Learning Styles and Students' Attitudes Toward the Use of Technology in Higher and Adult Education Classes

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Abstract

The purpose of this research was to examine students' attitudes toward the use of technology and to determine if attitudes toward the use of technology differ based on learning style. Lukow's Attitude Toward the Use of Technology Survey (ATUTS) measured attitudes toward the use of technology, and learning styles were measured using Kolb's Learning Style Inventory (LSI). The participants of the study were enrolled in Higher and Adult Education (HIAD) courses in the summer and fall semesters of 2004 in the Department of Leadership at The University of Memphis. A one-way analysis of variance (ANOVA) was used to determine if attitudes toward the use of technology differed for participants based on learning style. The results of the ANOVA showed no significant findings, which demonstrates that in the population for this study, no relationship existed between attitude toward the use of technology and learning style.

Introduction

Education today is faced with the challenge of adapting to an environment of ever increasing technological advances. The challenge for educators is to utilize this technology in ways that facilitate the highest level of learning outcomes. The educational community has growing concern about the effectiveness of technology such as CD-ROM, videotapes, multimedia presentation software, World Wide Web (WWW) discussion forums, and the Internet to meet the needs of students when utilized in the classroom (Lukow, 2002). Thus, it can be said that while technology use in the classroom is copious, improving learning through the application of this technology should remain the goal.

There are several issues that may arise when applying technology in the classroom. Among these are (a) choices about which technology to use (Bascelli, Johnson, Langhorst, & Stanley, 2002), (b) how effective technologies are in reinforcing learning (Grasha, 1996), and (c) technology's role in shifting from an instruction paradigm, which is teacher focused, to a learning paradigm, which is student focused (Van Dusen, 1997).

Shifting the classroom perspective from teachers to students must involve recognizing learning styles of students. Subsequently, teachers must adjust teaching

strategies to accommodate different styles. Given the amount of literature about how "learning style" is actually defined, the following definition addresses the role of the individual in learning. Learning style can be defined as the general tendency towards a particular learning approach displayed by an individual (Keefe & Ferrell, 1990; Robotham, 1999). In other words, students may prefer one approach to learning over other approaches.

If the goal of educators is to increase learning outcomes, addressing the issues involved in using technology in the classroom and accommodating student learning styles must be examined. Although there are studies addressing the issues of technology integration into the curriculum and the attitudes of students toward the technology being used, there is limited research that links these attitudes to individual learning styles (Lukow, 2002).

Problem Statement

The problem examined in this study is whether the attitudes toward the use of technology of students enrolled in Higher and Adult Education (hereafter referred to as HIAD) courses at the University of Memphis differ based on their learning style preference. Further, students' attitudes toward the use of technology in HIAD courses can offer insight into such questions as whether to use technology in the classroom. The results of this study will be generalizable to graduate students in Higher and Adult Education courses at the University of Memphis.

1.What are students' attitudes toward the use of technology in HIAD courses?
2.Do attitudes toward the use of technology in HIAD courses differ for Kolb's four categories of students' learning styles?

Purpose of the Study

The purposes of this study were to examine student attitudes toward the use of technology in higher and adult education courses and to specify any differences in attitudes based on students' learning styles. Further, this study adds to the research about the relationship between attitude and learning style. The findings of this study can be compared to and perhaps increase the generalizability of a study done by Jennifer Lukow in 2002 at Indiana University. Lukow (2002) contends, "If correlations are found between the learning styles of students and how these relate to their [students'] attitudes toward technology, then instructors may feel fairly confident that they can use such instruments to appropriately gauge how to approach teaching a course with reference to instructional technologies" (p. 4).

This study can also be useful in aiding the education community about the technology choices students prefer based on their use of these technologies, and which technologies are not preferred. Seeking appropriate technology choices based on

learning style will serve to produce more desirable learning outcomes. Teaching students based on their preferred learning style significantly increases their achievement level (Dunn, Deckinger, Withers, & Katzenstein, 1990). Thus, the use of technologies that match students' preferred style of learning may have a positive impact on educational outcomes.

Significance of the Study

Results of the study may contribute to the information available to educators about the use of technology in the classroom. Additionally, information about the importance of adjusting the use of technologies to accommodate the differences in learning style from student to student may be determined. There is a need for educators to understand students' attitudes toward the use of different types of technology as well as how these attitudes are related to their learning style. Determining the value of technology in the classroom is one of the most controversial issues challenging education today. Part of this challenge is understanding how technology lends itself to student learning.

Infusing technology into the curriculum can offer valuable lessons to educators as to what is appropriate in facilitating learning. Lessons learned when using technology in the classroom can be a) you can have too much technology in your classroom, b) technology can be intimidating if students have not been uniformly prepared prior to its use, c) students can be unforgiving if technology fails, d) in many instances, the process is more important than the product developed using technology, and e) technology can affect teaching style. Technology cannot teach, only teachers teach, and the tools for technology do not always enhance learning (Richards, 1999). Moreover, Richards suggests that it is necessary to continually reflect, evaluate, and adjust instruction when using technology (1999, p. 4).

In the last ten years, the World Wide Web and technology have become increasingly pervasive in higher education, yet little empirical evidence has been generated to demonstrate the connections between students' learning styles and the use of this technology. It is becoming increasingly clear that technology, in and of itself, does not directly change teaching or learning (Lukow, 2002). Rather, the critical element is how technology is incorporated into instruction. This integration of technology is so expansive across all areas of education that research is needed to explore the connections between its use and how students respond to its use in the classroom.

Literature Review

With technology advancing at an increasing rate, it is necessary to understand how it shapes or influences the learning process. As an ever-present component in higher education pedagogy, more empirical evidence is needed to demonstrate the

connections between students' preferences for learning and the use of this technology. The review of this literature will seek to a) explain four categories of learning styles as well as describe learning style, b) explore technology and its role in the classroom, and c) discuss students' attitudes toward technology.

Learning Styles

"Perhaps the most vital development in American education today is the concept of individual learner's preferences" (DeBello, 1990). This contention is widely supported by further study (Green & Parker, 1989; Kirkpatrick 1983; Miller & Rose, 1975) addressing the importance of learning style associated with learning outcomes. One particular way of organizing research on learning styles is that of Curry (1983). Curry's categorization of learning style research is analogous to the layers of an onion; each of these layers is a person's characteristics that make up "style" (p. 7). The four layers of this "onion" are described as a) instructional preferences, b) social interaction, c) information processing, and d) personality. For purposes of this study, the information processing models are examined.

Information Processing Models

Information processing models are those that assert the importance of understanding of how information is obtained, sorted, stored and utilized (Curry, 1983). One such model that emphasizes information processing as key to learning is Howard Gardner's Theory of Multiple Intelligences (1983). Gardner proposes that there are eight intelligences that describe the way in which people process information and names them in terms of the learner (Gardner & Hatch, 1989). The linguistic learner learns best by saying, hearing, and seeing. This type of learner likes to read, write, and tell stories; he/she is sensitive to the influence or words and languages on others. The logical/mathematical learner learns best by categorizing, classifying, and working with abstract patterns/ relationships. This type of learner also likes to do experiments, figure things out, work with numbers, ask questions, and explore patterns and relationships, and is good at math and logic.

The visual spatial learner learns best by visualizing, dreaming, using the "mind's eye", and working with colors/pictures. This type of learner likes to draw, build, design and create things, daydream, look at pictures/slides, watch movies, and play with machines. He/She is good at imagining things, sensing changes, mazes/puzzles, reading maps and charts.

The musical rhythmic learner learns best by rhythm, melody, and music. He or she is good at picking up sounds, remembering melodies, and keeping time. He or she also likes to sing or play an instrument. The bodily/kinesthetic learner learns best by touching, moving, and interacting with others, and is good at physical activities.

The interpersonal learner learns best by sharing, comparing, and relating. This type of learner processes the world outside herself/himself, and is comfortable is everyone else is comfortable. This type of learner is also good at understanding people, is good a leading others, and mediating conflicts. The intrapersonal learner learns best by working alone, likes individualized projects, and having their own space. This type of learner is self-attuned and is good at focusing inward on feelings and dreams. Also, this learner processes the world inside himself and talks only when necessary. The last of the eight types based on Howard Gardner's work is the naturalistic learner. This type of learner learns best by identifying and categorizing. The naturalistic learner also likes to organize, collect, sort and recognize based on appearance, texture, and sounds.

These multiple intelligences described by Gardner offer a framework for which the processing of information can be explained. These eight categories of learning styles can be applied to the processing of information from many sources, thus aiding educators in understanding that students are likely to process information in several ways. Another information processing model is that of Kolb (1984). Kolb's model and self-assessment are based on experiential learning theory that emphasizes the need of learner involvement in educational activities. Life experience is a major influence in how the learner obtains, sorts, stores, and utilizes information.

Kolb (1984) describes learning as a four-step process that includes a) concrete experience, b) reflective observations, c) abstract conceptualization, and d) active experimentation. Concrete experience is the feeling component of taking in information whereby learners involve themselves fully in the experience and then reflect on the experience. These reflective observations (watching) are where the learner is able to see a concrete experience from other perspectives. Next, engaging in abstract conceptualization (thinking) is where the learner creates "generalizations or principles that integrate their observations into sound theories" (p. 26). Finally, active experimentation (doing) is where the learner takes these theories and generalizations and tests what they have learned in new ways.

Kolb further states that knowledge "results from the combination of grasping experience, and transforming it" (p. 41). The grasping of information is taking in information. Kolb contends that some learners prefer to take in information through concrete experience, while others prefer to take in information through abstract conceptualization. The processing of information (transforming) occurs through reflective observation or active experimentation.

Kolb's theory is based on a model with two dimensions. The first dimension is "taking in" and runs vertically with "feeling" at the top, and "thinking" at the bottom. The second dimension is "transformation" or "information processing" and runs horizontally with "doing" on the left, and "watching" on the right. These four polar opposites are called learning modes. These learning modes are a) Concrete Experience,

b) Reflective Observation, c) Abstract Conceptualization, and d) Active Experimentation.

The intersection of the two dimensions results in the designation of the four learning styles. The theory asserts that each of us has a preference for comprehending and transforming, and the combination of these preferences is called our learning style. A learner who prefers concrete and reflective has a "diverging" learning style. A learner who prefers abstract and reflective has an "assimilating" learning style. A learner who prefers abstract and active has a "converging" learning style. A learner who prefers concrete and active has an "accommodating" learning style.

Learning Styles and Technology

The new axiom in the world of technology-enhanced learning is that teachers must allow content to drive technology and should be cautious not to let technology drive the content. The goal is to use tools that are appropriate to the needs of the learning experience (Gynn, 2001). There should always be good reason for including technology in the learning environment. Gynn points out that technology can be the tool that connects the student to knowledge, the student to other students, and the student to the teacher.

One of the questions that Gynn sought to answer was "How do we address learning styles?" She contends that to address the multiple learning styles in any classroom, the principles of sound pedagogy are at the forefront. One way to do this is to incorporate a variety of learning activities to accommodate different learning styles. This will help students expand their learning style experience. According to Gynn, it is also important to consider student access to and comfort with current technology and software packages. While comfort with using technology is separate from learning style, it affects learning, and making sure all students are comfortable with the technology is important in accommodating diverse learning styles, especially those taking online or distance education courses. Several studies were reviewed which elucidate the importance and/or implications of the usefulness of technology in regards to learning styles. These range from multimedia software to online distance education.

Montgomery (1995) conducted a study at the University of Michigan which investigated the issue addressing diverse learning styles through the use of multimedia. A survey of learning styles was conducted in a sophomore level introductory chemical engineering class with an enrollment of 143 students. Early in the semester, one class was devoted to the topic of learning styles. The author contends that one of the challenges of teaching engineering, or any other discipline, is trying to meet the needs of a variety of students (Montgomery, 1995). She asserts that this is particularly challenging in large classes, where the typical teaching mode is heavily dependent on lectures. One way to meet the needs of all the students individually is through the use

of educational software; specifically multi media based software, in meeting the diverse needs of learners.

Buerck, Malmstrom, and Peppers (2003) of St. Louis University conducted a study entitled "Learning Styles and Learning Environment." The study examined student success in an internet-based versus a lecture based computer science course. Success in the courses was determined by final grade and learning styles were assessed using David Kolb's Learning Style Inventory. Since many colleges and universities are increasingly using information technologies to enhance the learning environment, many institutions are offering internet-based online courses in an effort to meet the educational needs of a diverse student population. The authors' primary goal was to determine a relationship between students' preferred learning environment (online or face to face), and their learning style. Another goal was to determine if there were any differences in the academic success in the students in the face-to-face versus the online sections of a course.

The participants in the study were adults (22 years and older), non-traditional computer science students who were given the option of taking a face-to-face lecture-based course or an online Internet based course. The results of the study showed that computer science students in the face-to-face learning environment were more likely to have the assimilating learning style, whereas computer science students in the online course were more likely to have the converging learning style. Student academic success did not differ significantly because of learning environment selection.
In 1993, Gunawardena and Boverie adapted David Kolb's experimental learning theory and Learning Style Inventory, and studied the interaction between adult learning style and computer-mediated classes compared with non-equivalent traditional classes. Specifically, they focused on the interaction between learning styles and the media, methods of instruction, and group functioning in a distance learning class using audio and graphics. They found that learning styles do not affect how students interact with media and methods of instruction, but they do affect satisfaction with other learners, with Accommodating learners being the most satisfied and the Diverging learners being the least satisfied with class discussions and group activities.

Sein and Robey (1991) also used Kolb's LSI to study the interaction between learning style and usefulness of computer training methods. They concluded that Converger participants who combine active experimentation and abstract conceptualization perform better than participants with other learning styles do. This suggests that student learning outcomes when using computer application software may be affected by the learning style, regardless of the training methods. However, in an effort to seek the relationships between learning style preference and the effectiveness and acceptance of interactive video instruction, Larson (1992) found no significant differences between learning style groups and suggested that both effectiveness and satisfaction are independent of students' learning style preference. All

these studies provide information about different ways in which technology- enhanced learning takes place, and its significance in increasing learning. The implication is that the use of technology and technology-enhanced learning can and should be used in such a way as to engage students relative to their preference for the way in which they learn.

Methods

This study sought to examine the attitudes of students toward the use of technology in higher and adult education (HIAD) courses at the University of Memphis. Also, the study explored the differences in students' attitudes based on their individual learning styles. Attitudes toward the use of technology were measured using Lukow's Attitude Toward the Use of Technology Survey (ATUTS), and learning styles were measured using the Kolb Learning Style Inventory (LSI). This section of the study is organized as follows: arrangements for conducting the study, selection of the participants, instrumentation, data collection, and data analysis.

Students enrolled in the Department of Leadership at the University of Memphis were the population from which the participants were chosen. Specifically, all graduate courses offered in Higher and Adult (HIAD) education were the total population. This included all sections offered during the summer and fall semesters of 2004. Every course offered during these semesters was used due to the variance in amount of technology used in the classes. These courses included Master's and Doctoral students who were the focus of the study and only those who volunteered to participate were used as participants. Students who were enrolled in more than one of the offered classes were asked to participate in the study only one time.

Students enrolled in HIAD courses in the Department of Leadership received a packet of information that included: Study Information Sheet, the Kolb Learning Style Inventory, and the Attitude Toward the Use of Technology Survey. Each of the items in the packet contained a number written on the top right corner in order to ensure the responses of each student are kept together. Also, this ensured that the students responses to the LSI and the ATUTS be compared appropriately. The packets were distributed to the participants either at the beginning or the end of each class period. The information sheet included enough information about the study so that each participant could make an informed decision regarding whether they wished to participate in the study. The completion of both instruments took 15-20 minutes.

Data analysis was conducted using the information gathered on the Kolb Learning Style Inventory and the Attitude Toward the Use of Technology Survey. The instruments were checked to see if they were completed accurately. The first analysis of the data answered the research question: What are students' attitudes toward the use of technology in HIAD courses? The first analysis was a description of the data gathered

from the Attitude Toward the Use of Technology Survey. A similar descriptive analysis was used to describe the data from Kolb's LSI. In order to answer the research question, "Do attitudes toward the use of technology in HIAD courses differ for the four learning styles?" a one-way analysis of variance (ANOVA) was performed on the learning styles in order to discover any differences in respondent attitudes toward the use of technology. The dependent variable (DV) was attitude toward the use of technology. The independent variable (IV) was learning style that has four categories; Diverging, Accommodating, Assimilating, and Accommodating.

Results

A One-way Analysis of Variance (ANOVA) was used to examine whether students' attitudes toward the use of technology is a function of their learning style. The independent variable represented the four different learning styles (Diverging, Assimilating, Converging, and Accommodating). The dependent variable is attitude toward the use of technology (Range: -60 to +60). Table 1 entitled "Range of Attitude for Learning Style" identifies the means, standard deviations, and minimum and maximum attitude score for each of the four learning styles. Respondents with "Converging" learning style had the most favorable attitude toward the use of technology (M = 32.16). Respondents with a "Diverging" learning style had the lowest attitude toward the use of technology (M = 24.21).

Table 1
Range of Attitude for Learning Style

Learning Style	*f*	Mean	*SD*	Min.	Max.
Diverging	24	24.21	17.33	-14	54
Assimilating	41	24.90	12.91	-8	50
Converging	25	32.16	13.10	11	49
Accommodating	12	25.25	7.25	11	34

An alpha level of .05 was used for all analyses. The test for homogeneity of variance was not significant [*Levene* (3, 98) = 2.64, $p = .054$] indicating that this assumption underlying the application of ANOVA was met. The one-way ANOVA of students' attitudes toward technology revealed a statistically non-significant main effect [F (3, 98) = 1.88, $p = .139$] indicating that the four groups (learning styles) did not differ in their attitude toward technology (see Table 2).

Table 2
Analysis of Variance for Learning Style

Source	*SS*	*df*	*MS*	*F*	*p*
Between	1049.97	3	349.99	1.88	.139
Within	18281.18	98	186.54		
Total	19331.15	101			

Discussion

This study was conducted to determine if a relationship existed between students' learning styles and their attitude toward the use of technology. In order to identify any differences among learning styles with relation to the Total Attitude Score, a one-way ANOVA was conducted. The results of the ANOVA showed no significant results. This demonstrates that there is no relationship between attitude toward the use of technology and students' preferred learning style. Further, the non-significant results support Lukow's (2002) contention that no matter how a student prefers to learn, the students may have been previously exposed to sufficient levels of technology, and have developed their attitude toward technology long before they entered the Higher and Adult Education program. This may be true particularly with this sample given the age

range of the respondents. A total of 52% of the respondents were in the age category of 21-35 years of age.

Another possible explanation for the non-significant results of this ANOVA is that the Higher and Adult Education program may attract students who are already similar in their attitudes toward technology, and their learning style. This possibility implies the need for more research to be done in order to clarify the results.
For future research, this study should be replicated with a different population. Lukow's (2002) study showed no significant results with undergraduate students in recreation courses, and this study showed no significant results in regard to graduate students. Perhaps a study should be done using another graduate population with different characteristics.

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