

THE INFLUENCE OF LEARNING STYLES ON STUDENT ATTITUDES AND ACHIEVEMENT WHEN AN ILLUSTRATED WEB LECTURE IS USED IN AN ONLINE LEARNING ENVIRONMENT

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Abstract

The technological capabilities of an online-learning environment allow an instructor to make an online class better than a face-to-face class by providing students with learning activities that are individualized to meet their needs and characteristics. One possible learning activity is an illustrated web lecture, which consists of a text-based presentation, such as PowerPoint, with an audio recording of the instructor presenting the lecture. However, a deficiency exists in the research that identifies the student characteristics, such as learning styles, which influence student achievement and attitudes when an illustrated web lecture is used. This study sought to fill that void. Results indicated that there were no differences in achievement or attitudes, based on learning styles. Therefore, it was concluded that when an illustrated web lecture is used to deliver content, students of varying learning styles achieve at similar levels and have similar attitudes toward the learning activity. Based on this conclusion, it was recommended that instructors should continue to use this learning activity to reach broad audiences of students.

Introduction/Theoretical Framework

Formal education has historically required that students physically be in class on campuses of universities, colleges, and schools. However, some students are unable or unwilling to attend on-site classes. In an effort to better meet the needs of these students, alternative methods were explored to deliver instruction. Known as distance education, this practice began as correspondence education in the late 19th century (Simonson, Smaldino, Albright, & Zvacek, 2003). As communication technologies advanced, the methods used to deliver education at a distance followed suit. Telephones, radios, televisions, and satellites have all been used to deliver instruction. The emergence of the Internet and World Wide Web as communication tools yielded yet another avenue for teaching and learning at a distance.

The distance education phenomenon has become commonplace on many university campuses throughout the United States. Nearly 10% of all college students in the United States have taken off-campus distance education courses (Sikora, 2002). In 1998, 54% of all higher education institutions either offered, or planned to offer, distance education courses (Lewis, Snow, Farris, Levin, & Greene, 2000). In 2000, 60% of all distance education students had at least one course that used the Internet to deliver content (Mayadas, Bourne, & Moore, 2003). Additionally, countless more students have taken what is commonly referred to as “near-distance” or “hybrid distance” courses, which are situated on-campus. The increased usage of distance methodologies to deliver instruction has led to considerable interest in the area of distance education research due to its differences with traditional face-to-face education.

Twigg (2001) identified five key features that can improve student learning in an online environment. They were as follows:

1. An initial assessment of each student's knowledge/skill level and preferred learning style
2. Appropriate, varied kinds of human interaction when needed
3. Individualized study plans
4. Built-in, continuous assessment to provide instantaneous feedback

5. An array of high-quality, interactive learning materials and learning activities (p. 11)

The theoretical framework for this study lies in Mitzel's (1960) model of the teaching and learning process, as adapted by Dunkin and Biddle (1974). In this model, the authors posit that presage variables and context variables influence process variables, which in turn yield product variables (Figure 1).

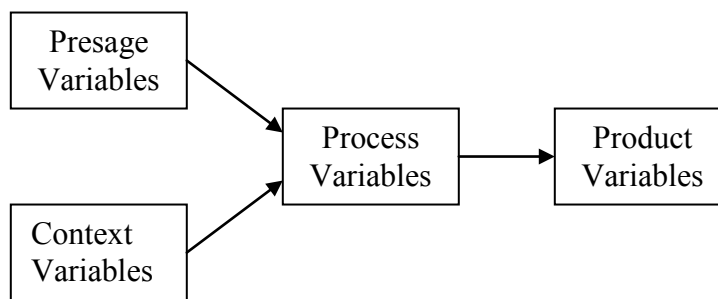


Figure 1. A Model of the Teaching and Learning Process

Presage variables are variables that deal with teacher characteristics (Dunkin & Biddle, 1974). Context variables are those variables over which the teacher has little or no control. These include student formative experiences, school and community contexts, student characteristics, and classroom contexts. Presage variables and context variables influence process variables. Process variables include the actual activities that take place in the classroom. Process variables affect product variables. Product variables concern the outcomes of teaching. One measure of outcomes is immediate student academic growth, which can be measured by evaluating student learning of the subject matter and attitudes toward the subject.

Many scholars have proposed theories and models for distance education that are consistent with Mitzel's model. For example, when proposing his Theory of Interaction and Communication, Holmberg (1989) made the assumption that distance education is an interaction between learners (context variables) and teachers (presage variables) in a distance learning

environment (process variables). He further indicated that student learning determines effectiveness (product variables).

Wedemeyer (1981) proposed a model for distance education that is compatible with Mitzel's model. In his model, Wedemeyer outlines four essential elements in a teaching and learning situation. They are a teacher, a learner, a communication system, and something to be taught (content). Similar to Mitzel's model, the teacher is represented as a presage variable, the learner as a context variable, and the communication system and content are represented as process variables. Missing from Wedemeyer's model are the product variables.

This study sought to determine the influence of student characteristics (context variables) on student achievement and attitudes (product variables) while holding constant the learning activity (process variable) and instructor (presage variable). The student characteristics examined in this study were learning styles and demographic variables. As such, relevant research studies on these student characteristics and their

influence on student achievement and attitudes in a distance-learning environment were consulted.

Delivering content in an online learning environment can take many forms and utilize many learning activities. These learning activities can be synchronous or asynchronous. One such learning activity, or process variable, available in an online learning environment is an illustrated web lecture (Simonson et al., 2003). This asynchronous learning activity seeks to closely mimic the traditional lecture that dominates higher education classrooms. It consists of a text-based presentation, such as PowerPoint, with an audio recording of the instructor presenting the lecture. Recent computer software advances have made creating an illustrated web lecture a relatively simple task. Instructors can easily convert their materials used in a face-to-face class to use in an online environment.

People have preferred ways of absorbing, processing, and retaining information (Schunk, 2000). Not synonymous with academic ability, this preference is often called a learning or cognitive style. The terms learning style and cognitive style are often used interchangeably (James & Gardner, 1995). Gregorc (1982a) defined learning styles as the way that people perceive, sort, absorb, process, and retain information. Witkin and Goodenough (1981) elaborated that cognitive styles are individual differences in how people process information. Similarly, James and Gardner (1995) defined learning style as, "the ways individual learners react to the overall learning environment" (p. 19). Dunn and Dunn (1993) added that both biological and developmental characteristics contribute to a student's learning style.

Learning styles have often been the focus of research in distance learning. These studies are consistent with the model presented by Dunkin and Biddle (1974) that asserts that individual differences in students can affect the outcomes of the educational experience. However, the conclusions drawn from these studies conflict. As such, the influence of learning styles on student achievement in distance education courses is inconclusive. Several studies reported a

relationship (Daniel, 1999; Oxford, Park-Oh, Ito, & Sumrall, 1993); while others reported learning styles had no influence on achievement or attitudes (Day, Raven, & Newman, 1998; Freeman, 1995). Perhaps the differences in these studies are attributable to the differing learning activities that composed the courses examined by these studies. By isolating a specific learning activity, an illustrated web lecture, the current study sought to further investigate the influence of learning styles on student achievement and attitudes in a web-based learning environment.

The effects of student characteristics related to computer proficiency and computer usage are uncertain when trying to predict student achievement and attitudes in a distance-learning environment. Several studies examined factors associated with computer proficiency and usage. For example, the anxiety involved in using this technology was a variable studied by Sexton, Raven, and Newman (2002). Their sample included 26 extension agents enrolled in a distance delivered inservice program. They reported that computer anxiety did not affect performance of extension agents in an in-service training conducted via the web. While Dutton, Dutton, and Perry (2002) conducted a study that compared online students to traditional students. As part of this study, the researchers examined numerous variables, including the previous experience of students with computers. Results from this study indicate that a student's prior experience with computers improved their performance as measured by course grades.

Numerous studies have investigated how other student variables influence achievement and attitudes in a distance-learning environment. For example, Dutton et al., (2002) reported that student employment had a negative impact on performance. Age is also related to student attitudes in a distance-learning environment (Berg, 2001; Brouard, 1996; Irani, Scherler, Harrington, & Telg, 2001). The influence of gender is inconclusive (Lim, 2001; Ory, Bullock, & Burnaska, 1997; Oxford et al., 1993). A student's previous experience with distance education is also inconclusive as a predictor of student success in a distance-

learning environment (Cheung & Kan, 2002; Lim, 2001).

By determining if student learning styles and other variables influence student achievement and attitudes when an illustrated web lecture is used in an online learning environment, instructors will be able to determine for which students this learning activity is appropriate. With further research on other learning activities, distance education practitioners will be able to reach the goal identified by Twigg (2001) of providing an individualized learning experience for each student, based on his or her specific characteristics, needs, and requirements. Furthermore, given that university agricultural education programs and university agricultural educators are often leaders in distance education, the focus of this study is of particular importance to the profession (Roberts & Dyer, 2003).

Purpose

Based on a review of the literature, a lack of research exists that explains the influence of learning styles and student demographics on student attitudes and achievement when an illustrated web lecture is used as a learning activity in a online-learning environment. With this knowledge, instructors could determine if using an illustrated web lecture is appropriate for the students enrolled in their courses. With further research on other distance learning activities and other context variables, instructors could reach the goal of designing an individualized learning environment for each student based on his or her characteristics.

The purpose of this study was to determine the influence of learning styles and student demographic variables on student achievement and attitudes when an illustrated web lecture is used as the learning activity in an online-learning environment. One null hypothesis was used to guide this research.

H₀: There is no difference in achievement and attitudes, for students of different learning styles in the presence of student demographic characteristics.

Methods/Procedures

This study is part of a larger study that used a causal-comparative design (Gall, Gall, & Borg, 2003). The independent variables were already present in the subjects of this study, and as such, random assignment and manipulation of variables was not achievable.

The population of this study was all students enrolled in the online sections of a University of Florida course, delivered using an illustrated web lecture. A purposive sample of 322 students was used. This sample was deemed to be representative of the population based on previous enrollments of this course.

The data collection period for this study was six weeks during the 2003 summer semester. Students from many academic disciplines were included in the sample. All data collection occurred using web-based forms. The instructor of the course administered the achievement post-test, which also served as the second examination in the course. Great effort was taken to integrate the data collection of this study with regular instructional activities of the course. To accomplish this, all instrumentation was linked from the course web page and was designed to appear as if it were a normal part of the course.

Learning styles were assessed using the Gregorc Style Delineator (Gregorc, 1982a). This instrument was chosen based on its ability to separate learners into four distinct learning styles and because of the ease in creating an electronic version of the instrument. These four styles are Concrete Sequential (CS), Concrete Random (CR), Abstract Sequential (AS), and Abstract Random (AR). Gregorc, (1982b) reported reliability coefficients of .92, .91, .92, and .92 for the CS, CR, AS, and AR constructs, respectively. Construct and predictive validity for this instrument was established and reported by Gregorc (1982b).

A researcher-developed instrument was used to gather demographic data. Face and content validity were determined by an expert panel of university faculty. Reliability was not an issue on this instrument. The questions did not elicit demands for considerable time, thought, nor variation and

therefore posed no reliability risks (Dillman, 2000).

The class instructor developed the achievement post-test. The researchers created a parallel form to use as the achievement pre-test. Ary, Jacobs, and Razavieh (2002) defined a parallel test as one that is as similar as possible in content, difficulty, length, and format. Both tests were evaluated for face validity by an expert panel of university agricultural educators. The instructor of the course evaluated the instruments for content validity. Post hoc reliability analysis yielded a Kuder-Richardson-20 score of .82.

The attitudinal instrument was adapted from Shih and Gamon (2001) and based on the work of Miller and Honeyman (1993). The instrument used 11 Likert-type items to assess student attitudes towards web-based instruction. Shih and Gamon reported acceptable content and face validity. Slight wording changes were made in this instrument to focus on an illustrated web lecture. Post-hoc reliability analysis yielded a Cronbach's alpha of .85.

Three reminder emails were sent to participants during the data collection process. Response rates were 83% for the demographics instrument, 73% for the achievement pre-test, 79% for the learning styles instrument, and 79% for the attitudinal instrument. The achievement post-test was administered face-to-face by the instructor, which allowed for a 100% response rate. Therefore, the generalizability of the findings of this study is limited.

Findings

Over half of the respondents in this study were female (59%). The average age of participants was 21.13 years old ($SD = 3.93$). Participants represented nine academic colleges at the University of Florida. The greatest percentage of the participants was from the College of Liberal Arts and Sciences ($n = 104$, 32.3%). Self reported grade point averages ranged from 1.95 to 4.0. The mean GPA was 3.17 ($SD = .52$).

The number of distance or online classes that participants have previously taken ranged from 0 to 15. The median number of

courses was 1.0. Almost 40% of the participants in this study ($n = 98$) had taken no previous online or distance education courses. Participants in this study were also asked to indicate their self-perceived computer proficiency on a scale from 0 to 100. Responses ranged from 5 to 100. The mean was 78.77 ($SD = 14.30$).

Nearly half of the participants ($n = 160$, 49.7%) were employed. Of the employed participants, 130 indicated that they worked from 5 to 70 hours per week. The mean hours worked per week was 27.97 ($SD = 12.14$). The median number of hours worked was 27.

Participants were categorized as CS, AS, AR, or CR, based on their highest score for each individual construct. Having equal scores in more than one learning style has been handled in numerous ways (Duncan, 1996; Ross, Drysdale, & Shulz, 2001; Ross & Schulz, 1999; Swearingen, 1998). Swearingen created multiple learning style categories, such as CS-AS. Other researchers, such as Ross et al., (2001), have used only the four learning styles of CS, AS, AR, and CR by allowing a computer to randomly assign a participant to one of the categories in which they tied. However, classification into one of the four learning styles was desired for this study. In doing so, a more methodical approach to breaking ties was used. For example, if a participant had equal scores in two learning styles, the highest score on the common component was used to break the tie (i.e., if a participant had equal scores for CS and AS, the scores from CR and AR would be examined. If the CR score was higher, the participant was classified as CS). If a participant had equal scores in constructs that had no common component, such as CS and AR, the participant was classified as having no dominant learning style.

The majority of participants were concrete in their learning style (Figure 2). Eighty-two participants (33.5%) were classified as Concrete Sequential learners. Sixty-two participants (25.3%) were classified as Concrete Random learners, 52 participants (21.2%) were classified as Abstract Random learners, and 38 participants (15.5%) were classified as Abstract Sequential learners. Eleven

participants (4.5%) were classified as having no dominant learning style.

Achievement was assessed using a pre-test and post-test. The maximum possible score for each assessment was 100. Achievement pre-test scores ranged from 15 to 75. The mean was 34.36 ($SD = 10.28$). Scores on the achievement post-test ranged

from 23 to 74. The mean score was 55.24 ($SD = 9.20$).

Participants expressed relatively favorable attitudes about the use of illustrated web lectures. Scores on the attitudinal instrument ranged from 15 to 55. The mean score was 39.24 ($SD = 8.44$). The possible range of scores was 11 to 55.

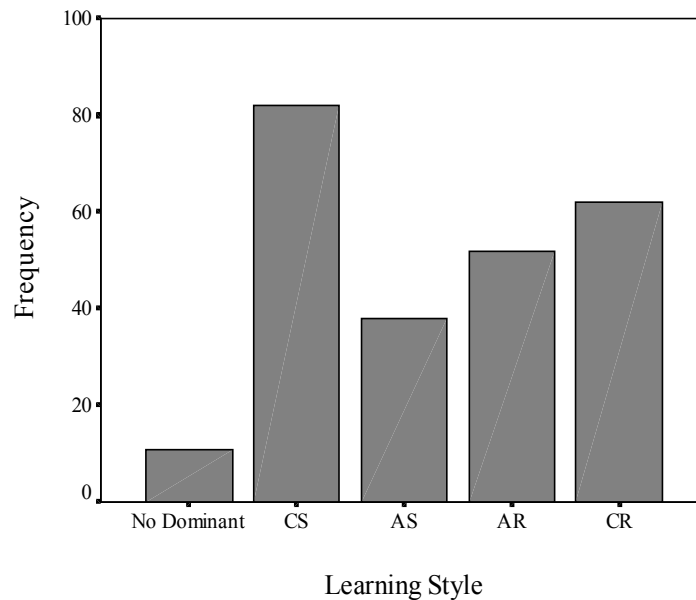


Figure 2. Distribution of Participant Learning Styles

Variables were examined for correlations prior to any inferential analysis. The magnitude of the correlations is discussed using terminology presented by Davis (1971). Correlations between .01 and .09 are negligible, correlations between .10 and .29 are low, correlations between .30 and .49 are moderate, correlations between .50 and .69 are substantial, correlations between .70 and .99 are very

high, and a correlation of 1.0 is perfect. Pearson correlations were used for continuous data and point biserial correlations were used for dichotomous data. As seen in Table 1, low correlations were found between computer proficiency and attitudes ($r = .210$), achievement pre-test and attitude ($r = .146$), and achievement pre-test and achievement post-test ($r = .256$).

Table 1
Correlation Between Variables

Variable	Attitude	Achievement Post-Test
Computer Proficiency	.201*	.040
GPA	.088	.077
Age	.035	.033
Previous Courses	.037	.026
Achievement Pre-Test Score	.146*	.256*
Gender ^a	.046 ^c	-.019 ^c
Employment ^b	-.099 ^c	-.051 ^c

^aFemales coded higher; ^bEmployment = Yes coded higher; ^cPoint Biserial Correlations
* $p < .05$

H₀: There is no difference in achievement and attitudes, for students of different learning styles in the presence of student demographic characteristics.

The MANCOVA procedure was used to test the hypothesis of no differences in achievement and attitudes. Attitudes and achievement post-test scores were the dependent variables. Learning style category was the independent variable, computer proficiency score and achievement pre-test score were covariates. Covariates were chosen based on their correlation with the dependent variables (Ary et al., 2002; Stevens, 1992).

Assumptions of the MANCOVA procedure were met; Box's M test ($p = .708$) and Levine's tests ($p = .489$ and $p = .512$) were not significant. No significant differences were found; Hotelling's T^2 for the effects of learning style on the dependent variables was 4.82, $F(8,430) = .890$, $p = .583$. The effect size was .011 and the power was .272. The null hypothesis was not rejected, indicating no differences in achievement and attitudes based upon learning styles.

Conclusions, Implications, and Recommendations

Based on the findings of this study, it was concluded that when an illustrated web lecture is used to deliver content, students of varying learning styles achieve at similar levels and have similar attitudes toward the learning activity. Previous studies that examined the influence of learning styles on achievement and attitudes have reported mixed findings (Daniel, 1999; Day et al., 1998; Freeman, 1995; Oxford et al., 1993).

Students with a dominant learning style of Abstract Random (AR) value relationships and interactions with others (Gregorc, 1982a). Likewise, students with a dominant learning style of Abstract Sequential (AS) thrive in an environment in which they can share their knowledge with others (Gregorc, 1982a). An illustrated web lecture is a learning activity that has no student-student interaction and only one-way student-instructor interaction. Given the lack of interaction in an illustrated web lecture, it was hypothesized that students with AR and AS learning styles would have

lower achievement and less favorable attitudes. However, no differences were observed. As reported earlier, the effects of learning styles are inconclusive in a distance-learning environment. The findings of the current study are consistent with previous studies that showed no differences (Day et al., 1998; Riddle, 1994; Shih & Gamon, 2001).

This phenomenon may be partially attributable to the condensed nature of summer courses. The course used in this study lasted only six weeks. Perhaps AR and AS students enrolled in this course with the attitude that "I can do anything for six weeks." Another possible explanation of this phenomenon is that the Gregorc Style Delineator indicates a student's "preferred" learning style (Gregorc, 1982a). Many students, especially students that have been academically successful, are adept at learning in many different ways. Although these students had preferred learning styles of AR and AS, they may have been accustomed to learning in ways that are inconsistent with their preferred learning style. As a result, no differences between students of varying learning styles were observed.

Based on the findings and conclusions of this study, several recommendations for practitioners were made. Because students of various learning styles achieve at similar levels and have similar attitudes toward an illustrated web lecture, instructors may choose to continue to use this learning activity to reach broad audiences of students. Based on the results of this study, there is apparently neither an advantage nor disadvantage to students based upon their learning style.

These findings and conclusions also lead to several recommendations for further research. The sample for this study was purposively selected. This study should be replicated using procedures that allow a higher degree of randomization and ultimately more generalizability. Additionally, in this study, an illustrated web lecture was used only to deliver course content in a food science area. It is recommended that this study be replicated

using other content areas as the foci. Perhaps in other content areas, influences of variables that were not influential in this study may prove to be of interest.

An illustrated web lecture is only one learning activity used to deliver content in a distance or online classes. This study should be replicated to see how learning styles and student demographics influence achievement and attitudes when other learning activities are used. Although learning styles were not influential for achievement and attitudes for an illustrated web lecture, they may be for other learning activities. Building the research base in this area will ultimately allow for high quality instruction that meets the needs of individual students.

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