching style, they were unnecessary to the equation due to their collinearity.

Finding this combination of variables highly related to teaching style was anticipated in light of previous research. This predictor model indicates support for the importance of instructor training and consultation to facilitate planned change to more learner-centered interactive television classrooms. These findings also support the belief that in addition to personal traits that may be shaped by training and consultation, teaching style is also affected by the teaching environment and the technology employed.

## Implications for Practice

Interactive classroom type was determined to be one of the best predictors of university interactive television teaching style. Recognizing that interactive television teaching style is related to interactive classroom type may help institutions as they consider choosing appropriate distance learning technology. Distance education administrators should consider these results in addition to other criterion when weighing costs versus benefits of using full video or one-way video technologies for delivering interactive distance education programs.

Consulting with instructors who have taught via distance education was found in this study to predict more learner-centered approaches to interactive television teaching. Based on this finding, universities are encouraged to institute faculty support structures such as mentoring programs, peer workshops, and electronic discussion groups that provide instructors with opportunities to consult with each other. These programs may provide avenues for instructors to share their experiences, ideas, concerns, and achievements regarding elements of the entire distance teaching process. Peer support programs may serve a vital role in improving the quality of distance education experiences for instructors and students alike.

Training topics that were found in this study to predict more learner-centered teaching approaches provide criterion upon which curriculum for distance education training programs may be developed. Professional faculty development programs that include training in adult and continuing education are recommended as a means for guiding universities and their instructors in planned change. Study results should be used to select training opportunities that are likely to help faculty become more learner-centered in their approach to distance teaching.

Implicit in the study results is the idea that teaching style is an individual preference. Although, research supports the assertion that utilizing more learner-centered instructional approaches enhances distance learning, literature also supports that teaching style is a combination of internal and external qualities an instructor exhibits that reflects their personal educational philosophy. Therefore, results of this study should not be used to force instructors into adopting any teaching strategy to which they are philosophically opposed. University administrators should assist instructors in choosing to make instructional changes or adaptations on their own by encouraging personal development plans. These plans should incorporate formal training, self-directed readings, peer interaction, critical self-reflection, and experimentation with a variety of teaching approaches.

## Recommendations for Future Research

This study was able to account for 37% of the total variance in explaining or predicting variables related to teaching styles of the university interactive television instructors in the sample. Additional studies should be conducted to try to explain more of the variance. These studies should look at different variables that are believed to be related to teaching style.

Many variables were found in this study to be related to teaching style. Future studies should test the causal relationship between these variables and interactive television teaching style. An experimental design, which examines the effects of a professional development program based on the *Model of Teaching Style*, is recommended for exploring causal relationships between teaching style and the predictor variables.

Based on theoretical principles of distance learning, the learner-centered teaching style is assumed to be an appropriate method of instruction in distance education environments. However, with the emergence and popularity of asynchronous distance education the field is in need of empirical research to support this assumption in web-based courses. Future studies should test the link between learner-centered teaching styles and student learning/satisfaction in web-based courses.

As distance education becomes more integral to the mission of institutions of higher education, knowing variables that help explain or predict learner-centered teaching styles will help institutions refine their programs to better serve the needs of students. As supported by numerous research findings, providing students with instructors who are more learner-centered in their approach to distance teaching may lead to better distance education programs by increasing student learning and satisfaction. In the future, the knowledge base that will be called upon to improve distance learning and instructional practice, will come from continued research that seeks to understand variables that may facilitate or impede learner-centered distance education environments.

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**Editor's Note**: This study relates teacher training to effectiveness of interactive video. It concludes that teacher and administrator skills in interactive television are best developed by a combination of classroom training and laboratory experiences. With experience, concern evolves from technology concerns to curriculum, learning and students.

# Effects of Training in a Telecommunications Classroom upon the Stages of Concern of College Faculty and Administrators

**Rita L. Dobbs**

## Introduction

Distance education, which incorporates a variety of electronic delivery methods, has become increasingly popular in higher education institutions. Teleconferencing, interactive television (ITV) became a popular medium for higher education institutions to offer educational opportunities to remote areas. In 1997-98, 80% of public four-year higher education institutions in the United States were offering courses through two-way interactive video (National Center for Education Statistics [NCES], 1999). At that time, 61% of the respondents indicated that distance education delivery utilizing two-way interactive video would start or be increased by their institution within the next three years (NCES, 1999).

A review of the related literature reveals that only about a quarter of higher education institutions offering distance education courses required faculty to have training in distance education methodologies (NCES, 1999). The implementation of two-way interactive video classes can be an expensive venture for an institution, yet the research indicates that training does not seem to factor into the process. Distance education offers many benefits to higher education institutions. Hanson, et al. (1997) stated, "a well-run distance education enterprise is the product of people, planning, and technology" (p. 34). However, the implementation of effective programs is often hampered by a variety of factors. Some professors and administrators may have negative attitudes toward distance education. They have concerns about the quality of the education that is possible in an ITV format. Many times this is due to the lack of understanding of the technology itself or due to lack of training of faculty, staff and administration (Lehman, 1992). Some instructors are afraid of having to change instructional methods or of losing autonomy. If instructors do not receive support for planning or course design, negative attitudes may develop; however, a formal and thorough orientation to distance teaching and distance education can change educators' perceptions (Dillon & Walsh, 1992).

A review of the research related to implementing an innovation, such as ITV, into an organization or institution revealed the Concerns Based Assessment Model (CBAM) developed by Hord, Rutherford, Huling-Austin, and Hall (1998) who wrote, "the single most important factor in any change process is the people who will be most affected by the change"(p. 29). Even though the technology and the institution are important to the successful implementation of a distance education program, the faculty, staff, and administrators utilizing the system are the most important factors in successful implementation (Hord, Rutherford, Huling-Austin, & Hall, 1998). Moore and Kearsley (1996) suggested that the success of a distance education program in an institution is dependent upon the internal commitment by the teachers and others within the organization. If the innovation is to be successful, the *concerns* of faculty and administrators utilizing the systems must be addressed (Hall & Hord, 2001). It is important to note that the success of any new program in higher education is dependent upon the innovation being supported and implemented by the faculty of the institution (Hall, & Hord, 2001).

Frances Fuller, University of Texas psychologist, in 1969 originated the idea of addressing the concerns of individuals faced with implementing a new innovation. Through Fuller's work and that of Ven den Berg & Bandenberghe, 1981; Persichitte & Bauer, 1996; Shieh, 1996; and Hall & Hord, 1986, it was found that when people are exposed to change, they experience the same concerns (Hall & Hord, 2001). An administrator or director of a new ITV system would want to identify and address the concerns of faculty who would be using the new system for teaching purposes.

Hall and Hord (2001) identified and confirmed seven specific categories of concerns that are detailed in the Stages of Concern (SoCQ) and tested in the Stages of Concern Questionnaire. "The most rigorous technique for measuring concerns is the Stages of Concern Questionnaire (SoCQ), which is a thirty-five item questionnaire that has strong reliability estimates (test/retest reliabilities range from .65 to .86) and internal consistency (alpha-coefficients range from .64 to .83)(Hall & Hord, 2001, p. 68).

## Problem Statement

The use of distance education technologies to deliver instruction to geographically bound or time-restrained students has become commonplace among higher education institutions; however, training for personnel delivering the instruction is not always offered. This study was undertaken to determine if formal distance education classroom training or classroom training combined with laboratory experiences would affect the concerns of college faculty and administrators about the implementation of distance education through ITV in their institution.

### Research Question

Do the stages of concern, as measured by the Stages of Concern Questionnaire (SoCQ), differ among groups of college faculty and administrators who are expected to begin delivering instruction via distance education and who receive (a) classroom training on distance education, (b) classroom training and laboratory experiences on distance education, or (c) no distance education training?

### Research Methodology

This research was conducted at Texas State Technical College-Marshall (TSTC-M), which is located in Marshall, Texas, a rural East Texas town of approximately 25,000 people. The college is part of the TSTC system, the only state-supported technical college system in Texas.

The population for this study was comprised of full-time faculty and administrators of the college. A total of 27 faculty and administrators participated in this study. The population was divided into three groups for the purpose of this study. Each group included nine faculty and administrators. The first group, the classroom group, consisted of personnel who participated in only the classroom portion of the distance education training activities. The second group, the classroom and laboratory group participated in the classroom training and completed an additional 18 hours of hands-on training in the distance-learning classroom. . The third group, comprised of the personnel who did not participate in distance education training activities, served as the control group. A quasi-experimental design was used for the research because the individuals were not randomly assigned to treatment conditions.

The SoCQ was administered as a pretest to all three groups before formal distance education training was conducted. The validity of this instrument was established by Hall, George, and Rutherford (1986) over two and one-half years of research with "intercorrelation matrices, judgments of concerns based on interview data, and confirmation of expected group differences and changes over time" (p. 12). The seven stages of concern, awareness, informational, personal,

management, consequence, collaboration and refocusing, assessed in the SoCQ represent a developmental sequence that an individual progresses through when confronted with change or innovation (Toms, 1997).

Each participant in all three groups received the questionnaire on the first day of the scheduled classroom training. The control group attended the first fifteen minutes of the first scheduled classroom training to complete the survey. Once their survey questionnaire was returned, the control group members were dismissed from the classroom training session. Respondents indicated on a Likert scale the degree to which each concern was true and circled a number from 0 to 7 on the printed scale. Respondents were given as much time as necessary to complete the survey before actual classroom training began. Each series of the questionnaire consisted of items that are important at a certain stage of concern, according to the Hall, George and Rutherford (1986) concerns theory. Each of the seven stages of concern was represented by five questions on the survey. A scale score was obtained for the peak score and for each of the stages of concern on the questionnaire. This information provided the baseline data for the research. After the SoCQ was completed, the researcher presented nine hours of classroom instruction in distance education teaching strategies to the 18 participants in groups two and three.

Personnel choosing to participate in the study were placed into two groups. Each group met one day every second week for three hours of instruction. Classroom training consisted of three, three-hour sessions over six weeks of instruction. Participants took part in discussion and hands-on activities that familiarized them with the technology and the necessary skills for teaching at a distance. At the conclusion of the last classroom session, the participants who elected to end their training with the classroom portion were administered the SoCQ as a posttest.

The classroom and laboratory group was comprised of the faculty and administrators who wished to receive college credit for their participation in the classroom sessions. In order to receive college credit, this group participated in 18 hours of individual, hands-on practice in the distance-learning classroom in addition to the required classroom instruction. The laboratory time included guided practice in how to use the equipment effectively and feedback on instructional delivery utilizing the equipment. Participants presented a 10-minute lesson in their subject area in the ITV classroom to a remote site as part of their course requirements for credit. Upon completion of the presentations, the SoCQ was administered to the classroom and laboratory group and to the control group. The respondents completed the SoCQ following the same procedures as in the two previous test administrations. A scale score was determined for the peak score and for each of the seven stages of concern.

## Analysis of the Data

Data obtained from the SoCQ were hand-scored using the Quick Scoring Device included in the Hall, George, and Rutherford (1986) manual about measuring the stages of concern of an innovation. Data was transferred by hand to scoring sheets. Raw scores, the sum of the responses to the five questions matching each stage of concern, were entered into the SAS statistical program (SAS Software, 1999) which was used to analyze the data. The analysis of covariance (ANCOVA) was conducted on the data to determine if differences occurred among the three groups.

To determine if a covariate was needed in the analysis of the data, analysis of variance (ANOVA) was run on the pretest (covariate) for each of the seven stages of concern. A significant F ratio was found at the $p < .01$ level of confidence in five of the seven stages of concern, and at the $p < .05$ level of one additional stage of concern, indicating the appropriateness of the covariate analysis. The ANOVA results among the three groups on the pretest are reported in Table 1.

## Table 1

**Analysis of Variance on the Seven Stages of Concern in the Stages of Concern Questionnaire**

| Stage of Concern | Group | Mean (SD) | F | Probability |
|---|---|---|---|---|
| Awareness | | | 1.92 | ns |
| | Classroom | 11.67 (3.12) | | |
| | Classroom and Laboratory | 11.33 (4.80) | | |
| | Control | 15.11 (5.37) | | |
| Informational | | | 16.46 | p < .01 |
| | Classroom | 25.00 (4.58)+ | | |
| | Classroom and Laboratory | 22.78 (6.34)* | | |
| | Control | 11.56 (4.90)*+ | | |
| Personal | | | 8.71 | p < .01 |
| | Classroom | 24.78 (6.04)* | | |
| | Classroom and Laboratory | 17.22 (8.69) | | |
| | Control | 8.78 (9.31)* | | |
| Management | | | 4.86 | p < .05 |
| | Classroom | 16.67 (7.48)* | | |
| | Classroom and Laboratory | 12.00 (5.24) | | |
| | Control | 7.33 (6.12)* | | |
| Consequence | | | 8.54 | p < .01 |
| | Classroom | 21.89 (7.13)* | | |
| | Classroom and Laboratory | 16.22 (9.51)+ | | |
| | Control | 6.33 (7.40)*+ | | |
| Collaboration | | | 17.61 | p < .01 |
| | Classroom | 22.67 (6.06)* | | |
| | Classroom and Laboratory | 21.00 (8.70)+ | | |
| | Control | 4.78 (6.10)*+ | | |
| Refocusing | | | 20.69 | p < .01 |
| | Classroom | 15.44 (5.15)*# | | |
| | Classroom and Laboratory | 9.22 (5.17)+# | | |
| | Control | 2.11 (2.20)*+ | | |

*indicates significant difference between means designated *
+indicates significant difference between means designated +
#indicates significant difference between means designated #

A linearity analysis between the pretest and posttest was performed to meet the assumption of using a covariate. This analysis demonstrated a strong correlation at the $p < .01$ level between the pretest and posttest in all seven stages. These results supported the need for analysis of covariance. Correlations between pretest and posttest for each of the seven stages of concern are presented in Table 2.

**Table 2**

**Correlations between Pretest and Posttest on the Seven Stages of Concern in the Stages of Concern Questionnaire**

| Stage / Dimension | | Coefficient | Probability |
|---|---|---|---|
| Awareness | .57 | p < .01 | |
| Informational | .73 | p < .01 | |
| Personal | .60 | p < .01 | |
| Management | .52 | p < .01 | |
| Consequence | .75 | p < .01 | |
| Collaboration | .92 | p < .01 | |
| Refocusing | .70 | p < .01 | |
| Self | .70 | p < .01 | |
| Task | .52 | p < .01 | |
| Impact | .85 | p < .01 | |

Once the need for the covariate was determined, the data were analyzed by using ANCOVA. Peak score analysis, summed raw scores converted to a percentile score for each stage, was presented as additional analysis of the data.

## Analysis of the Seven Stages of Concern

Hall, George and Rutherford (1986) recommended two methods of dealing with group data. The first method tallies the number of individuals that score high on each stage to obtain the range of peak stage scores within a group. Peak scores are related to the stage definitions in the questionnaire. The authors noted that “the higher the score, the more intense the concerns at that stage. The lower the score, the less intense the concerns at that stage (p. 31). The second method, and the method utilized in this study, is to "aggregate individual data by developing a profile that presents the mean scores for each stage of the individuals in the group" (p. 32). The aggregate score was derived from the sum of the responses given to the five questions addressing each stage of concern. The total stage raw scores for each of the participants in each group were used in the ANCOVA test to determine differences among the groups.

The initial pretest score on the Stages of Concern Questionnaire was used as the covariate in this study. Analysis of covariance (ANCOVA) was used to adjust for initial differences between groups before a comparison of the within and between groups was made. Gall, Borg and Gall (1996) suggested “the preferred statistical method is analysis of covariance in which the posttest mean of the experimental group is compared with the posttest mean of the control group with the pretest scores used as a covariate” (p. 496). Independent *t* tests of least squares means, Tukey, were conducted on the comparison results of the groups to determine which differences between and among groups were significant. For clarity, results of the analysis of the data are presented in separate table form by stage.

### Stage 0 - Awareness

The analysis indicates little difference in the awareness stage of concern about involvement with distance learning. After the posttest scores for the three groups were adjusted by ANCOVA, the obtained F value of 1.03 failed to reach the .05 level of probability. This analysis of adjusted mean scores among the groups is reported in Table 3.

**Table 3**

**Analysis of Covariance Results of Stage 0 – Awareness**

| Stage of Concern | Adjusted mean (se) | F-value | Probability |
|---|---|---|---|
| Awareness | | 1.03 | ns |
| Classroom | 10.07 (1.63) | | |
| Classroom and Laboratory | 8.39 (1.64) | | |
| Control | 11.87 (1.70) | | |

## Stage 1 - Informational

In stage 1, informational, a general awareness of distance learning is indicated. After the posttest mean scores for the three groups were adjusted by using the ANCOVA analysis, the obtained F value of .79 did not exceed the critical value at the .05 level. There was no significant difference among the adjusted mean scores of the groups as reported in Table 4.

**Table 4**

***Analysis of Covariance Results of Stage 1 – Informational***

| Stage of Concern | Adjusted mean (se) | F-value | Probability |
|---|---|---|---|
| Informational | .79 | ns | |
| Classroom | 14.76 (1.85) | | |
| Classroom and Laboratory | 17.47 (1.68) | | |
| Control | 15.43 (2.18) | | |

## Stage 2 - Personal

The analysis of stage 2, personal, indicates little difference in the involvement with distance learning. After the posttest scores for the three groups were adjusted, the obtained F value of 2.32 failed to reach the .05 level of probability. The results of the analysis are reported in Table 5.

**Table 5**

**Analysis of Covariance Results of Stage 2 - Personal**

| Stage of Concern | Adjusted mean (se) | F-value | Probability |
|---|---|---|---|
| Personal | | 2.32 | ns |
| Classroom | 13.97 (2.79) | | |
| Classroom and Laboratory | 18.97 (2.40) | | |
| Control | 11.62 (2.82) | | |

## Stage 3 - Management

Responses to stage 3, management, indicated concerns with logistics, time and management concerned with distance learning. Adjusted posttest scores resulted in an obtained F value of 7.04 indicating a significant difference at the .01 level of probability. The results of the Tukey post hoc analysis indicated that significant differences occurred between the classroom and laboratory group (17.11) and the control group (11.51). This analysis is reported in Table 6.

### Table 6

**Analysis of Covariance Results of Stage 3 - Management**

| Stage of Concern | Adjusted mean (se) | F-value | Probability |
|---|---|---|---|
| Management | | 7.04 | p < .01 |
| Classroom | 11.97 (2.11) | | |
| Classroom and Laboratory | 17.11 (1.93)* | | |
| Control | 6.47 (2.11)* | | |

*indicates significant difference between means designated *

## Stage 4 - Consequence

Consequence, stage 4, indicates the degree of concern about the consequence of the distance learning innovation upon students. The F value of 7.70 for treatment effects among the three groups was significant at the .01 level. The results of the Tukey post hoc analysis indicated that the adjusted mean of the classroom and laboratory group (21.99) and the adjusted mean of the classroom group (14.61) differed significantly. The post hoc analysis also indicated that the adjusted mean of the classroom and laboratory group (21.99) and the adjusted mean of the control group (11.51) differed significantly. Results of the analyses are reported in Table 7.

### Table 7

**Analysis of Covariance Results of Stage 4 - Consequence**

| Stage of Concern | Adjusted mean (se) | F-value | Probability |
|---|---|---|---|
| Consequence | | 7.70 | p < .01 |
| Classroom | 14.61 (2.12)* | | |
| Classroom and Laboratory | 21.99 (1.88)*+ | | |
| Control | 11.51 (2.22)+ | | |

*indicates significant difference between means designated *

+ indicates significant difference between means designated +

## Stage 5 - Collaboration

Stage 5, collaboration, indicates the degree of concern about working with others in distance learning. The F value, 7.14, was significant at the .01 level of probability. Results of the Tukey post hoc analysis indicated that the adjusted mean of the classroom and laboratory group (21.53) differed significantly from the adjusted mean of the classroom group (17.00). The post hoc analysis also indicated that the adjusted mean of the classroom and laboratory group (21.53) differed significantly from the adjusted mean of the control group (14.14). Results of the analyses are reported in Table 8.

### Table 8

**Analysis of Covariance Results of Stage 5 - Collaboration**

| Stage of Concern | Adjusted mean (se) | F-value | Probability |
|---|---|---|---|
| Collaboration | | 7.14 | p < .01 |
| Classroom | 17.00 (1.31)* | | |
| Classroom and Laboratory | 21.53 (1.24)*+ | | |
| Control | 14.14 (1.61)+ | | |

*indicates significant difference between means designated *

+ indicates significant difference between means designated +

## Stage 6 - Refocusing

The analysis of stage 6, refocusing, indicates the degree of concern about wanting to learn more about distance learning. The F value of 6.52 exceeded the critical value at the .01 level of probability. Results of the Tukey post hoc analysis indicated that the adjusted mean of the classroom and laboratory group (16.51) differed significantly from the adjusted mean of the control group (6.55). Results are reported in Table 9.

### Table 9

**Analysis of Covariance Results of Stage 6 - Refocusing**

| Stage of Concern | Adjusted mean (se) | F-value | Probability |
|---|---|---|---|
| Refocusing | | 6.52 | p < .01 |
| Classroom | 11.50 (2.39) | | |
| Classroom and Laboratory | 16.51 (1.77)* | | |
| Control | 6.55 (2.44)* | | |

*indicates significant difference between means designated *

### Analysis of Peak Scores on the Stages of Concern Questionnaire

Hall, George, and Rutherford (1986) suggested that "the simplest form of interpretation is to identify the highest stage score" (p. 29). To determine the highest stage score in grouped data, the simplest approach is to tally the number of participants who are high on each stage. This gives a clear picture of the high scores within a group (Hall, George, & Rutherford, 1986).

Another way to identify the peak stage for a group is to aggregate individual data in a profile that presents mean scores for each stage. Hall, George, and Rutherford (1986) suggested that "normally, the group averages will reflect the dominant high and low Stages of Concern of the composite group" (p. 32). When analyzing these data, the raw scores are computed by summing the scores on each of the five questions in each stage. When interpreting the peak score, the raw score is converted to a percentile score

The group data for peak scores on the Stages of Concern are presented in Figure 1. The line graph is a pictorial representation of the peak scores on each stage of the SoCQ among the three groups. The adjusted means of the summed raw scores were converted . to percentile scores using the procedures recommended by Hall, George, and Rutherford . (1986).

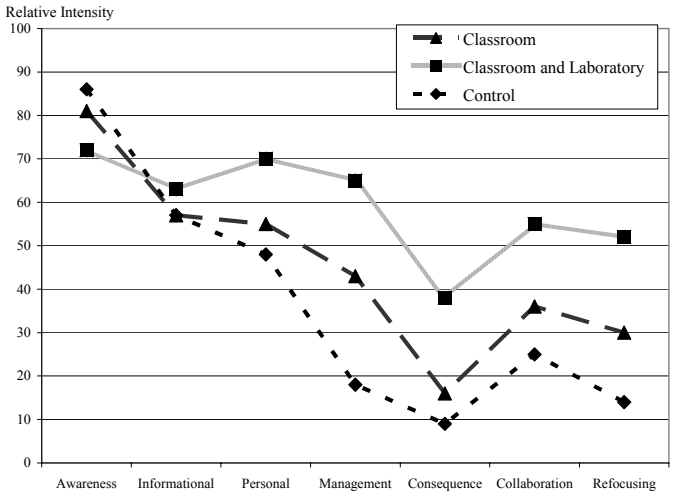


**Figure 1.** Line Graph Representation of the Peak Scores for the Classroom Group, Classroom and Laboratory Group, and the Control Group on Each of the Seven Stages of Concern.

## Discussion of Findings

Results of the data analysis for the experimental populations in this study indicated that significant differences favoring the experimental strategy for the classroom combined with laboratory experiences group occurred in four of the seven stages of concern at the $p < .01$ level of confidence.

Concerns research shows that concerns change over time in a developmental manner. Because this is true, professional development for faculty and administrators should address the stages of concern in a progressive manner if the innovation is to be effective. This means that a person's concerns should be addressed at the point where they score on the SoCQ and then activities should be presented to help them move to the next concern. For example, if a person is at the informational stage when the new innovation is introduced, then there is no reason to take the person back the first stage of awareness. The professional development should address the individual's concern at the time and help them move to the next stage of personal and so on until

the individual reaches the refocusing stage where the concern that the individual has is for the institution and the students receiving the instruction through the ITV classroom. The sum of the responses to the five questions addressing the seven stages of concern should show the progressive development of an individual or group moving from a high awareness or self concern to the refocusing concern that indicates acceptance and willingness to implement an innovation (Hall & Hord, 1987).

When evaluating the classroom and laboratory group in this study, the analysis of the data indicated that this group had shifted its focus away from concerns primarily about self and had begun to evaluate the management, consequence, collaboration, and refocusing stages that are essential for the new innovation, distance education, to be successful at TSTC-M.

High concerns in stage 3 for the classroom and laboratory group indicated that this group was concerned about logistics, time and management concerns. The highest adjusted mean score for the classroom and laboratory group occurred in stage 4. This indicated that the group had concerns about the effects of distance learning on students. Their next highest adjusted mean score was in the adjacent stage 5, collaboration. This indicated that the group had concerns about the collaborative efforts of distance learning. The high score on the refocusing stage, with a low score in the awareness stage, indicated that the individuals who had participated in classroom and laboratory experiences were concerned about its effects on students. They were also concerned with collaboration efforts to make distance education more effective for students involved in the process.

The analysis of the data of the classroom group in this study showed a significant difference at the $p < .01$ level of confidence in two stages of concern. The highest adjusted mean score for the classroom group was in stage 5, collaboration. A significant difference between the classroom and the classroom and laboratory groups appeared at this stage. A significant difference between these two groups also occurred in the consequence stage. These differences indicated that classroom training was beneficial to both groups but the actual laboratory experiences helped the faculty and administrators feel more comfortable about distance education. The classroom group also showed a significant difference from the classroom and laboratory group in the impact dimension. This shows that the classroom training made the group more aware of distance education but faculty and administrators need the additional laboratory experiences before beginning instruction in the distance learning classroom.

The control group profiles in this study align with that of the nonuser in the stages of concern. The concerns of nonusers are typically the highest on stages 0, 1, and 2, and typically lowest on stages 4, 5, and 6. The highest adjusted mean score for the control group occurred in stage 1. This indicates that the group is more concerned with personal position and well being in relation to the change. With the second highest adjusted mean score falling in stage 5, the results of the ANCOVA suggested that the control group is also highly concerned with working with others. The "tailing-off" stage 6 indicates that the group does not have ideas that compete with the distance education innovation. The responses for the control group followed the typical pattern of a nonuser of distance education. This group appeared to have little interest in distance education.

When comparing the peak score analysis with adjusted mean scores converted to percentile scores, the chart presented in Figure 1 graphically illustrates the development, or lack of development, of each group through the Stages of Concern. The peak scores reinforce the adjusted mean scores found in the ANCOVA results. The classroom and laboratory group progressed steadily through the Stages of Concern with the aid of training and laboratory experiences. The classroom group made some developmental moves but adjusted means were not significant. The graphic view of the control group results resembled the profile of the typical nonuser described by Hall, George, and Rutherford (1986).

### Limitations of the Study

The results of this study should not be generalized to extend to other institutional groups without comparative data. The findings must also be viewed with limitations specified by the experimental design, the participating faculty and administrators, the researcher, the questionnaire, and the statistical analysis.

## Conclusions

Based on the findings of this study and recognizing the limitations stated in the previous section, it was determined that classroom training combined with laboratory experiences was more effective for addressing concerns of college faculty and administrators about the innovation of interactive television classes. This type of treatment seemed to be more effective in preparing these personnel to teach in an ITV setting and helping them move from the early stages of concern concentrating primarily on how the innovation affects them to the task and impact states of concern where a person can be more concerned about how the innovation affects the student. Another conclusion that could be supported by the data is that training in the new teaching methodologies required in this environment can help increase the institutionalization of the innovation and should be viewed as a critical component when beginning interactive television classroom instruction.

Determining if classroom training and classroom experiences aid in the smooth acquisition of the innovation of ITV programming provides pertinent and useful data on how higher education administrators and faculty embrace and adapt to change as measured by the SoCQ. This study was conducted under the assumption that personnel implementing distance education programs desire a smooth and successful acquisition of the innovation.

## Implications for Training

The implications of this study are important to address the quality of educational programs being offered through ITV classes. Because of the expense involved for any institution installing an ITV classroom, it is important to ensure that the equipment is being used and that faculty and administrators do not have negative feelings about teaching in the new environment. “For faculty members to succeed in distance education, they need to be supported with accurate and complete information and training in order to develop their skills and understanding”(Cavanaugh, 2002, 176). With faculty focusing on the needs of their students and not their personal concerns about teaching in the new environment, they can focus more on the quality of the curriculum and in attracting and retaining students in the ITV program. Cavanaugh (2002) also points out that all distance education faculty members need training and this training should be followed up with ongoing assistance and peer mentoring.

By using the SoCQ, the concerns of faculty and administrators can be assessed throughout the process of implementing ITV classes as well as assessing concerns years into the process. This can help determine if the faculty and administrators utilizing the classrooms are effective in their instruction. The literature supports that teaching in an ITV environment is different than teaching in a traditional face-to-face classroom (Willis, 1994, Palloff & Pratt, 1999, Palloff & Pratt, 2001). Oblinger and Maruyama (1996) report that in higher education lecture is still the traditional mode of delivery of course content. Because of this, it is important to provide training combined with laboratory experiences to faculty new to the environment so that their concerns can be addressed and effective instruction, resulting in quality programs will be the product of the new innovation.

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**Editor's Note**: Quality of instruction can be improved by a variety of means. In this study, traditional classroom courses in computer science were the baseline for comparison with online learning (5 semester-pairs). In four of five semester pairs, superior results were obtained with online courses enriched with laboratory, additional quizzes and homework.

# Comparative Analysis of Face-to-Face and Online Course Offerings: King Fahd University of Petroleum and Minerals Experience

**S. Junaidu and J. AlGhamdi**

## Abstract

*This paper compares face-to-face (F2F) teaching and online facilitation of a Data Structures course at King Fahd University of Petroleum and Minerals (KFUPM). Participants were undergraduate full-time students of our Computer Science and Computer Engineering BS programs. We analyzed final exam grades and the students' cumulative GPAs over five semester pairs. The results show that the CGPAs of the online students and the corresponding course GPAs were higher in four of the five semester pairs studied. This may be attributed to the students' ability, the lab component in the online offerings (there was no lab in the F2F offerings), the increased number of quizzes and homework assignments in the online offerings or attributed to a synergy of all these.*

## Introduction

Online education has been a very popular, and somewhat controversial, topic in higher education in recent years. The number of institutions offering some type of online education has risen sharply, and there is no sign that this trend will slow down any time soon [1]. Motivating factors for this include potential for cost efficiency, time and place convenience for students and faculty, and the possibility of pedagogic improvement.

With this growing popularity of online education, there has been considerable debate about the use of information technology in higher education and whether the technology delivers good educational outcomes. While some researchers demonstrate the 'no significant difference' phenomenon [2,3,4,5], others have found that there is a significant difference either in favor of F2F or in favor of computer-mediated online offerings [6,7,8,9].

The study conducted in this paper reports result of our own experience in offering a Data Structures course online for full-time on-campus students. Students were required to take the course online and no F2F alternative of the course was available for the past three years. In most cases, this was the only online course among the courses that the students registered for in these semesters. Furthermore, the instructors that facilitate this online course teach other courses concurrently and, in some cases, to a subset of the online students, in the traditional F2F mode. This makes our 'online experience' of this Data Structures course quite different from other online course offerings where, typically, the students elect to take the course online and reside off-campus.

The rest of the paper is organized as follows. The next section highlights the differences in coverage, delivery and assessment in the course during the F2F and the online offerings. Section 3 compares the exam results over the five semester pairs under study. The paper is summarized in Section 4 and Section 5 concludes with acknowledgement.

### Course Coverage, Delivery and Assessment

In this section we highlight the similarities and differences in the course coverage, delivery and student assessment in the F2F and the online modes. Table 1 shows the major topics of coverage in the two offering modes.

**Table 1: Major Topics for F2F and Online Offerings**

| Main topics in the F2F course | Main topics in the Online course |
|---|---|
| Linear data structures<br>Recursion<br>Searching & Sorting<br>Hashing<br>Binary trees<br>Graphs | OO Design Patterns<br>Liner data structures and algorithm analysis<br>Recursion<br>Trees<br>Graphs<br>Hashing<br>Applications (data compression, memory management) |

There was more depth and breadth coverage in the online course. For example, Trees and Graphs are covered more extensively and the Applications topics, comprising of about 2 weeks of lectures, were not covered at all in the F2F mode.

In the F2F offerings, there were three weekly meetings without a lab component. In the online offering, there was a single weekly meeting for answering students' questions. No teaching was done in these weekly meetings. However, the weekly lab was conducted with an instructor lead. Additional elements in the online mode include electronic discussion group, chat rooms, e-mail communication and virtual office hours. The programming language of instruction in the F2F offerings was C and the language was Java in the online offerings.

With respect to students' assessment, there were typically three to four quizzes and homework in the F2F offerings. On the other hand, there were seven homework assignments, seven quizzes in weekly class meetings and four lab quizzes over the semester in the online offerings. There were two major exams and a final exam in both offering modes. However, different instructors had different exams and different cut-points for the final grades in the F2F offering. In the online offerings all exams and cut-points were common in each semester. More details on the online course development, delivery, course and student assessment can be found in other papers [10,11,12,13].

## Examination results statistics

We examine the final exam results for five semester pairs in this section. We consider the last five semesters during which the course was delivered F2F and the following five semesters during which the course was offered online. We compared first semesters with first semesters, second semesters with second semesters and summer semesters with summer semesters because we observed that results of summer semesters tend to be better.

Results of the five semester pairs are discussed in the next five subsections. In the results that follow, all calculations were based on the total enrolment including the students who dropped the course. An exception is the course GPA calculations.

### 3.1 Semester 991 versus 011

In this section we discuss results of the face-to-face offering of the course in the first semester of 1999 (991) and the first semester of 2001 (the first time the course was offered online). There were a total of 101 and 106 students in the F2F and the online course offerings, respectively.

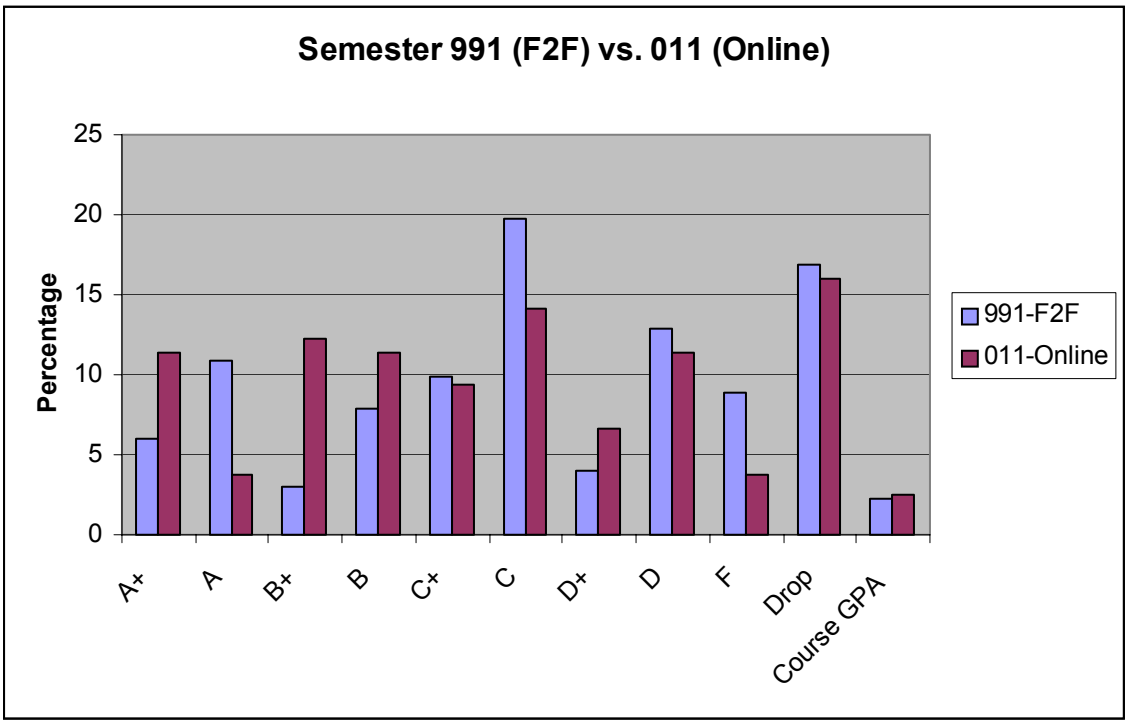


**Figure 1: Results for Semesters 991 vs. 011**

The bar chart in Figure 1 shows the comparative exam grades for the F2F and the online offerings of the course. This figure shows that a higher proportion of the online students obtained grades A+ (11%), B+ (12%), B(11%) and D+ (7%) compared to the F2F offering. On the other hand, a higher proportion of the F2F students obtained grades A (11%), C (20%), D (13%) and F (9%) compared to the online offering. Ten students obtained C+ grade in each group and about 16% of the students in each group dropped the course. The cut-points for the letter grades in the F2F and the online offerings are shown in Table 2. The number of students, for all sections in both offerings, that obtained each grade, is also shown in the table.

**Table 2: Grades Cut-Points: 991 vs. 011**

| | A+ | A | B+ | B | C+ | C | D+ | D | F |
|---|---|---|---|---|---|---|---|---|---|
| F2F | ≥90 | ≥80 | ≥75 | ≥70 | ≥60 | ≥56 | ≥50 | ≥45 | <45 |
| Students | **6** | **11** | **3** | **8** | **10** | **20** | **4** | **13** | **9** |
| Online | ≥90 | ≥85 | ≥80 | ≥70 | ≥65 | ≥56 | ≥50 | ≥45 | <45 |
| Students | **12** | **4** | **13** | **12** | **10** | **15** | **7** | **12** | **4** |

There were three sections in the F2F offering taught by two instructors with different exams and different cut-points for the letter grades. The cut-points shown in the table are those for the two sections of the course taught by one instructor. The cut-points of the other section were slightly lower for most grades. There were four sections in the online offering facilitated by four instructors. The exams and cut-points were the same in the online offering.

The average student cumulative GPA for the F2F and the online offerings were 2.435 and 2.537 respectively. Finally, the course GPA for the F2F and the online were 2.19 and 2.49, respectively.

## 3.2 Semester 992 versus 012

We compare the examination results for second semester of 1999 (992) and second semester of 2001 (012), for the F2F and the online offerings respectively. A total of 122 students enrolled in the course in the 992 semester. These students were divided into four lecture sections taught by three instructors. On the other hand, 148 students enrolled in the online offering of the course in the 012 semester. The students were divided into five sections facilitated by three instructors.

**Table 3: Grades Cut-Points: 992 vs. 012**

| | A+ | A | B+ | B | C+ | C | D+ | D | F |
|---|---|---|---|---|---|---|---|---|---|
| F2F | ≥84 | ≥80 | ≥73 | ≥65 | ≥60 | ≥55 | ≥50 | ≥45 | <45 |
| Students | **9** | **14** | **10** | **9** | **20** | **19** | **8** | **7** | **6** |
| Online | ≥90 | ≥85 | ≥80 | ≥70 | ≥65 | ≥54 | ≥50 | ≥45 | <45 |
| Students | **12** | **10** | **7** | **17** | **14** | **29** | **8** | **3** | **9** |

As in the 991 semester, each of the F2F instructors had a different exam and different cut-points for the letter grade. On the other hand the online offering was closely coordinated with common exams and common cut-points for all sections. Table 3 shows representative cut-points (for two sections taught by the same instructor) for the F2F offering and cut-points for the online offering. This table also shows the total number of students, in both offering modes that got A+, A, etc.

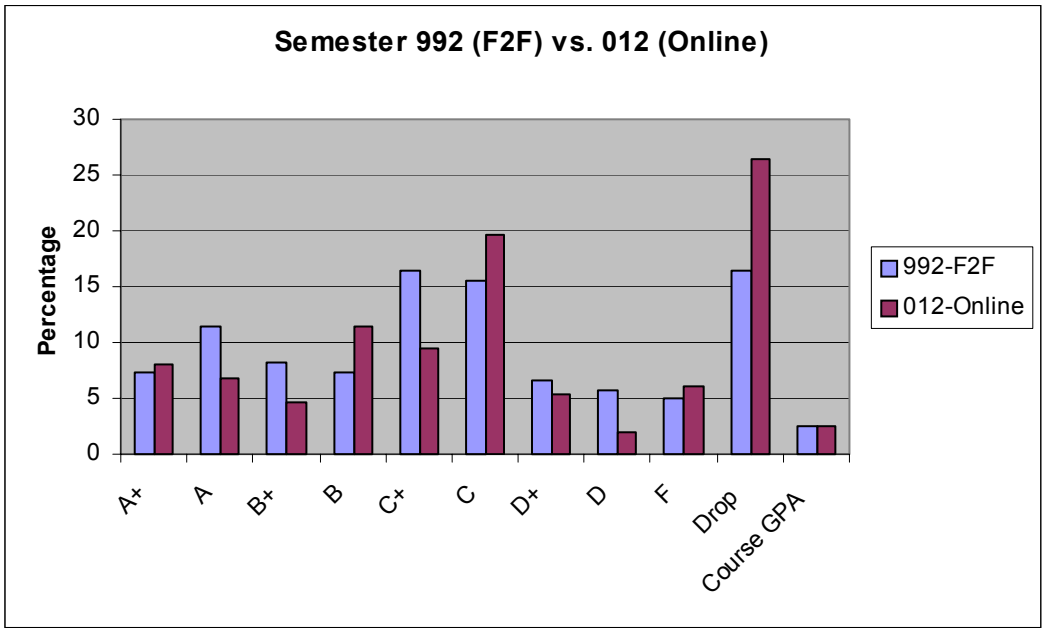


**Figure 2: Results for Semesters 992 vs. 012**

Figure 2 shows that 11% of the F2F (and 7% of the online) students obtained A grade, 8% (and 5% of the online) students obtained B+ grade, 16% (and 9% of the online) students obtained C+ grade and 6% (and 2% of the online) students obtained a D grade. On the other hand, 8% (and 7% of the F2F) students obtained A+ grade, 11% (and 7% of the F2F) students obtained B grade, about 20% (and 16% of the F2F) students obtained C grade and 6% (and 5% of the F2F) students failed the course.

Furthermore, Figure 2 shows that a much higher percentage of the online students, 26% (compared to 16% of the F2F) of the registered students failed to complete (i.e., dropped) the course. The mean cumulative GPA of the students that took the F2F and the online courses were 2.681 and 2.674 respectively. The course GPA of the F2F and the online offerings based on the examination results were 2.52 and 2.47 respectively. As in the 991 semester, the mean CGPA of the students is reflected in the course GPA of the examination results.

### 3.3 Semester 001 versus 021

We analyze exam results for the F2F offering during 001 and the online offering during 021. A total of 123 and 122 students, respectively, registered for the course during the F2F and the online offerings. There were four sections in the F2F offering taught by two instructors and five sections in the online offering facilitated by four instructors.

**Table 4: Grades Cut-Points: 001 vs. 021**

| | A+ | A | B+ | B | C+ | C | D+ | D | F |
|---|---|---|---|---|---|---|---|---|---|
| F2F | ≥85 | ≥79 | ≥72 | ≥67 | ≥61 | ≥57 | ≥52 | ≥49 | ≥49 |
| Students | **5** | **9** | **12** | **14** | **19** | **13** | **6** | **15** | **14** |
| Online | ≥87 | ≥80 | ≥75 | ≥67 | ≥61 | ≥56 | ≥50 | ≥42 | <42 |
| Students | **9** | **7** | **9** | **16** | **14** | **9** | **14** | **9** | **11** |

Cut-points in Table 4 for F2F offering are for the instructor who taught three of the four sections.

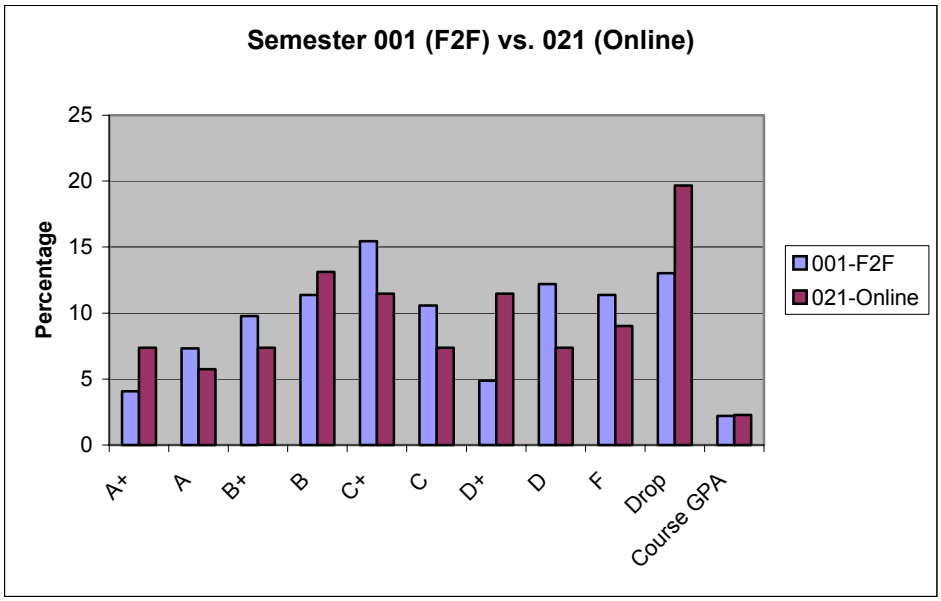


**Figure 3: Results for Semesters 001 vs. 021**

Figure 3 shows that the highest percentage (about 15%) of the F2F students obtained C+ grade, followed by 13% who dropped the course, followed by 12% who obtained D grade, followed by 11% who obtained B grade and another 11% who failed the course. Then 5% got D+ and 4% got A+. On the other hand, the highest percentage (about 20%) of the online students dropped the course, followed by 13% who obtained B grade, followed by two groups, of 11% each, who obtained C+ grade and D+ grade, followed by four groups of 7% each who obtained grades A+, B+, C and D. The least percentage of students in the online offering was for those who obtained A grade (6%).

The mean students' cumulative GPA in this pair of semesters were close to each other. So were the corresponding course GPA's. The mean CGPA was 2.533 and course GPA was 2.29 in the online offering while the mean CGPA was 2.489 and the course GPA was 2.2 in the F2F offering.

## 3.4 Semester 002 versus 022

A total of 165 students registered for the F2F offering in 002 and 184 students registered during the online offering in 022. F2F students were grouped into six sections taught by two instructors and the online students were also grouped into six sections facilitated by four instructors.

**Table 5: Cut-Points for 002 and 022 Semesters**

| | A+ | A | B+ | B | C+ | C | D+ | D | F |
|---|---|---|---|---|---|---|---|---|---|
| F2F | ≥90 | ≥83 | ≥80 | ≥75 | ≥72 | ≥68 | ≥60 | ≥54 | <54 |
| Students | **10** | **12** | **20** | **22** | **17** | **24** | **27** | **13** | **12** |
| Online | ≥90 | ≥84 | ≥78 | ≥70 | ≥64 | ≥57 | ≥50 | ≥45 | <45 |
| Students | **18** | **13** | **11** | **21** | **18** | **25** | **13** | **4** | **7** |

The cut-points shown in Table 5 are for four of the six sections taught by the same instructor; those for the other two sections were similar.

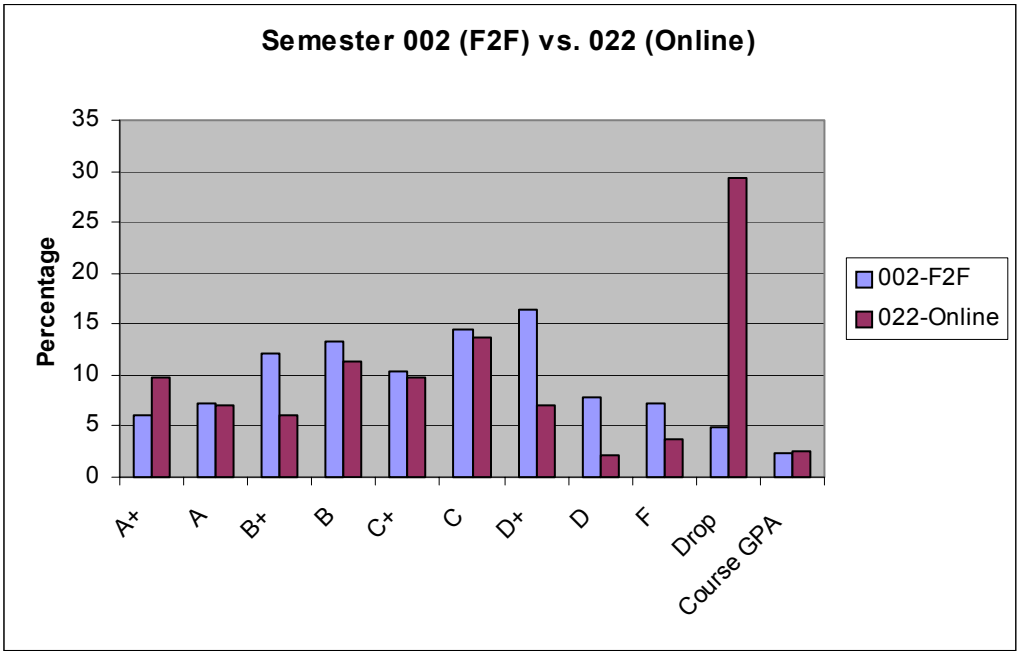


**Figure 4: Results for Semesters 002 vs. 022**

Table 5 and Figure 4 show that there were about the same numbers of students who obtained A grade (12 in F2F, 13 in online), B grade (22 in F2F, 21 in online), C+ grade (17 in F2F, 18 in online) and C grade (24 in F2F, 25 in online). Figure 4 also shows that 10% of the online (and 6% of the F2F) students obtained A+ grade, 12% of the F2F (and 6% of the online) students obtained B+ grade, 16% (and 7% of the online) students obtained D+ and 7% (and 4% of the online) students failed the course. About 30% of the online students dropped the course in the 022 semester compared to only 5% of the F2F students who dropped the course in the 002 semester.

The mean student CGPA, 2.656, in the 022 semester was higher than that of the 002 semester, 2.56. The corresponding course GPA's in these semesters were consistent with a course GPA of 2.62 in 022 semester and a course GPA of 2.32 in the 002 semester.

### 3.5 Semester 003 versus 023

In this section we compare results for Summer 2000 (003) offered F2F and Summer 2002 (023) offered online. There was one section of 28 students in 003 and two sections with a total of 55 students in 023.

The cut-points for the letter grades of Figure 5 are shown in Table 6 for both offering forms.

**Table 6: Grades Cut-Points: 003 vs. 023**

| | A+ | A | B+ | B | C+ | C | D+ | D | F |
|---|---|---|---|---|---|---|---|---|---|
| F2F | ≥90 | ≥85 | ≥80 | ≥75 | ≥60 | ≥52 | ≥48 | ≥45 | <45 |
| Students | **0** | **2** | **1** | **3** | **3** | **7** | **2** | **1** | **0** |
| Online | ≥90 | ≥85 | ≥80 | ≥75 | ≥70 | ≥65 | ≥60 | ≥55 | <55 |
| Students | **5** | **6** | **5** | **6** | **7** | **3** | **7** | **4** | **0** |

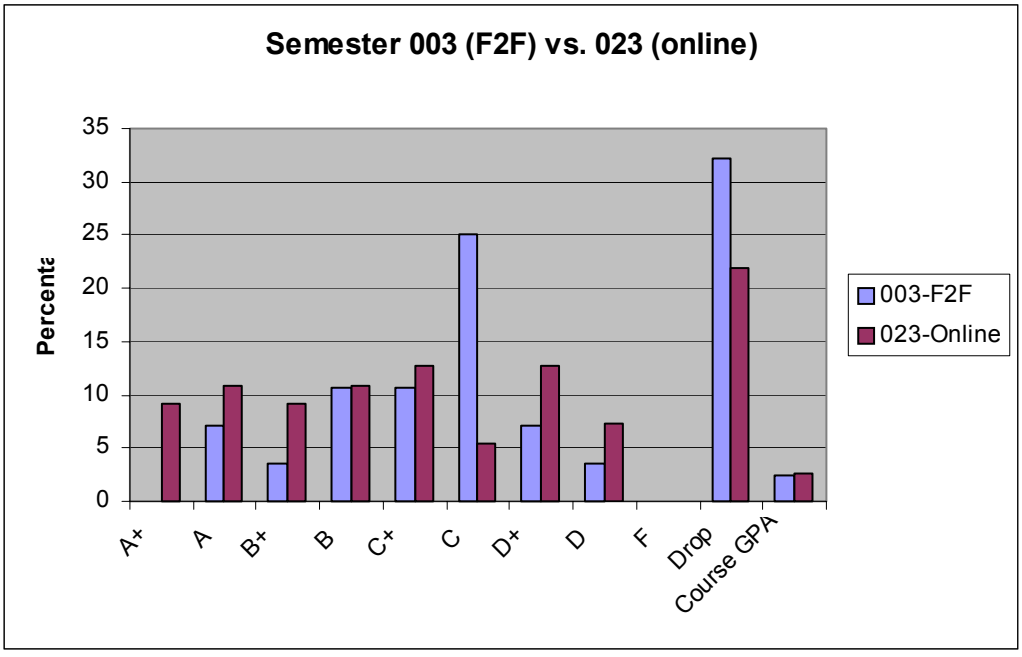


**Figure 5: Results for Semesters 003 vs. 023**

The results depicted in Figure 5 show that no students failed the course in both modes. 25% of the F2F (and 5% of the online) students obtained C grade and about the same students' proportions obtained B and C+ grades in both modes. The percentage of online students that obtained each of the grades B+, D+ and D was about twice that number of those who obtained the same grades in the F2F offering. There was no A+ in 003 and 7% of the students obtained an A grade whereas 9% got A+ and 11% got A in 023.

As in the 991 semester, there were comparatively more dropouts in the F2F offering (32%) than in the online offering (22%). The mean students' CGPAs were, respectively, 2.669 and 2.103 for 023 and 003. This gives the highest difference (0.556) among the five semester pairs under study. The corresponding course GPAs were 2.7 and 2.39 for 023 and 003, respectively. These results seem to indicate that the batch of students in 003 is weaker than that in 023.

## Summary and Conclusions

Over the five semester pairs under study, there was a total of 539 students in the F2F semesters and 605 students in the online semesters. The mean CGPA of the online students, 2.617, was slightly higher than that of the F2F students, 2.524. The corresponding course GPAs also followed the same trend for the online and F2F offerings, which were respectively, 2.49 and 2.32.

**Table 7: Average Cut-Points over the Five Semester Pairs**

| | A+ | A | B+ | B | C+ | C | D+ | D | F |
|---|---|---|---|---|---|---|---|---|---|
| F2F | ≥88.3 | ≥81.6 | ≥75.6 | ≥69.9 | ≥62.1 | ≥55.6 | ≥49.8 | ≥44.9 | <44.9 |
| Students | **30** | **48** | **46** | **56** | **69** | **83** | **47** | **49** | **41** |
| Online | ≥89.4 | ≥83.8 | ≥78.6 | ≥70.4 | ≥65 | ≥57.6 | ≥52 | ≥46.4 | <46.4 |
| Students | **56** | **40** | **45** | **62** | **63** | **81** | **49** | **32** | **31** |

As discussed in Sections 3.1 to 3.5, the letter-grade cut-points for the F2F offerings differed from instructor to instructor. Table 7 shows the averages of the different cut-points for the different letter grades. Although the cut-points were the same in each semester in the online offering, they varied from semester to semester and the average over the five semesters is shown in Table 7.

The summarized results in Figure 6 show that a relatively higher percentage of the F2F students obtained most grade types. The percentage differences, however, were small ranging between 2% to 4%. An exception was the A+ grade where the percentage of the online students was relatively higher by about 4%.

The dropout rate was also generally higher in the online offerings (24%) compared to the F2F offerings (13%). Considering the staggering eLearning dropout rates quoted by industry experts, which is as high as 80% [16,14,15], the dropout rate we recorded in our course is acceptable. Our course delivery model and students' evaluation regime addresses this problem extremely well.

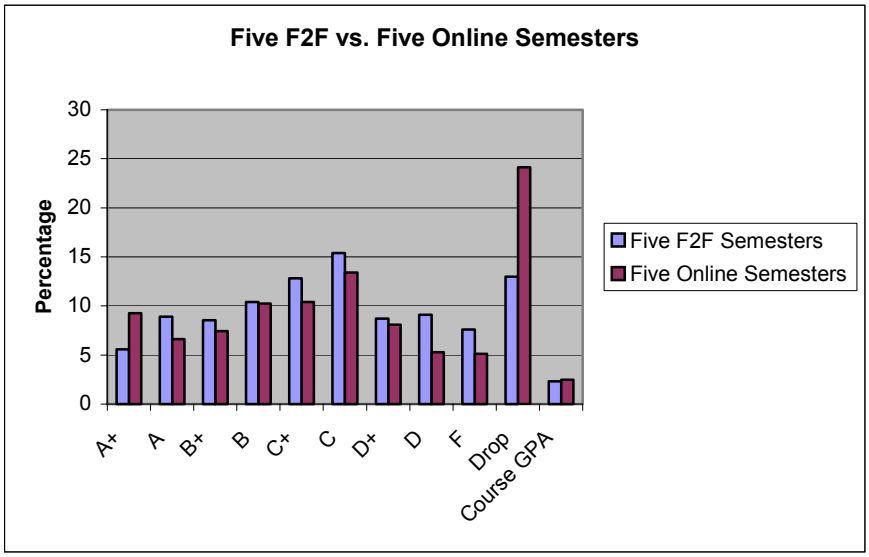


**Figure 6: Comparative Results for the Five Semester Pairs**

Although the these results may not provide sufficient information for making definitive inferences, because of varying exams difficulty level from semester to semester and from instructor to instructor (in the F2F case) etc, we make the following general observations regarding the study reported in this paper:

- There was about 25% more coverage content (covering both depth and breadth) in the online offerings than in the F2F offerings.
- The online version of the course was four-credit (with a lab component) while the F2F version was a three-credit course with no lab component.
- There were twice as many quizzes and homework assignments in the online offerings than in the F2F offerings.
- The dropout rate was generally higher in the online offerings compared to the F2F offerings.
- There were relatively smaller class sizes in the online offerings than in the F2F offerings.
- There were consistently more A+ grade earners in the online offerings compared to the F2F offerings.
- Based on the students' average CGPA, weaker students were the ones that always dropped the course in both offering modes. The difference in the students' average CGPA between those who completed and those who dropped the course, in both offering modes, each semester was about 0.5 except in the summer semesters.
- The mean CGPA of the students in each pair of semesters was reflected consistently in the course GPA for that pair of semesters. That is, whenever the students' mean CGPA was higher, the corresponding course GPA was also higher and vice-versa.
- The overall results suggest that the performance of the students was a function of the students' ability (reflected by their mean CGPA) more than it was a function of the course-offering mode (F2F or online). Results of our surveys, reported in [13], show that our frequent quizzes and homework helped the students greatly due to their general low time management skills. The results in this paper support and add weight to the findings of other researchers elsewhere [2,3,4,5].

## Acknowledgement

*We commend the University (KFUPM) for initiating the online project and the college of computer sciences & engineering for pioneering this effort in the University. Without this initiative, this work would not have been possible.*

*We acknowledge the support of our colleagues with whom the online courses were developed and delivered.*

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**Editor's Note**: Whether developed from a theoretical base or an empirical base, research is necessary to test the viability of teaching strategies individually and in combination. This study relates graduate student's perception of effectiveness of teaching/learning strategies based on three contrasting theories, number of teaching/learning strategies used, and instructor's choice of theory and strategies. Level of instructor experience and support systems for instructors and students are taken into account.

# Creating and Testing Teaching/Learning Strategies for the Virtual Classroom

**Nancy E. Thompson**

## Abstract

The Effective Distance Education Model, adult educational theory, and brain-based educational theory were used in the creation of teaching/learning strategies for use in the virtual classroom. The strategies were tested in three courses, taught by instructors with varying levels of experience with distance education. The strategies were successfully used and viewed as effective by the students. However, the instructors' levels of experience impacted both the number of strategies used and the perceived effectiveness of those strategies. The implications on the training and support of novice distance education instructors are drawn.

## Introduction

Historically, education meant bringing students to the sources of knowledge. The paradigm is shifting. Modern educational institutions are bringing sources of knowledge to the students (Bailey, 1999). Ten million students are taking distance education degree courses in the world, including one-third of the two- and four-year post secondary education institutions in the United States. In 1997-1998, 54,470 different courses were offered through distance education (National Center for Educational Statistics, 1999). Distance education is defined as "education or training courses delivered to remote (off-campus) location(s) via audio, video (live or prerecorded), or computer technologies, including both synchronous and asynchronous instruction" (National Center for Education Statistics, 1999).

Nationally, courses offered via distance education compare favorably with courses offered through more traditional means of delivery. Since 1992, when systematic study of distance education started, research shows no statistically significant difference in student learning between classroom and distance instruction (Saba, 2000).

Utah State University began electronic delivery of courses in 1983 and currently has an enrollment of approximately 3,000 students per semester. In 2000, a survey of students who had participated in distance education classes at Utah State University indicated that there is a significant correlation ($p<.01$) between the students' perceived quality of the course taken through distance education and the following factors related to the instructor: course materials selected by the instructor, interactions with the instructor, perceived knowledge of the instructor, teaching methods used by the instructor, and accessibility of the instructor. There was also a significant correlation between the students' perceived quality of the course and the academic skill development of the students, defined as writing, presentation, critical thinking, teaching, curriculum development, networking, and research (Thompson, 2001).

A theoretical model was developed from the results of the Thompson study (Thompson, 2002). It was the purpose of this study first to create and describe teaching/learning strategies that are consistent with the Effective Distance Education model, adult education theory, and brain-based

educational theory. Second, the strategies were tested in three courses taught via distance education. The courses represented varying level of instructor experience in distance education. The third purpose was to determine if the level of instructor experience influenced the use and effectiveness of the strategies. Student evaluations of the strategies were used to assess the impact of the distance education model and the effectiveness of the teaching/learning strategies.

Given the increasing number of courses being offered through distance education and the need for instructors to teach those courses, it is important to provide the support for those instructors as they strive to teach in a new medium. The teaching/learning strategies developed for the project could provide those instructors with the necessary tools for effective instruction.

## Review Of Literature

The following review of the literature for this study includes a presentation of the three theories that guided the selection and creation of the teaching/learning strategies created for this project. First, a description of distance education students and the related adult education theory is presented. Second, the Effective Distance Education Model is discussed. Last, brain-based education theory will be reviewed as it relates to the development of teaching/learning strategies.

### Distance Education and Adult Education Theory

Distance education students are described as non-traditional, focused, highly motivated, and independent learners, returning to school through the use of technology (Roberts, 2000). Because most have full-time jobs and families, convenience may be a crucial factor in the lives of many distance students (U.S. Distance Learning Association, 2000). Most students would not have access to graduate education or graduate education within their field without the availability of distance education (Laughlin, 1999). Growing numbers of working adults are eager for post secondary experiences, a factor that is driving the market for distance education (Green, 1999).

The majority of students participating in distance education programs are adults, and as such display unique characteristics and needs. Adults, by definition, are older and have greater responsibilities than traditional college students. While Long (1990) cautions educators to remember that learning is contextual and all learners are unique, there are characteristics, possessed by adults, which differ from younger students. First, adult students are more complex (Brundage, 1993) and have more sophisticated insights (Niemi, et.al., 1998). Adult students bring to the classroom knowledge from their career, skills developed at home and at work, and the experiences of a wide variety of relationships. They are more likely to see how ideas can become actions and theory can become practice.

Second, adult learners have more clear-cut goals (Brundage, 1993). They are more likely to know what career applications and advancements are related to their studies. They have a clear picture of skills they want to develop. They can prioritize time and resources in order to meet those goals.

Third, the adult learner wants to take an active part in the learning process and, therefore, has different expectations of the instructor (Brundage, 1993; Niemi, et.al., 1998). Each will have unique experiences and goals and wants the instructor to adapt the course expectations, strategies, and assignments to reflect their personal experiences and help achieve their academic, personal, and career goals. It is important to remember that, while young students are primarily in one developmental stage of life, adult students may range from 20 to 80 years of age and may represent many different developmental stages. That life stage will impact the adult student's expectations for the course and the instructor.

### The Effective Distance Education Model

Thompson (2001) surveyed students who had enrolled in Utah State University, Family and Consumer Sciences Education graduate courses taught through distance education from 1996

through 2000. The purpose of the survey was to assess the effectiveness of the distance education program. As a result of that study, an Effective Distance Education (EDE) Model was developed. The model is presented in Figure 1.

Previous studies have focused on the technology used to present distance education courses and logistics of course management (time, locations, duration) in the assessment of distance education courses (Mancuso, 2001; Green, 1999). In contrast, findings of the Thompson study indicated that the role of the instructor was key to the success of the distance education program. To be effective, distance education instructors need to carefully select course materials to meet the students' needs, be accessible to students both during class time and outside of class, be knowledgeable about the subject matter and share that expertise, and use a variety of teaching strategies which meet the students' leaning styles and needs. In addition, course curriculum and teaching/learning strategies need to help the students develop skills in writing, presentation, critical thinking, networking, and research. The EDE Model was developed following the analysis of data from one distance education program. The effectiveness of that model as a guide to distance education curriculum development needs to be tested, both at Utah State University and at other universities who offer distance education as an option to course work completion.

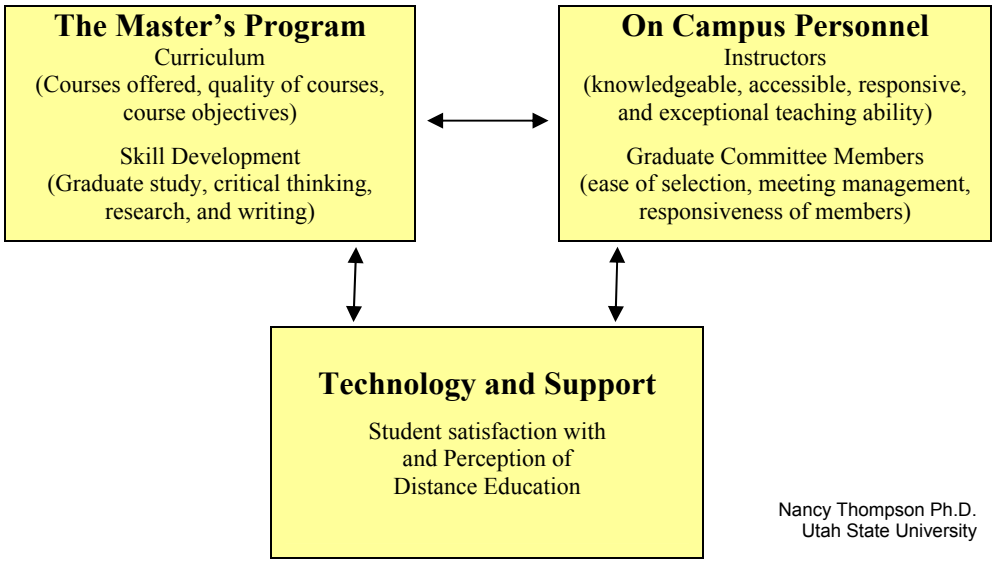


**Figure 1. The Effective Distance Education Model**

## Brain-Based Educational Theory

Educators once thought of learning in terms of Pavolov's classical conditioning, Skinner's operant conditioning, and applied behavior analysis (Woolfolk, 1995). However, as scientists learn more about the composition and function of the brain, educators are redefining learning. Sylwester (1995), in examining brain function, describes learning in terms of the physical changes that occur in neural networks, the functional organization of memory systems within the brain, and the procedures used by humans to maintain important memories. Learning physically changes the brain because new stimulations, experiences, and behaviors cause the brain to rewire itself or create new neural connections (Jensen, 1998). Caine and Caine (1991) present the idea that "the brain learns because that is its job" (p.3). Further, the brain has four features that promote learning: the ability to detect patterns and to make approximation; a capacity for various

type of memory; the ability to self-correct and learn from experience; and a capacity to create. Wolfe (2001) defines learning as "a process of building neural networks" (p.135).

As researchers discover how the brain works as it learns, practical strategies have emerged which apply that information to the classroom setting. Wolfe (2001) suggests meaningful curriculum comes through problems, projects, and simulations that create learning experiences at three levels: concrete, symbolic, and abstract. Increased visual and auditory stimulation for organization are also suggested. Examples of visual organizers are mind maps, T-charts, outlines, story-plot diagrams, and advanced organizers. Auditory stimulation may come from the use of music, rhyme, and rhythm.

Teaching/learning strategies are also suggested by Jensen (1998). Student motivation and attention are critical for learning. The three critical factors that influence student attention for learning are choices, relevance, and engagement. Woolfolk (1995) presents similar factors for student motivation, but categorizes them as intrinsic source of motivation, meaningful learning goal, and task involvement. Strategies that encourage students to learn fulfill basic requirements, build confidence, show the value of learning, and help students stay focused on the task. It is also suggested that strategy designed for student motivation should be assessed in the following areas: task structure, autonomy/responsibility, recognition, grouping, evaluation, time, and teacher expectations.

In addition, Caine and Caine (1991), Sylwester (1995), Jensen (1998), and Wolfe (2001) recommend that teachers plan teaching/learning strategies which provide for a variety of experiences, present an emotionally supportive environment, promote creativity, and respect the strong link between movement, the arts, and learning. The value of these recommendations remains constant regardless of the age of the learner.

Current research shows there are students who benefit from the availability of distance education. Assessment of distance education courses indicates equivalency to traditional education. Brain-based educational theory presents an understanding of how students learn and suggests teaching/learning strategies that are compatible with that theory. However, strategies for traditional educational settings need to be adapted for presentation via distance education. It is suggested that teaching/learning strategies used for distance education be compatible with both brain-based education theory and the EDE Model previously described.

## Methodology

It was the purpose of this study to create and describe teaching/learning strategies for use in distance education, use those strategies in designing distance education instruction, and test their effectiveness. The study was comprised of two phases. In phase one, teaching/learning strategies which are consistent with adult educational theory, brain-based educational theory and the Effective Distance Education (EDE) Model were developed and described in detail. In phase two, the model and teaching/learning strategies were tested. Three courses were taught using the EDEM strategies that enhance the role of the instructor and promote skill development in the areas of writing, presentation, critical thinking, networking, and research. At the end of the semester, the strategies were evaluated by the instructors and the courses will be evaluated by the students. These assessments were used to determine the effectiveness of the EDEM in planning and presenting distance education courses.

Three hypotheses were tested.

- **Hypothesis 1**: Teaching/learning strategies developed using brain-based educational theory, adult education theory, and the Effective Distance Education model would be perceived as effective by the students.

- **Hypothesis 2**: There would be no differences among the three test courses with relationship to the number of teaching/learning strategies used by the instructors.
- **Hypothesis 3**: There would be no differences among the three test courses with relationship to the perceived effectiveness of the teaching/learning strategies used by the instructors.

## Subjects

The subjects for the study were graduate students enrolled in three distance education courses at Utah State University. The courses were selected prior to the beginning of the semester to reflect three levels of instructor experience. Unfortunately, the student enrollment was unusually small for those courses and did not reflect the average enrollment of 20 students per course. As a result, there were only 42 enrolled students in the three courses. In order to protect the student subjects, permission from the Internal Review Board at Utah State University was obtained.

## Procedure

The study was comprised of two phases. In phase one, the teaching/learning strategies were developed. In phase two, the effectiveness of the Effective Distance Education Model (EDE Model) and the teaching/learning strategies were tested.

Phase One

In phase one, the teaching/learning strategies, compatible with the EDE Model were developed and described in detail. Strategies included motivational, presentation, musical, assessment, community-building, and management approaches All strategies were assessed using a rubric designed to help align the strategies with EDE Model, adult education theory, and brain-based education theory. Specifically, the strategies were assessed using the following criteria: meaningfulness of projects; visual and auditory organizational stimulation; choices provided to the student; relevance to the student; engagement; teaching of basic skills; building of student confidence; teaching of the value of learning; assistance in focusing students; provision for a variety of experiences; presentation of an emotionally supportive environment; promotion of creativity; and respect for the strong link between movement, the arts, and learning. Following the evaluation of the strategies, each strategy was described on an individual card and given to the three distance education instructors selected for participation in the study.

Phase Two

In phase two, the teaching/learning strategies were tested. Three distance education courses being taught in the fall semester, 2002 were selected. The courses represented different levels of teaching experience by the instructors: one taught by an experience instructor, with eight years experience (18 previous courses); one taught by an instructor with three years experience (8 previous courses); and a third course taught by a novice instructor with no distance education experience. The teaching/learning strategies developed in phase one were used in the instruction of all of these courses. The instructors were asked to make brief reflective notes following each class session in order to help them assess the strategies.

## Data Collection and Analysis

At the end of the semester, the students were asked to complete the university-required course evaluation and an evaluation prepared by the researcher. That evaluation asked students to respond to the effectiveness of each EDE Model teaching/learning strategy used by the instructor. Using a four-point, Likert-type scale, students rated each teaching/learning strategy by responding to five prompts: “I remember when this technique was used in class;” This technique was effective;” “I enjoyed the use of this technique;” “As a teacher, I would use this technique;”

and "This technique aided in student learning. Descriptive statistics on student evaluations were compiled. In addition, differences in student evaluations from the courses were analyzed.

Descriptive statistics were computed and reported. An effectiveness score for each teaching/learning strategy was determined by computing the mean score for all five prompts given on the Likert-type scale. Correlations between the effectiveness scores and the course instructor's experience were determined.

## Findings

It was the purpose of this study to define and describe teaching/learning strategies for use in distance education, use those strategies in designing distance education instruction, and test their effectiveness. Three theoretical frames were used in the creation of the strategies: adult educational theory; brain-based educational theory; and the Effective Distance Education Model. The subjects were 42 master's students enrolled in three distance education courses. The three courses represented three levels of teaching experience: one course was taught by a novice instructor, teaching for the first time via distance education; the second course was taught by an instructor with moderate experience, having taught eight distance education courses over a period of three years; the third course was taught by an experienced instructor; having taught 18 courses over an eight year period.

### Hypothesis 1

Hypothesis 1 (teaching/learning strategies developed using brain-based educational theory, adult education theory, and the Effective Distance Education model would be perceived as effective by the students) was supported. The students assessed the effectiveness of the teaching/ learning strategies by responding to a 4.0 Likert-type scale. The experienced instructor used 40 strategies and had a mean effectiveness score of 3.70. The less experienced instructor used 27 strategies with a mean effectiveness score of 3.58. The novice teacher used 6 strategies with a mean effectiveness score of 3.03. When combining the scores for all three courses, a total of 73 strategies were used. The mean score was 3.60, with a range of 2.40 - 4.00 and a standard deviation of .34474.

Three teaching/learning strategies were used by all three instructors. In the first strategy, "Virtual office hours" were kept by all three. The syllabus for each course contained information about the times when the instructors would be in their offices and on-line so that the students could contact them by e-mail or telephone. This information was repeated to the students during class time. The effectiveness scores for this activity ranged from 2.40 to 3.73, with a mean value of 3.21.

Another strategy used by all three instructors was the use of visual aids that were easily seen and read. This is critically important because the easy viewing of the visual aids helps the distance education student feel included in the learning community. The strategy was successfully used by all three instructors with a mean effectiveness score of 3.86.

All three instructors also successfully used "Power Point" presentations in their courses. The lecture outline, charts, and other visuals were developed on and presented via a personal computer. The mean effectiveness score for this strategy was 3.34.

### Hypothesis 2

Hypothesis 2 (there would be no differences among the three test courses with relationship to the number of teaching/learning strategies used by the instructors) was rejected. The experienced instructor used 40 of the 46 teaching/learning strategies developed for distance education. The less experienced instructor used 27, the novice instructor used only six teaching strategies. There

was a very high correlation (r = .986) between the experience of the teacher and the number of strategies used in the presentation of the distance education course.

### Hypothesis 3

Hypothesis 3 (there would be no differences among the three test courses with relationship to the perceived effectiveness of the teaching/learning strategies used by the instructors) was also rejected. There was a significant ($p<.05$) difference between the effectiveness scores for the teaching/learning strategies used by the experienced instructor and those used by the moderately experienced instructor. The experienced instructor's teaching/learning strategies had a mean score of 3.70, on a 4.00 scale. The moderately-experienced instructor's strategies had a mean score of 3.58. Because of the low number of strategies (N=6) used by the novice instructor, statistically significant differences were not determined when comparing that number to those of the other two instructors.

## Conclusions

Reviewing finding of the study allows certain conclusions to be drawn. First, teaching/learning strategies developed within a theoretical frame of adult education, brain-based education and the Effective Distance Education Model can be effective when used in the virtual, graduate classroom. While it appears the strategies themselves can be effective, the experience of the distance education instructor appears to impact both the number of strategies incorporated into the course and the effectiveness of those strategies as perceived by the students. As instructors gain experience in distance education, they become more familiar with both the content of their courses and the technology used in the transmission of that content. This familiarity with content and delivery permits the instructor to become more relaxed and try new approaches to instruction. The novice instructor, with no previous experience teaching via distance education, focused on learning the intricacies of the technology and the content of the course that was being taught. This lack of experience, discomfort with technology and course content, and resulting lack of confidence appears to also impact the students' perceptions of the effectiveness of the instructors' teaching/learning strategies.

Looking at these conclusions, it is evident that effective teaching/learning strategies for distance education can be developed and successfully used. However, the inexperienced instructor needs additional help in implementing those strategies. Faced with a new, and often frightening task, the novice distance education instructor may need some of the same assistance used in successful teacher induction programs across the country. Wong (2001) describes the three components of a successful induction program as training, support, and retention. Weiss and Weiss (1999), while acknowledging a wide range of induction programs and philosophies, argue that the most successful programs are the ones that include sustained feedback in a collaborative environment. Others suggest that new teachers need supervision, coaching, demonstrations, and assessment (ERIC, 1986).

Given the information on successful induction programs, three suggestions are made for distance education teacher induction. First, the new instructor needs *training*. While many universities provide a training session that introduces the technology of distance education, few present training sessions designed to acquaint the teacher with distance education teaching strategies. Collecting effective teaching/learning strategies designed for distance education and presenting those strategies to the novice instructors would enhance their knowledge of the teaching process and add to their repertoire of teaching strategies available to them in the classroom. Providing time and facilities for practice could also be very helpful.

Another successful technique used in the induction of new teachers is the use of a master teacher as a *mentor*. Pairing the new teacher with an experienced teacher can provide the new teacher with a role model, friend, advisor, and confidante. The same would be true in the distance education setting. The new teacher would be able to observe classes, learn new teaching/learning strategies, seek advice, and share ideas.

The third guideline is the encouragement of *reflection*. Brookfield (1995) describes the role of reflection in the development of teaching skills as teachers learn to know themselves and view themselves through the eyes of their students, their colleagues, and the professional literature. Three suggestions can be made to encourage the process of reflection. The first is to video tape the instructor and make the tape available to the teacher for review. The process of reflection on the teaching skills demonstrated on the video tape can be encouraged by the teacher's mentor. This is useful in helping the teachers know themselves and see themselves through the eyes of the students. Second, teachers should be encouraged to have students complete periodic assessments of the course and the teaching strategies being employed. Third, reflection can be encouraged and used as an instrument for professional growth by participation in informal professional-development groups. This group would meet on a regular basis to share experiences, both successes and failures, share ideas for growth, and encourage each other. The group would not necessarily need to meet face-to-face. An internet chat room or bulletin board could be created for a "virtual" support group. Both novice and experienced distance education instructors could participate. Discussion could be spontaneous, or one of the teachers could take a leadership roll, posting questions and "leading" the discussion.

Following Brookfield's (1995) suggestion for reflection, learning to see oneself through the lens of the professional literature, it would be important to provide distance education instructors with access to resources developed to improve and support distance education instructions. These resources would include current professional journals, texts, and research reports. In addition, a video library of a variety of instructors and teaching/learning strategies would be very useful to the novice teacher.

The distance education instructor, like instructors in all other classrooms, needs support and encouragement as new skills are developed and tested. Training sessions, mentors, and the means of reflection need to be provided so as to help the new teachers develop their maximum potential. Successful teaching/learning strategies may be designed for distance education, but without training and support, teachers may not have the confidence, skill, or time to successfully implement them.

## Limitations

*This study has limitations that need to be addressed. The teaching/learning strategies were tested with a limited number of courses and students and in only one distance education program. It is not possible to generalize the findings to other programs. However, the results suggest that further testing would be helpful. Creating and testing a distance education teacher induction program could also be informative.*

*Demographic information about the students and instructors who participated in this study was not collected. Therefore, it is difficult to know the impact of individual characteristics on the findings. It is suggested that subsequent studies collect that demographic information.*

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**Editors' Note**: Physician Assistant programs extend the level of patient support in doctor's offices and medical facilities. PA training also benefits from web-based training. Research here is directed to what courses are amenable to web-based courses, and which elements are predictive of student success. An introductory course on medical terminology was chosen for this research.

# Effect of teaching/learning methodology on effectiveness of a web based medical terminology course?

**Paul David Bell, Suzanne Hudson, and Michelle Heinan**

## Abstract:

The purpose of this study was to investigate how a particular method of instruction can impact the effectiveness of an on-line or web based course in delivering subject content. Two different versions of an existing web-based medical terminology course were compared in order to determine which was more effective in teaching content to first semester students in a physician assistant studies program at a 4-year public university. Learner achievement and learner satisfaction levels for the two different course versions were compared. The mean exam scores total and the mean increase in knowledge assessment score did not differ significantly for the two teaching protocols once the achievement measures had been adjusted for initial medical terminology knowledge. Reasons are offered to explain why this occurred and, in addition, differences in learner satisfaction ratings for the two course versions are discussed.

## Introduction:

The World Wide Web (WWW) has become firmly entrenched in our working and social lives. Not only is it a space where people can communicate, work, trade, and spend leisure time, but it has also increasingly become a place to learn.[1,2] Both the academic and business sectors have made significant commitments to the adoption of web based technologies for learning and training. For example, in addition to the great number of courses and academic programs offered on-line, academically accredited virtual universities now exist in cyberspace. The health care industry has also adopted internet based technologies for patient health care management and the Pew Health Professions Commission has advocated the inclusion of internet and web based technologies in the professional education of future allied health professionals. In particular, they recommend the training and development of specific competencies in the use of information technologies such as the Internet for patient care management and continuing professional education.[3]

In light of the investment being made in the development of the Internet for training and education, evaluating the effectiveness of web based instruction is a critical pursuit. Most research into the effectiveness of web based learning is composed of media comparison studies that concentrate on the effect of the course delivery medium on learner outcomes. Although the comparison of delivery media is a recognized component of educational technology research, some have proposed that media comparison studies have been unproductive [4-6] This area of research has found no significant differences in student learning regardless of whether the learning medium is video, www, computer assisted instruction or traditional face to face environments. It is doubtful, then, whether such research contributes to a better understanding of what factors make for effective web based learning.[7,8] Therefore, the focus of web based learning research should, instead, be on understanding what elements may be predictive of student success in web based courses.[9]

Reviews of educational technology research suggest that investigational research of instructional methods used in on-line learning environments can produce more useful information about what works versus what doesn't in effective web based instruction.[8,9] Instructional design methods influence learning regardless of whether one is speaking of a face-to-face traditional classroom delivery or a web based on-line distance learning format. Instructors/teachers exert control over content and the methods used to teach it. An effective course is, therefore, the product of good teaching. And good teaching includes knowing how to deliver appropriate subject matter content via optimal teaching and learning methodologies. A three year study of Innovations in Distance Education spearheaded by Pennsylvania State University (PSU) concluded that when it comes to teaching on-line technologic competence alone is not sufficient for guaranteeing effective technology integration. It went on to emphasize that good teaching is described by the educational event experienced by both the instructor and the learner and that the delivery mode is secondary to that event.[10] Furthermore, McFadden, et al. (1999) summarize that concerns regarding the quality of distance education courses should be no different than those for the traditional classroom.[11] They conclude that quality is the responsibility of the professor whether teaching on-line or in front of a classroom. If this is so, then it would appear that the instructional design phase and the decision to employ specific methods of content delivery are important determinants of what makes a quality or effective web based course.[12,13]

The purpose of this study is to investigate how a particular teaching/learning methodology can impact the effectiveness of an on-line web-based course in delivering subject content. Two versions of an existing web-based medical terminology course that differed according to the teaching/learning methodology utilized were compared in order to determine which was more effective in teaching content to first semester students in a physician assistant studies program at a 4-year public university. Learner achievement as measured by knowledge assessment and learner satisfaction levels for the two different course versions will be compared.

Health care professionals must be able to communicate with each other about patients and their health care via the language of medicine. Physician Assistant (PA) students, therefore, must take medical terminology during their first semester in the PA program at ECU in order to gain a working knowledge of medical terms, including an overview of abbreviations most commonly used in health care. The medical terminology course required of PA students is a 2 credit 5 week summer course offered through the health information management department. The department of health information management in the school of allied health has been offering this course since 1980 and began teaching it on-line to first semester PA students in the summer of 2000 in lieu of the traditional face to face classroom format. The decision to place PA curriculum courses on-line was taken for two reasons, first, in response to the President of the University of North Carolina system's directive to place more on-campus courses on-line and secondly, in order to provide a medium that could deliver learning to students who needed to work to support themselves and their families while they were also studying to be physician assistants.

In the summer of 2002 two different versions of the introduction to medical terminology course were created. This was done in order to investigate the extent to which instructional methodology plays a role in determining the effectiveness of web based learning.

Learning medical terminology involves learning word roots, prefixes and suffixes derived from Latin and Greek word forms. Mitchell and Myles define second language learning as "the learning of any language to any level provided only that the learning of the "second" language takes place sometime later than the acquisition of the first language"(1).[14] According to their definition, then, learning medical terms is very much like learning a second language. Therefore, teaching medical terminology can benefit from second language learning research and what it has to offer as far as the theoretical bases for second language teaching models.

The many theories of language learning can be distilled down to two main schools of thought. One, the universal grammar theory, represents the viewpoint that language learning is mainly the result of working an individual's innate "grammar" control box. Therefore, the process of learning a second language is a neuro-cognitive process and language skills are a matter of habit formation. Teaching methodologies that are founded on this theory emphasize audiolingual teaching methods that have students practice particular patterns of language through structured dialogues and drills until the language is sufficiently rehearsed for responses to be automatic. [14, 15, 16] On the other hand there is a very different school of second language learning that believes that the process of language learning is very much influenced by the social environment of the learner. That is, according to this sociolinguistic orientation, second language learning is a social constructivist activity. And it is chiefly by communication and social interaction that the learner inductively acquires the grammar and rules of discourse. Thus, teaching methodologies based on this theory stress communicative interaction among learners and instructor rather than the memorization of language patterns through drill and repetition.[14, 17,18]

The 2 course versions were equivalent in the following aspects: They included the same programmed text book (Exploring Medical Language: a student centered approach by LaFleur Brooks, Mosby 5th edition); contained the same sequence of study units, the same introductory PowerPoint lessons on prefixes and suffixes, cancer terms, specialist terms, and the same "checklists" or reviews of terms to know for each exam. They also contained matching collections of external links to web pages containing more information on the same variety of topics. Both versions also contained the identical "fill in the blanks" exercise on anatomical planes, body cavities and directional terms. Course content for both versions was uploaded into identical web based course shells or templates designed by Blackboard. Blackboard is a company that provides software for electronic or distance education and has been the standard infrastructure for the creation of on-line courses at ECU since 2000.

Furthermore, both course versions included the same exams. Exam content and format were equivalent and questions were asked in the same sequence. For each exam 2/3 -3/4 of exam items were multiple choice questions designed to evaluate student comprehension of medical terms and another ¼ to 1/3 of exam items were fill-in-the-blank questions constructed to assess student comprehension of medical abbreviations.

Despite these similarities, the 2 course versions differed in one important way. Each included independent learning activities that differed from the other according to the particular language learning methodology they represented. These methods were in turn based on the two very different language learning theories or models discussed above.

One version of the introduction to medical terminology course; henceforth, referred to as the ***Tutorial*** was designed with the universal grammar approach to second language learning in mind. A web based tutorial entitled Web Learning Services, developed by MC Strategies, was built into this version of the on-line course. MC strategies develops and delivers web based training for the health care industry. Their medical terminology curriculum has been offered since 1986. Learners can learn, review, and self test in medical terminology at their own pace via this program. It is flexible enough such that the instructor is able to configure lesson content and sequencing in order to correspond to the course textbook. Learners read text that explains terms and also listen to sound files of correct pronunciation of unit terms. At the end of each unit learners take an exam and receive immediate feedback from the program on their performance. Thus, learners exposed to this independent learning activity interact only with the computer program and drill terms until they are committed to memory. There are 45 separate lessons that correspond to the 12 units of study in the curriculum.

The other version of the introduction to medical terminology course; henceforward, referred to as the ***CS/DB*** (Case Study/Discussion Board) version was designed based on the communicative approach to second language learning. In this version 12 case studies were formatted into PowerPoint presentations and then uploaded into Blackboard. In addition, sound files of the instructor reading each case study were uploaded into the same folder containing the PowerPoint presentation. This was done to make it possible for on-line learners to read and hear medical terms used in a clinical scenario. Next, case study discussion questions were uploaded to the Blackboard discussion board center. Students were, then, required to respond to a minimum of two case study questions per unit as well as reply to a minimum of 2 of their colleague's responses. Learners received feedback through fellow learner and instructor replies to initial and subsequent postings. This asynchronous discussion board activity was designed to facilitate interactive communication among learners and instructor. As such, it was a threaded discussion in which learners had to correctly employ medical terms in the context of their discourse. It was, therefore, a platform for the communicative interaction crucial for learning medical terms in context.

Although, current second language learning methodology borrows from both second language learning theories described previously, most second language learning methods draw from the sociolinguistic theory. These models are collectively referred to as "communicative language teaching" or CLT.[19] In this approach the teacher is viewed as a needs analyst and counselor who designs tasks for the learner and the learner is seen as an improviser and collaborator in the learning venture. Learners exposed to this form of second language learning learn the rules of grammar via the process of communication and interaction. Feedback to their "improvisations" of language usage helps the learner create his grammar control box for the target language. Therefore, based on this rubric of second language learning methodology, it is hypothesized that those PA students who are enrolled in the CS/DB version of the course will learn more medical terminology as reflected in higher total exam and in the difference in post and pre-course knowledge assessment scores compared to the PA students enrolled in the Tutorial version of the course. It is further hypothesized that in addition to achievement, learner satisfaction ratings will also be higher in the CS/DB sections than in the Tutorial sections.

## Methods:

There were 49 PA students taking the course. Of these, 22 were true distance (or off-campus) learners, and the rest were on-campus students. The distance learners were divided into two sections such that the gender composition, age distribution, and prior health care related experience were similar for these two sections. One of the distance-learner sections was taught using the Tutorial method, and the other was taught using the CS/DB method. The on-campus group was also divided into a Tutorial section and a CS/DB section such that the gender composition, age distribution, and prior health care related experience were similar for the two sections. Both groups had to complete the same prerequisite courses before applying to the PA program and meet the very strict academic requirements for acceptance into the program. The chief difference between the two groups of learners, then, was in the version of the introduction to medical terminology course to which they were exposed.

The two medical terminology learning protocols were evaluated and then compared based on the level of learner achievement and the level of learner satisfaction with the particular protocol. Achievement in the course was measured by the exam score total, and by the difference in post- and pre-course knowledge assessment scores. The assumption is that an evaluation of student learning in medical terminology can be made based on performance on four exams and on a comparison of pre-course knowledge assessment and post-course assessment scores. These exams and assessments consist of multiple choice and fill-in-the-blank question items. These question

types have long been considered appropriate for testing factual recall and applied knowledge and as such have been used historically in the assessment of clinical competence.[20] Thus, the higher the exam score totals and the greater the improvement between pre vs. post course assessment scores, the greater the amount of learning and mastery of medical terminology that occurred.

Both of these achievement outcomes were analyzed using a general linear model with protocol (CS/DB or Tutorial) as a factor, and pre-course knowledge assessment score as a covariate. The pre-course knowledge assessment score was included as an explanatory variable since it is reasonable to assume that students who start the course with a greater knowledge of medical terminology have an advantage over those with lesser knowledge. The analyses were carried out using SPSS 10.1.

In addition to comparing the learning achievement of the two protocol groups, the groups were also surveyed for their level of satisfaction with the particular learning method (CS/DB or Tutorial) used. Kirkpatrick's work concerning the sequence of evaluation of programs suggests that measuring the reaction or satisfaction level of program participants can provide information about learner's motivational level for learning. Although a positive reaction cannot in and of itself guarantee learning, negative reactions may very well reduce the possibility of it occurring. [21]

The survey contained 10 Likert scale items. Learners indicated the degree to which they either agreed or disagreed with these statements. Eight of these items were the same or very similar for the two teaching protocols. These are given in Table A along with results of the survey. The two remaining items were different for the two protocols and are given in Table B. Learners completed this survey during the last week of the course and submitted it anonymously via the Zoomerang survey site. 42 of 49 students completed the survey. Four (4) of the students who did not complete the survey were in the CS/DB sections, and three (3) were in the Tutorial sections.

The opinion ratings for the two protocols on the first eight Likert scale items were compared using Wilcoxon-Mann-Whitney test. The StatXact program was used to do these analyses. The Wilcoxon-Mann-Whitney test is a nonparametric test that is considered more appropriate than a t-test for ordinal data (such as Likert scale data).

## Results:

For both achievement measures (exam scores total and increase in knowledge assessment score), the pre-course knowledge had significant predictive power at the 0.05 significance level ($p = 0.001$ and 0.000, respectively) but protocol did not. Hence the mean exam scores total and the mean increase in knowledge assessment score did not differ significantly for the two teaching protocols once the achievement measures had been adjusted for initial medical terminology knowledge. The mean increase in knowledge assessment score for the CS/DB sections was nearly significantly higher than for the Tutorial sections ($p = 0.054$), but the actual predicted difference in adjusted means was only 2.5 percentage points. For a student with a pre-course knowledge assessment score equal to the average value of 66.3%, the predicted increase in knowledge was 25.8 percentage points for the CS/DB protocol, and 23.3 percentage points for the Tutorial protocol. The predicted means for the exam scores total were nearly identical for the two protocols (305.9 and 305.5, respectively, for a student with a pre-course knowledge assessment score of 66.3%). Hence the teaching protocols were about equally effective as measured by either achievement outcome.

The 8 items that were the same or similar for the two protocols on the learner satisfaction survey were compared using the Wilcoxon-Mann-Whitney test. (Please see Table A.) The opinion ratings for the CS/DB sections were significantly higher than those for the Tutorial sections for items 3 and 8, ($p = 0.016$ and 0.002, respectively) and nearly significantly higher for item 2 (p

=0.057). For items 1-5 and 8 the ratings in the CS/DB sections tended to be higher than in the Tutorial section, but not significantly higher. For item 7 the ratings in the Tutorial section tended to be higher than in the CS/DB sections, but again, not significantly higher.

## TABLE A

| Question | Protocol | Opinion Rating* | | | | Mean Rating |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | |
| 1. This course was effective in helping me learn medical terminology. | CS/DB | 0% | 0% | 35% | 65% | 3.65 |
| | Tutorial | 0% | 0% | 37% | 63% | 3.63 |
| 2. The on-line testing format was an effective means for assessing my level of learning in the course. | CS/DB | 0% | 0% | 17% | 83% | 3.83 |
| | Tutorial | 0% | 5% | 37% | 58% | 3.53 |
| 3. The course provided sufficient opportunity(ies) for interaction and communication between/among learners. | CS/DB | 0% | 4% | 35% | 61% | 3.57 |
| | Tutorial | 5% | 21% | 42% | 32% | 3.00 |
| 4. The course provided sufficient opportunity(ies) for interaction and communication between learner(s) and instructor. | CS/DB | 0% | 4% | 30% | 65% | 3.61 |
| | Tutorial | 0% | 16% | 26% | 58% | 3.42 |
| 5. Success in learning medical terminology depends mostly on how many textbook and on-line exercises the learner completes. | CS/DB | 0% | 5% | 64% | 32% | 3.27 |
| | Tutorial | 6% | 6% | 72% | 17% | 3.00 |
| 6. Success in learning medical terminology depends mostly on how much interactive communication the learner engages in. | CS/DB | 4% | 39% | 35% | 22% | 2.74 |
| | Tutorial | 16% | 21% | 37% | 26% | 2.74 |
| 7. (CS/DB) Reading and listening to the clinical case studies helped me understand and remember medical terms | CS/DB | 4% | 30% | 35% | 30% | 2.91 |
| 7. (Tutorial) Working independently through the Educode lessons helped me understand and remember medical terms | Tutorial | 11% | 11% | 42% | 37% | 3.05 |
| 8. (CS/DB) The graphics included with the case studies helped me understand and remember the medical terms. | CS/DB | 0% | 13% | 48% | 39% | 3.26 |
| 8. (Tutorial) The graphics included after each section in Educode helped me understand and remember the medical terms. | Tutorial | 11% | 42% | 37% | 11% | 2.47 |

* Opinion Rating: 1. Disagree, 2. Somewhat Disagree, 3. Somewhat Agree, 4. Agree

## TABLE B

### Opinion ratings for protocol-specific survey questions. Opinion ratings for survey questions that were the same or nearly the same for the two protocols.

| Question | Protocol | Opinion Rating* | | | | Mean Rating |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | |
| 9. The case studies/discussion board questions helped me apply my knowledge of medical terms in a clinical context. | CS/DB | 0% | 9% | 35% | 57% | 3.48 |
| 10. Responding to instructor as well as replying to fellow learner discussion board postings helped me understand and remember medical terminology | CS/DB | 0% | 26% | 48% | 26% | 3.00 |
| 9. Analyzing medical terms according to their component parts (prefix, word root(s), suffixes) helped me understand and remember them. | Tutorial | 0% | 0% | 26% | 74% | 3.74 |
| 10. Taking a test after each section in Educode helped me understand and remember medical terms | Tutorial | 11% | 5% | 42% | 42% | 3.16 |

* Opinion Rating: 1. Disagree, 2. Somewhat Disagree, 3. Somewhat Agree, 4. Agree

**Discussion:**

The original hypothesis that those PA students who are enrolled in the CS/DB version of the course will learn more medical terminology as reflected in higher total exam and in the difference in post and pre-course knowledge assessment scores compared to the PA students enrolled in the Tutorial version of the course is not supported by the results.

In this case the above finding would appear to argue for the lack of any effect of instructional design/methodology on learner achievement. However, the influence of instructional method on learning medical terminology may be overshadowed by other factor(s). One such factor may be learner ability. For example, the learners in this study were all students in the physician assistant studies program. This professional program has very competitive and selective entrance requirements. Thus, such a selective admissions process will result in a cohort of individuals characterized by high academic achievement as measured by GPA. In addition, PA students like other health care professional students, such as medical students, are characterized by high goal setting behavior and high academic persistence. Research regarding the phenomenon of student persistence has demonstrated that student attributes such as academic ability, goal setting behavior, and internal locus of control correlate strongly with an individual's drive to persist academically.[22,24.] It is plausible, then, that highly motivated learners who take control of their own learning can demonstrate high achievement levels in a wide variety of learning environments. Therefore, learner attributes such as ability and intrinsic motivation may well trump learning methodology to the extent that there are no differences in learner achievement as measured on exam and knowledge assessment performance.

Moreover, the type of assessment measure used to evaluate learner achievement may not have been well suited for demonstrating the effects of instructional design on learner achievement. It may well be, for example, that different learning methods emphasize different levels of learning such that one method emphasized more superficial learning; whereas, the other method stressed deeper learning. For example, the tutorial method was basically drill and practice of word parts and the tutorial exams were all multiple choice items. The CS/DB method required students to read clinical case studies that utilized terminology in context and then to respond to discussion questions on that content. For the most part these questions fell into the analysis, application and synthesis domains of Bloom's cognitive taxonomy. Thus, this activity required more than rote memorization as it obliged students to utilize more critical/analytical thinking skills during their learning.

However, the two groups of students were assessed via the same short answer multiple choice items. The majority of these question items required learners to indicate their comprehension of word terms. It is quite possible to perform well on such test items by only utilizing superficial learning strategies such as memorization. Furthermore, deep learning strategies such as reflection and analysis may not be necessary in order to perform well on such short answer exams. Thus, regardless of the instructional design/method utilized to learn medical terms, the learners may have adapted their learning style to accommodate the superficial nature of the testing instruments. The research indicates that successful learners are not only deep learners but "adaptable or strategic learners" who know how to adjust their learning style in order to suit the circumstances of their learning and testing environment.[25-28.] In this case both sets of learners but especially the CS/DB learners adjusted their learning strategies to match the cognitive level of the assessment instrument.

Although both groups of learners were equivalent in their opinion regarding how effective their course version was in helping them to learn medical terminology, the two learner groups had different perceptions concerning their learning experience. More CS/DB learners believed that the course provided sufficient opportunities for interaction and communication between learners than

did Tutorial learners. This is really not surprising. CS/DB learners engaged in asynchronous communication as an on-line learning activity whereas learners in the tutorial section did not. The other notable differences in the opinion rating came in response to questions 2 and 8. In question 2 the CS/DB group rated the effectiveness of the on-line testing format more highly than the Tutorial group. This may have occurred because it was viewed as a welcome change from the on-line discussion board activity. As such, the novelty effect of the on-line testing experience translated into higher rankings for question 2 than for the tutorial group for whom this on-line testing was viewed as just more of the same. They had to complete a total of 85 tutorial exams during the course. In question 8 each group is asked about the effectiveness of the graphics included with their version. More CS/DB learners than tutorial learners believed that their version's graphics helped them to understand and remember medical terms. This finding is expected because there was a real difference in the quality of the graphics used in each course version. The graphics included with the case study/discussion board version included pathology photos and animations while the tutorial (educode) graphics were mostly clip art quality images.

Another interesting finding is that both groups were equally "lukewarm" (2.74 on the Likert scale; somewhere between "somewhat disagree" and "somewhat agree") in their agreement with the statement that success in learning medical terminology depends mostly on how much interactive communication the learner engages in. This finding is supported by some anecdotal comments that students included with their university course evaluation forms. Several CS/DB learners indicated that they were not sure that the CS/DB method was appropriate for an introductory level course in medical terminology, offering that such an activity would be more appropriate for an advanced course such as clinical diagnosis. This finding suggests that learners may have definite expectations about how course subject matter content and course curricula is to be taught and may be "somewhat" disappointed when the actual teaching/learning design method does not match that expectation.

Future research into the relationship between instructional design and learner outcomes in on-line learning environments should include qualitative analyses of both learner performance and learner satisfaction/opinion ratings, in order to discern those factors that facilitate learner achievement in on-line learning. In addition, it is important to perform this type of research with different learner populations in order to understand how on-line learning experiences can be designed to reach a wide variety of learners with different learning styles. For example, many universities are employing distance learning technologies to teach both their adult continuing education students as well as their traditional on and off-campus undergraduate students. Therefore, a future research design might assign learners to one learning method vs. another based on individual cognitive or personality attributes in order to learn which attributes correlate with which specific learning or instructional methods.

This line of research should also be conducted in a variety of subject matter courses in order to determine which instructional methods match up best with what types of learning to be achieved. It is also important to match assessment instruments with the type of learning (surface vs. deep) that is taking place.

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**Editor's Note**: In a lecture, attention and learning degrade rapidly unless techniques are used to periodically refresh or redirect the learner's attention, or heighten or vary level of interaction. There are similar needs in distance learning to vary the repertoire to avoid attention fatigue and loss of motivation. In the teaching-learning transaction, instructor attributes include charisma and challenge while learner attributes include commitment and time.

# Attention Fatigue and the Effect of Debriefing in a Web-Enhanced Graduate Nursing Course

**Mary-Anne Andrusyszyn and Dawn Yankou**

**ACKNOWLEDGMENTS:**

The authors are grateful to the graduate student participants for helping us learn more about online learning.

This research was based on papers presented at the 13th Annual Conference sponsored by the University of Western Ontario, School of Nursing and the Iota Omicron Chapter of Sigma Theta Tau in May 1999, and the National Nurse Educators' Conference in Vancouver, BC in Feb 2000.

## Abstract

Changes in directed attention and the influence of debriefing on attention fatigue were examined in eight students completing a graduate nursing course, of which three weeks were online. Data were collected at three time points. No changes in attention were found between times one and two. Attention scores were highest following a debriefing experience (time three). Students noted online learning was effortful, and required time and commitment. Online learners can benefit from educational strategies that facilitate reflection and recovery of directed attention.

## Introduction and Review of Literature

Access to higher education through electronic means is fast becoming the norm in many disciplines. Few programs remain untouched by this sweeping influence. Distributed learning through the use of technology, regardless of the medium, offers greater flexibility and access to educational opportunities (Clark, 1998; Whittle, Morgan & Maltby, 2003).

Internet-based computer-conferencing (CC) has been used in the graduate nursing program at a Canadian university in Southwestern Ontario to deliver portions of courses for several years. Most students, new to technology, are often overwhelmed with the volume and intensity of online interaction. This is not unusual as constructing knowledge and learning from multiple, often-disconnected bits of shared information can be mentally challenging and fatiguing. Students can also experience feelings of uncertainty about the quality of personal contributions, particularly when they are anxious about having these documented in a permanent online transcript (Andrusyszyn & Davie, 1995).

Struggling to function effectively and maintain cognitive clarity by inhibiting distractions and by attending, reflecting, and making sense of learnings that emerge from multiple messages, require directed attention (Kaplan, 1983). Prolonged use of directed attention can lead to attention fatigue (Kaplan & Kaplan, 1989; Kaplan, 1995), a decreased capacity to attend. This fatigue often manifests in increased errors and the declining ability to concentrate, achieve clarity, problem solve, carry out plans, and behave in socially appropriate ways (Kaplan & Kaplan).

Tennessen and Cimprich (1995) suggest that university students are at an increased risk of developing attention fatigue. When directed attention becomes fatigued, reduced selectivity and inhibitory control central to information processing may result (Kaplan, 1995). Information processing is a key activity in all learning environments, particularly in the asynchronous online medium. In this environment, knowledge is constructed collaboratively and interactively through written dialogue, and all textual cues must be processed in a meaningful and efficient way.

The quality of learning depends a great deal upon the ability to focus or concentrate and clarity. Clarity, "a state of mind characterized by a strong focus and the suppression of distraction" (Kaplan & Peterson, 1993) is a central concept to psychological wellbeing. Being focused feels good while being confused is disconcerting (Kaplan & Kaplan, 1982). Clarity can motivate an individual to learn more, foster the capacity to organize, make plans and decisions, and facilitate making sense of one's world. It plays a central role in one's willingness to take action (Kaplan & Peterson, 1993).

One way to help learners gain conceptual clarity and enhance the meaningfulness of their experiences is through reflection (Andrusyszyn, 1996; Mezirow 1990). Reflective activities allow individuals to examine their experiences and consider new understandings (Boud, Keogh & Walker, 1985). This personal process, arising from the cognitive and affective synthesis of ideas, may be strengthened through dialogue (Andrusyszyn)

Reflection can enhance clarity by helping learners shift information from surface level knowing to higher-order understanding and knowledge development (Cinnamond & Zimpher, 1990; Scardamalia, Bereiter & Steinbach, 1984). It is a process that may be facilitated (Boud, Keogh & Walker). Debriefing, "purposeful reflection by an individual or group" (Pearson & Smith, 1985), is one strategy that can be used to facilitate reflection (Boud, Keogh & Walker). In this study, researchers explored the influence of reflection through debriefing on attention fatigue in a web-enhanced graduate course using computer conferencing.

## Hypotheses

Two hypotheses were tested. Students enrolled in a web enhanced graduate course that integrates computer-conferencing will:

1. Demonstrate a decrease in attention function on measures of attention function following a three-week online experience compared to baseline data.
2. Demonstrate an increase in attention functioning on measures of attention function following a debriefing experience compared to data collected at the end of the online period.

### Sample

All eight students enrolled in the graduate nursing course were invited and agreed to take part in the study. The women ranged in age from 18 to 50 years with a median age between 41 and 45 years. Two were full-time students, six part-time. Three were employed full-time; the others had part-time employment. Years of experience in nursing practice ranged from 2 to 31 years with the majority between 13-31 years. All students had access to the Internet from home, place of employment, or the university.

## Instruments

The Attention Function Index (AFI) (Cimprich, 1990) was used to measure perceived attention or effectiveness in purposeful activity requiring attention. It consists of 16, 100mm linear analog scales on which participants place a mark at the point that best describes how they feel they are

functioning in each of the 16 areas. These include such items as: getting started on activities you intend to do; planning activities; and keeping your mind on what you are doing. A single overall score ranging from 0-100 (0=not at all; 100=extremely well), with higher scores reflecting higher perceived attention function, is computed for the AFI. Internal consistency reliability coefficients ranging from .89 to .94 have been demonstrated (Cimprich; Yankou, 1996).

The Necker Cube Pattern Control (NCPC) (Cimprich) is an objective measure of attention. It consists of a drawing of a three-dimensional cube that can be perceived from two alternate perspectives resulting from reversal of the foreground and the background. The frequency with which the cube appears to flip or change perspectives is counted at two time points. The first or baseline count involves the participant indicating the number of times the cube flips randomly. The second involves counting the number of flips as the participant attempts to hold one perspective, that is, control the number of cube reversals. The percent reduction in pattern reversals is derived from the rate of reversals during the baseline score and the holding score. Greater attention capacity is indicated by the ability to control the reversal of perspectives or flips (Cimprich). Cimprich conceptualized the Necker Cube as a direct, objective measure of attention capacity.

## Design

A one-group pretest-posttest design was implemented. The study was carried out during a three-week online period integrated into a traditional 13-week face-to-face graduate seminar course on nursing leadership facilitated by one of the researchers. Participation during this time was not graded to relieve any anxiety students may have felt about using technology. Six weeks prior to the formal online period the virtual space was opened; students were encouraged to practice using the system; and an orientation to the Internet-based asynchronous CC program was held.

Case studies about nursing leadership and access to a nursing leader as an online guest expert provided focus and context to the discussion. Students were encouraged to share new insights about the cases and the literature with colleagues so they could all benefit from the wealth of ideas within the group. As well, students were encouraged to reflect on how these new understandings applied to their individual knowledge and experiences. The reflection-in-action (Schon, 1987) took place during the three-week online period. No face-to-face classes were scheduled during this period.

Quantitative data were collected at three different time points. The self-administered AFI questionnaire and the NCPC, were given to participants at the beginning (time one), at the end of the online experience prior to debriefing (time two), and within 3 days of the reflective debriefing (time three). Demographic data were obtained at time one. The reflection-on-action (Schon) took place at the end of the 3-week online period through the 90-minute debriefing exercise. During that time researchers audiotaped and transcribed the dialogue. Content analysis was then used to identify themes derived from the dialogue.

Descriptive statistics were used at all three data collection time points to describe and summarize the data. Bivariate statistics were not used due to the small sample size.

## Results

The majority of students were comfortable with word processing, using email, and the Internet. At least five students (62.5%) used their computers for word processing, email, and accessing the Internet daily or often. None had prior experience with CC.

There were very slight changes in attention function as measured by the AFI (or the NCPC between the beginning of the online learning experience (time 1), and the end of the online experience (time 2). The scores on the AFI were higher at time 3, that is following the reflective debriefing experience (M=71.46 (s.d.17.72) than at either of the other two time points (time 1=64.97(s.d.19.37); time 2=65.81(s.d. 22.83). This finding, in the hypothesized direction, suggests attention function improved following the debriefing. The percent reduction in Necker cube pattern reversals declined slightly over time suggesting attention function got worse after debriefing.

Three common themes emerged from the researchers' analysis of the debriefing session. The first was *commitment*. Students spoke about the importance of commitment to themselves and others during the online period. They observed they had to be present and active online as others depended on their contributions. This was a double-edged sword in that students "...carried guilt of not participating more...." They feared letting the group down, while simultaneously, agonizing over written responses as they perceived these to be "a big investment". They also expressed the importance of being committed to themselves and responsible for their own learning. "...I had to be a lot more responsible for my own learning ... when you're in the classroom you can depend a lot more on other people..."

The second theme was *challenge*. Students felt disadvantaged by not being able to "see" or gauge responses in the way they had become accustomed in a face-to-face classroom. They perceived themselves as being more spontaneous in real life. One student stated: "when you're forced to say something, you think it should be profound or meaningful". Maintaining a commitment to meaningful learning for themselves and their peers was challenging. Making meaning from the volume of dialogue keeping track of what was said and extending the discussion in a meaningful way was also a challenge. One student shared it "...was difficult for me to express myself... like following a play...". Several noted it was a challenge to share work related personal experiences fully because they knew each other from the nursing practice area. Once student noted she might have shared more if co-learners had been strangers. Since the focus of the online discussion was on specific cases, and students were encouraged to reflect on these experiences in relation to their professional practice, they became conscious about what examples and experiences they could and could not share online. They did not want to commit their experiences to writing, fearing that "sharing experiences [online] was just too risky...we are more guarded".

The final theme emerging from the reflective debriefing related to *time*. It "took more time to process [information]" and "...it took longer to come up with an answer...." In other words, "work expanded to the time allotted". They noted that "online is ongoing...face-to-face has a beginning, middle, and an end and an interlude to the next week". It "took longer to get through...[and]...requires organization and prioritization". The group also noted the importance of "being respectful of other peoples' time".

## Discussion and Limitations

Learning activities that take place in web-based learning environments, such as computer-conferencing, require directed attention. When dialogue occurs online, a large volume of information is exchanged in text form. This information, to be meaningfully applied to one's personal context, must be read, analyzed, synthesized, and transformed into knowledge. The process of transforming information to knowledge and personal understanding requires directed attention. It was hypothesized that the process would be fatiguing.

Previous research has shown that ongoing use of directed attention leads to attention fatigue and reduced effectiveness in activities requiring attention (Kaplan & Kaplan, 1989). In this study, researchers did not find a decrease in attention function over time. This may have been due to students' relatively brief exposure to web-based learning. A longer online experience may have been perceived as more fatiguing. The small sample size must also be acknowledged. It is also possible that since participation was not graded, the sense of pressure to meet course expectations was diminished. Conversely, it is important to consider whether the lack of grading reduced the degree of attention students dedicated to the experience since "it did not count". However, the researchers' assessment of the quality of contributions and students' expressed commitment to the experience suggests this was not the case.

Since the majority of students (75%) took courses part-time, the flexibility of fitting online dialogue into their schedules may have been attractive, thus the online experience was not perceived as attentionally fatiguing. It should be acknowledged that AFI scores for participants in this study were quite high on entry into the study suggesting good attention function.

The final debriefing was intended to provide an opportunity for students to examine what they had learned, the learning process, as well what they learned about themselves and their colleagues. The focus of the debriefing gravitated to the learning process more than the content. Sharing these perspectives seemed to be foremost in the students' minds. Participants also noted what they learned about themselves, particularly about the importance of time, organization, and making meaningful contributions.

Although researchers did not find a change in attention function from time one to time two, an increase in attention was demonstrated following the reflective debriefing (time 3). The trend was in the hypothesized direction, suggesting there is a relationship between the process of reflection and attention. Given the sample size, however, no definitive conclusions can be made. This relationship is worthy of further examination and has relevance for educators in online learning environments.

It is important to acknowledge that one of the researchers was the course professor. Although participation in the study was voluntary, students may have felt compelled to participate. Further, it should be recognized that the online experience was a course requirement. It is possible that students who are required to participate in an online experience may be different from those who choose to participate. However, students did not object to trying this new learning medium. It may be interesting to examine the attention function of these two groups. It may also be valuable to compare the attention function of students taking online courses to those who are taking a course completely face-to-face.

Integrating educational strategies that encourage students to reflect may have a direct influence on students' abilities to attend and gain conceptual clarity. As more and more students embrace learning in distributed environments, it is incumbent on educators and their institutions to pay close attention to and integrate reflective strategies into educational programs to facilitate attention.

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**End Notes**

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