An ANOVA Analysis Of The Relationships Between Business Students' Learning Styles And Effectiveness Of Web Based Instruction

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ABSTRACT

Web based learning situations have been dramatically increasing with online books, and study guides, along with courses offered from primary school to graduate school in the form of hybrid courses (part live lectures, part web based learning), televised courses, courses offered entirely online, and even entire online degree programs (Serce & Yildirim, 2006; Jara, Candelas et al, 2009). It is the technological innovations and user interaction possibilities provided by the web based learning environment that have many individuals believing that the Web is an excellent medium for enhancing learning, due to its ability to adjust to individual student learning styles and preferences. Because of the web based learning environment's ability to adjust to individual student learning styles and preferences, one would assume that the variation in individual students learning styles would be a significant factor in instructional design. The concept of individual student learning styles, however, is subject to debate among instructional design professionals. This article first describes the theoretical base for concern for the students' learning styles when designing web based instruction. If there is any utility to the learning styles construct for Web Based Instruction (WBI); one would expect differential performance on WBI, or at least differential preference for the WBI experience. Thus, this study was intended to investigate the possible impact of learning style on student performance in a web based learning environment. Specifically, students in the course Taxes and Personal Finance with different learning styles, as measured by Kolb's Learning Styles Inventory (LSI-IIa), were randomly assigned to one of two web based instruction modules that differed only in terms of their number of enhancements and user interaction options. The success of the different instruction modules was measured by an online test over the material presented in the modules and the student satisfaction with the instruction modules was determined by an online survey assessing the participants' reactions to the modules. The major research question is whether the students' different learning styles impacted the learning of the materials in the web based instruction modules was assessed with respect to the students' final grade in the lecture course. This study found that neither student learning style nor online course module version had any impact on mean test score or on the students' reaction to the online module. In addition, the four learning styles were found not to be related to the students' overall performance in the lecture course. The results analyzed by ANOVA analysis, and after presenting the results, the implications of the results of this are discussed.

Keywords: ANOVA, Kolb's Experiential Learning Theory, Learning Styles, Web Based Instruction

INTRODUCTION

In order to improve a student's learning experience in a college or university course, the instructional design of most courses needs to be improved. A fundamental question in course (instructional) design is to what extent should the students' learning styles be considered when designing a course? Yet, among instructional design professionals, the concept of individual learning styles is subject to debate.

The concept of individual learning styles holds that the individual's learning style predisposes them to acquire and process new information in unique ways. Those instructional design professionals who subscribe to the concept of individual learning styles believe that a fundamental tenet of instructional design is that learning

experiences should be developed to take individual learning styles into account (James, 2001). There are other instructional design professionals who believe that the construct of learning styles, the notion that all people do not take in and process knowledge the same way, offers little utility for the task of instructional design (Merrill, Drake, Lacy, & Pratt, 1998). With the advent of multimedia learning technology, especially web based instruction (WBI), this debate seems to have intensified. The technological innovations and user interaction possibilities provided by the web and web based course development programs, such as "Blackboard"®, "Course in a Box"®, "Desired to Learn"®, and "ECollege"®, has made it easier to design courses that adjust to individual learning styles and preferences. It is this ability to adjust to individual learning styles and preferences which has many instructional designers believing that WBI is an excellent medium for enhancing learning, and preferences is often listed as one of the primary assets of WBI (Dulworth, 1996; Tyler & Baylen, 1998; Williams, 1998).

At this time much of the design of WBI is based on intuition and the new technological possibilities of the web and web based course development programs. There is, however, a growing body of solid empirical research, and the literature on "best practices" instructional design that have resulted from experimentation (McIntyre, 1997; Williams, 1998; Ellis, Hughes, Weyers & Riding, 2009; McCracken, 2009). The issue of individual learning styles and WBI has not received much attention in the research literature. To the extent that learning styles differ, there may be implications for WBI and how programs should be designed to take advantage of these differences. This study was to begin filling this knowledge gap. Specifically, this study addressed the following question: Will the individual learning styles of students be predictive of learning success from either of two WBI environments? A second question is whether the participants' learning styles would predict their scores on a likeability survey of how well they liked their WBI learning experience, regardless of how they performed on a final post test?

KOLB'S EXPERIENTIAL LEARNING THEORY

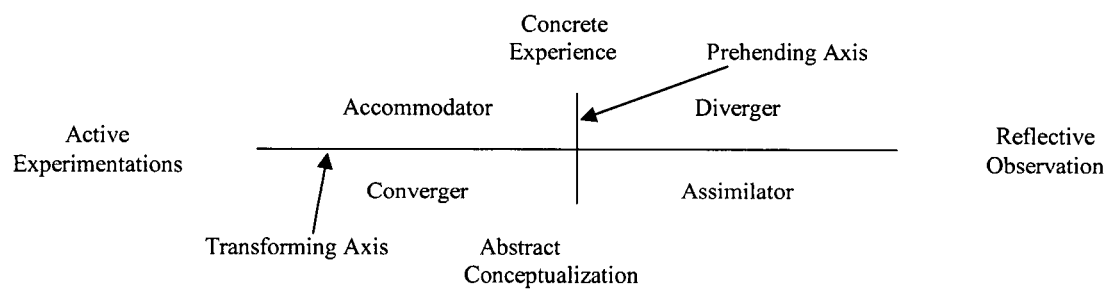
Most of the experiential learning theories are based on the construct of learning styles was developed by David Kolb (1984). Kolb's learning style construct describe learning styles as a person's normal way of thinking, problem solving, and remembering information. Theoretically this construct should be useful for predicting the methods and strategies that would be most effective for a particular person in a given learning task (Kearsley, 1994; Claxton & Murrell, 1987). Kolb states that there are two necessary processes for learning to take place, prehending and transforming. Prehending is the way a learner takes in information. Some individuals prefer to grasp information and experience in concrete ways, while other individuals prefer to use abstract methods. The transforming dimension pertains to how learners process or transforms the experience into useful knowledge. In Kolb's experiential learning theory some learners rely on reflection, looking at the information as it is, whereas others use active experimentation, changing the experience to fit their thinking (Claxton & Murrell, 1987; Kolb, 1984; Murrell & Murrell, 1997).

According to Kolb, these two dimensions are labeled as "learning modes" and comprise the vertical and horizontal axis in FIGURE 1. In the prehending dimension individuals learn by use of concrete experience or abstract conceptualization. Individuals who prefer concrete experience learn from their experiences and deal with situations in a personal manner and emphasize the feelings of the learner over thinking. Other individuals who use abstract conceptualization learn by thinking and the logical analysis of the ideas by relying on an intellectual understanding of the material. The transforming dimension is the horizontal axis. In transforming information, individuals rely on either reflective observation or active experimentation. Those individuals relying on reflective observation first observes the material carefully and then reflects on those observations before making any judgments, thus, they emphasize understanding rather than practical application. While the individuals at the active experimentation end of the transformation dimension learn by doing, thereby actively influencing people and changing situations, with an emphasis on practical applications rather than reflective understanding. These individuals have the ability to get things done while taking risks (Kolb, 1984; Kolb, 1999; Murrell & Murrell, 1997).

Kolb observed that there is a difference in the learners' preferences for different combinations of prehending and transforming information. The two axis, prehending and transforming, creates four quadrants depicted in Figure 1. Depending upon which quadrant (learning style) individuals fall into, Kolb labeled them as "Assimilators," "Divergers," "Convergers," and "Accommodators". Each of these styles is associated with a preferred approach to learning (Kolb, 1984; Murrell & Murrell, 1997; Stice, 1987). "Accommodators" focus on

doing tasks, making plans, and having new experiences. When a theory does not seem to fit, this type of learner quickly discards it. Accommodative learners rely on other people for information, rather than their own analytical ability. Another classification of learners is "divergers" who posses a strong imaginative ability and awareness of meaning and values. These learners view concrete situations from many perspectives, emphasizing adaptation through observation rather than action. The third type of learners, as classified by Kolb, are "convergers" who employ strategies of problem solving, decision making, and the practical application of ideas. They move quickly to find the one correct answer, and thus are best in situations where there is one correct solution. These learners organize their knowledge in a way such that it can focus on specific problems, and they prefer technical tasks rather than dealing with the social or personal side of things. Finally, the fourth types of learners, as described by Kolb are "assimilators". The individuals classified as "assimilators" are more concerned with abstract concepts and ideas and process their observations into an integrated explanation. They are interested in taking the learning experience and seeing it in the context of a larger framework of ideas and experiences. (Claxton & Murrell, 1987; Kolb, 1984).

Figure 1: Kolb's Experiential Learning Modes And Styles



Adapted from Kolb (1984) **Experiential Learning: Experience As The Source Of Learning And Development**

In 1976, Kolb developed the Learning Style Inventory (LSI), which was designed as a self-assessment test to measure learners' preferred learning modes, and consequently their learning styles. The third version of this 12-statement inventory, the Learning Styles Inventory Ila (LSI-IIa) (Kolb, 1992), has been refined so it demonstrates acceptable reliabilities and other psychometric properties and was suitable for investigations evaluating learning styles (Veres, Sims, & Locklear, 1991). The LSI-IIa is available in a physical form and an electronic on the web (Kolb, 1992).

Under what is labeled as the "matching hypothesis" learning is optimized when the instructional design is matched with the strengths of the student's learning style (Clariana, 1997; MacNeil, 1980). Thus, the determination of whether people with different learning styles actually behave differently in various types of learning situations is vitally important. A list of instructional approaches that relate to the learning mode preferences of the four learning styles identified by the LSI was intuitively derived by Murrell and Claxton (1987). In their list Murrell and Claxton stated their belief that students who show a preference for the abstract conceptualization mode (convergers and assimilators) would prefer the lecture format of instruction, whereas, divergers and accommodators (those who prefer the concrete experience mode) would prefer demonstrations. Ash (1986) advocates that trainers should use a method of instruction matched to learner's cognitive style as a result of his literature review so employees in business organizations could be more effectively trained. Ash's findings were at odds with studies by Trout and Crawley (1985) and Hodges and Evans (1983), which found only minimal support for the benefits of presenting information in a way that matched students' learning styles. In their study Trout and Crawley (1985) examined the benefits of matching instructional strategies with the learning needs of ninth grade physical science students. Results of the Trout and Crawley study showed that with use of teaching methods that complemented the students' characteristics, the students' attitudes toward science improved, however, the students' achievement levels did not improve. Hodges and Evans (1983) examined matching three instructional strategies, verbal instruction, visual instruction, and a combination of the two learning styles, defined in terms of verbal versus visual preference, of a group of juvenile delinquents. There was minimal evidence that, for only visual learners, the matching instruction to learning style improved achievement. Overall the result of these two studies revealed positive effects in terms of

students' attitudes toward learning, but showed little or no overall improvement in terms of academic performance. While none of these studies was conducted in the WBI format, one could conclude that the WBI capability for allowing individuals to customize the WBI environment to suit individual learning styles and preferences may not necessarily improve the learning process. On the other hand, the result of these studies do not imply that Kolb's learning styles theory may not be a factor in who benefits the most from the WBI, as opposed to some other learning environment, or a preference for the WBI environment. It is the purpose of this study to provide some evidence on two issues: 1) do people with different learning styles, as measured by the LSI-IIa, perform differentially in the WBI environment? And 2) do people with different learning styles perform differentially when presented with WBI modules that vary with respect to the amount of multimedia enhancements and interactions they contain? Before conducting this study, it would seem logical to predict that accommodators, who prefer concrete experience and active experimentation, would perform best on a WBI environment that provides more opportunities for interacting with the course content.

In Kolb's Experiential Learning Theory learning styles were expressed in terms of preferences. While individuals with different learning styles may not perform better in various learning environments, it is possible that they would prefer particular learning environments to others. Thus, an individual's preference for or comfort with various instructional designs becomes an issue. This issue was examined in this study for the WBI environment by obtaining the students' reaction data that expressed their degree of likeability for the two WBI modules. While the primary objective of this study was to examine whether students with different learning styles perform differentially and preferred a WBI format, it also looked at the performance of students with different learning styles in a traditional lecture-based learning environment. According to Murrell and Claxton's (1987) list of methods and strategies that would be most effective for a particular person in a given learning task, Convergers and Assimilators would perform better in traditional lecture-based learning environment. The results of this part of the study would provide evidence on the predictive validity of Kolb's Learning Style Inventory (LSI).

METHODOLOGY

Participants in this study were undergraduate students in four sections of Taxes and Personal Finance in the Lubar School of Business at the University of Wisconsin-Milwaukee (enrollment about 25,000 students), public comprehensive university (Carnegie classification: Doctoral, Research Intensive). The class, Taxes and Personal Finance is an open elective course, offered to sophomores, juniors, and seniors. As a part of the course the students were required to use a web based instructional module on "Estate Planning." Volunteers were solicited from these four sections by offering extra course credit to those who were willing to complete the LSI-IIa prior to working with the web based module. A total of 178 students completed the LSI-IIa, and 159 of these went on to complete the course module and post-course survey. The remaining students had either dropped the course, or were not attending class on a regular basis. The following information was collected on each of these participants:

- Preferred learning style from LSI-IIa
- ACT Composite Score
- Total combined score on three in-class examinations (n = 159)
- Ethnicity
- Gender (self-reported from reaction survey)
- Score on online test
- Time spent on online module
- Score on seven questions in a subsequent in-class exam that also appeared on the online test (M = 123)
- Responses on post-course reaction survey.

Of the 159 participants who completed the web program component of the study, 81 participants (30 males and 51 females) completed the text version, and 78 participants (28 males and 49 females) completed the enhanced version that contained multimedia components.

Two web based instruction modules were created using POWERPOINT for students in the course Taxes and Personal Finance with different learning styles. Each module was placed in separate Desire-To-Learn (D2L)

files with access only available to those students assigned to it. The two versions of the web based instruction modules contained the same content as presented in the in-class lecture, and differed only in terms of their number of enhancements and user interaction options. One of the web modules contained information in a text-only format and the other provided the same text, but enhanced with some of the multimedia and interactive components for which WBI is lauded (e.g., drag-and-drops, games[1], hyperlinks, options to connect with links for further information of the topic contain in each frame, pictures, pop-up elaborations,)[2]. In each module, every frame of the POWERPOINT presentations contained a question at the top in blue type, and the answer to the question, in black type at the bottom in order to focus the students' attention on the content. At the end of each module, the students were directed to the same 20-item multiple-choice online test that covered the same basic information contained in the module, and without test information appearing in the enhancements. The test was given using the D2L quiz function. After all the students completed the test, two post-module online surveys, with 14 questions each, were designed to assess students' reaction to the module they were assigned was given to the 159 participants. The proper version of the surveys was sent to the students assigned to the module utilizing the D2L survey function. In each version of the surveys, the questions were broken into three sections: 1) measurement of the students' reaction to the module in general (eight questions); 2) pertained to the multimedia components (four questions); and 3) the remaining two questions provided students the opportunity to describe the parts of the programs they liked and did not like, as well as any changes they would make to the programs. The students assigned to the enhanced module were asked how helpful the students thought those components were. Those in the text-only module were asked how helpful they felt specific multimedia might have benefited them had it been presented.

RESULTS

Learning Styles

Table 1 presents the distribution of learning styles among the participants who completed both the LSI-IIa and one of the online modules. There were 159 participants who completed the online program component of the study; 81 participants completed the text version, and 78 participants completed the enhanced version. The Converger learning style had the smallest number of participants (n = 17), though for all learning styles, participants in each WBI module were balanced.

Table 1: Number And Percentage Of Participants By Learning Style (*N* = 159)

	Learning Style				
	Accommodator	**Diverger**	**Converger**	**Assimilator**	**Total**
MALES	10 (6.3%)	15 (9.4%)	9 (5.7%)	25 (15.7%)	59 (37.1%)
FEMALES	21 (13.2%)	36 (22.6%)	8 (5.0%)	35 (22.0%)	100 (62.9%)
TOTAL	31 (19.5%)	51 (32.1%)	17 (10.7%)	60 (37.7%)	159 (100%)

As a check on the random assignment, a 2 (type of online module) x 4 (learning style) factorial ANOVA was performed to examine the relationship between these factors and ACT composite score. Results showed no significant effects, indicating that ACT composite scores of participants who received the text version of the program were not different from the ACT scores of those who received the enhanced version. A 2 (type of online module) x 4 (learning style) ANOVA was performed to examine these factors and total in-class examination scores; again, no significant effects were found.

[1] The games were fact cards, flash cards, pick a letter, fill in the blank, matching, crossword puzzles, practice quizzes (multiple choice), challenge (like the game show "Jeopardy" for one or two players), and glossary. StudyMate® was the device used to construct the games.

[2] These links access various forms and instructions needed to complete an estate tax return on the IRS' website at www.irs.gov, information from the Department of the Treasury's **Statistics of Income**, and additional POWERPOINT® presentations containing further explanations. These additional sources were also made available to the in-class students not taking part in this study.

Test Item Analysis

A test item analysis was preformed in order to evaluate the ability of the online questions to discriminate among students. This was performed by Desire-To-Learn.[3] The discrimination power of each question was shown through the percentages of students who answered an item correctly. Those items answered correctly by more than 90 percent of students indicate a reduced power to discriminate (Kehoe, 1995). Five items fell into this category and were eliminated for the analyses. The mean correct response rate to the 15 remaining test items was 68.70 percent *(SD* = 18.84).

Online Test Score Analysis

Initial analyses indicated that there were no significant interaction effects involving gender or ethnicity for any of the variables of interest, i.e., type of module, learning style, etc. Therefore, the analyses that follow are based on the entire study group. A two-way ANOVA was performed to examine the effect of the type of online program, the effect of learning style, and the interaction of these two factors on online test score. There was no significant effect of type of program F(1, 137) = .886, $p > .05$. Although students in the enhanced program (M = 71.47 percent) did slightly better than those in the text-only program (M = 66.60 percent), the effect size of .25 was small. Furthermore, the mean test scores for the four learning styles were not significantly different from one another $F(3, 137) = .653$, $p > .05$. The interaction of program type and learning style was also non-significant, $F(3, 137) = .327$, $p > .05$. The ANOVA table and means for this analysis is shown in Table 2.

Table 2: Analysis Of Variance For ACT Composite And In-Class Exams By Program And Learning Style

Source	df	F
ACT Composite		
Program	1	.011
Style	3	1.233
Program x Style	3	.183
Error	133	
In-Class Exam		
Program	1	
Style	3	
Program x Style	3	
Error	118	

Student Reaction

Participants' reactions to the online modules were measured using an eight question Likert-type scale with questions pertaining to the likeability of the program on a scale of 1 (Did Not Like) to 4 (Liked Very Much). The average scores on the post-course survey are found in Table 3. The Cronbach's alpha test was performed to determine whether items in this scale met the standards for reliability, resulting in an alpha of .79 for the eight-item scale, which is in the acceptable range for reliability (Nunnally & Bernstein, 1994). The mean overall score on the reaction survey was 21.47 *(SD* = 4.60) and a 2 (program) x 4 (learning style) ANOVA was performed on these items and it failed to show significant effects on likeability (see Table 3). The scores from participants in the text-only module *(M* = 21.15) were not significantly different from the reaction scores of participants in the enhanced group *(M*= 21.85). This study also tested the students' reactions to the use of, or possible need for, different multimedia components within the online modules. Since the text only module had no multimedia components in their module, these students were shown the multimedia and asked to determine on a scale from 1 (not helpful) to 4 (very helpful) how helpful they felt those components could have been for them, if they had been included. Students assigned to the enhanced module were asked how helpful it was for them, and a one-way ANOVA was performed to examine

[3] The analysis of the percent of students answering each question by accessing the quiz function, then clicking on the quiz grade, clicking on stats, and when the next screen pops up, click on question statistics. After these steps, the author accessed a screen showing the question number and the percentage of students answering each question correctly.

the effect of learning style on the helpfulness ratings of each multimedia component. When comparing the response of the students in each module, there was no significant relationship found for animations (Text—$F(3, 59) = .403$, $p > .05$, Enhanced—($F(3, 48) = 1.174$, $p > .05$); drag and drop options (Text—$F(3, 26) = .382$, $p > .05$, Enhanced—($F(3, 24) = 1.519$, $p > .05$); link boxes (Text—$F(3, 55) = .752$, $p > .05$, Enhanced—($F(3,47) = .918$, $p > .05$); or images (Text—$F(3, 52) = .568$, $p > .05$, Enhanced—($F(3, 48) = 1.617$, $p > .05$). A significant correlation was found between online test score and likeability score, $r = .226$, $p < .05$, indicating that participants with higher scores on their online test had higher likeability scores. Comparisons of the average amount of time spent in each module were made to determine whether the enhanced module engaged learners to spend more time in their module than the text-only version did in their module. Surprisingly, the students who received the enhanced version of the web program (M = 59.32 minutes) did not take significantly more time than students who received the text-only version (M = 50.49 minutes), $t(147) = -1.09$, $p > .05$. The effect size of 0.179 indicates that the effect of the type of module on the amount of time spent was small.

Table 3: Analysis Of Variance For Reactions Survey Scores By Program And Learning Style

Source	df	F
Program	1	.006
Style	3	.352
Program x Style	3	.601
Error	132	

Learning Style and Performance in the Lecture Course

Although 159 participants completed the LSI-IIa and one of the web modules, 33 students did not complete all three of the examinations that were given in class during the semester. The preferred learning styles of the 126 students remaining were distributed as follows: 28 Accommodators, 32 Divergers, 17 Convergers, and 49 Assimilators. Despite prior expectations, the results of a one-way ANOVA indicated that there was no significant effect on in-class exam score due to learning style, $F(3, 125) = 2.133$, $p > .05$, indicating that each of the four groups performed equally well when exposed to the lecture-only teaching format. It was also expected before the study to find a positive correlation ($r = .51$, $p < .001$, $n = 126$) between the ACT composite score and the total grade on the three one- hour exams. The results of a one-way ANOVA, however, after examining the effect of the participants learning style on ACT composite score indicated that there were no significant differences in average ACT composite score among the students exhibiting the four types of learning style ($F(3, 140) = 1.210$, $p > .05$). The ACT scores and in-class exam scores for participants are shown in Table 4.

The expected relationship between online test scores and the combined test score for the three in-class hour-exams was found to be significant, $r = .372$, $p < .001$, $n = 126$. The students who scored highly on the online test also tended to have higher combined hour-exam scores. This study also examined the more long-term effects of learning from the web programs. On their last in-class hour-exam, one class section of students (n = 123) was given an exam that contained seven questions used in their online test and were also subsequently included in their last in-class hour-exam, offering an opportunity to assess the degree to which learners retained the learned information over time. Of the 126 students who completed all three examinations, three participants did not answer those seven questions on the final exam, and thus were excluded from this analysis. A 2 (type of online program) x 4 (learning style) ANOVA was conducted to determine if there were any differences in the number of items missed. There were no significant effects of type of program ($F(1, 115) = 2.348$, $p > .05$), learning style ($F(3, 115) = 3.263$, $p > .05$), or the interaction of these two factors ($F(3, 115) = .297$, $p > .05$).

Table 4: Mean Scores For Those Who Completed The LSI And The Web Program ($N = 159$)

	ACT Composite	In-Class exam score (out of 150 points)
Males ($n = 63$)	22.53	96.88
Females ($n = 96$)	20.79	87.71
Total	21.48	91.28
Text version (n = 81)	21.34	92.54
Enhanced version ($n = 78$)	21.44	91.37
Total	21.39	92.02

Utility of Kolb's Learning Styles as a Construct

If there is any utility to the learning styles construct for WBI one would expect differential performance on WBI, or at least differential preference for the WBI experience. In measuring the efficiency of the learning styles construct, individual variations in style did not appear to have any predictive value for test performance on either the text-only or the enhanced versions of the online module or in a lecture class. Web based course development platforms, such as "Blackboard"®, "Course in a Box"®, "Desired to Learn"®, and "ECollege"®, has made it easier to design courses that adjust to individual learning styles and preferences. Despite which web based instructional platform is used, many professors use an integrate presentation software, such as Microsoft POWERPOINT® (Yi & Hwang, 2003). One sharply worded criticism of web base learning platforms and integrated presentation software was offered by Tufte (2006) which stated that "the core ideas of teaching are contrary to the cognitive style dimension of POWERPOINT, explanation, reasoning, finding things out, questioning, content, and evidence."

In terms of students' enjoyment of the online modules, there were also no significant effects of learning style. In regards to the type of lecture and online modules used in this study, the findings lead to two conclusions: 1) no particular learning style gives a learner an advantage in the lecture or WBI environment, and 2) the first conclusion holds for WBI even when the online course contains opportunities for interacting with the material. Thus, the findings of Hodges and Evans (1983) and Trout and Crawley (1985) concerning the predictive utility of the learning styles construct are given additional support by the results of this study. Learning styles, as presented by Kolb, are described in terms of preferences, although many researchers have made the assumption that preferences are somehow related to learning performance (Ash, 1986; Clariana, 1997; MacNeil, 1980). It is entirely possible, however, that any style preferences are made moot by extensive experience with certain forms of learning, such as that acquired through 13 years of schooling by the students who were successful enough to go on to college (i.e., the research sample). In effect, the students may develop learning strategies that allow them to learn in environments that do not necessarily reflect their particular learning style preferences. Thus, when the students are presented with learning situations in which they must take in and process information in a certain way, it is possible that these students' preferences are not important determinants of outcome. Stated another way, preferring one style may not mean that an individual is "not good at" other styles.

By finding that there is no relationship between learning style and ACT score, this study shows that the learning style construct does not seem to be related to cognitive ability. In addition, this finding may indicate that learning style preferences are not serving as proxies for intelligence, an attribute that did, indeed, predict performance on both online course modules, as well as the lecture course. It seems that the lack of significant findings that any impact of learning style suggests that web based instruction, at least, as designed for the study provides a learning environment in which students with varying learning styles learn at comparable levels. Some may say that the lack of significant findings leads to the conclusion that learning styles are irrelevant to WBI. The absence of any relationships for either WBI module places an obligation on the adherents of individualizing WBI to demonstrate the efficacy of WBI designs that accommodate various learning styles and preferences.

From Kolb's discussion of the transforming dimension in his model, as well as Claxton and Murrell's (1987) list of instructional approaches that people with various learning styles should prefer, the inference could be made that "doers" should benefit from, or at least more strongly prefer, learning contexts that involve more interaction with the material. Based on Kolb's discussion and Claxton and Murrell's (1987) list of instructional approaches that people with various learning styles should prefer, Divergers and Accommodators should have performed better on, or at least preferred, the enhanced module. The results, however, did not support this inference. It is possible that regardless of their preferred learning styles, motivation of the students was not high enough to engage the course enhancements, and such a statement may be made based on the fact that the average time devoted to the two modules was about equal. Since the class, Taxes and Personal Finance, is an open elective course, available to sophomore through seniors and was not part of any major or minor, perhaps, the "doers" were not interested in "doing." It is not known if the course was part of a major or a minor, the students in the enhanced module may have spent more time with the enhancements and performed better on the online post test. However, this interpretation does not explain the findings for the lecture course performance, for which this study again found no effect of learning style. The fact that learning style was not a moderator in any of the three learning conditions (two online modules and a lecture course) casts some suspicion on its practical utility as a construct.

Text-Only Versus Enhanced Training Modules

One result of this research study was that the students performed equally well on the two versions of online module, and they appeared to like the modules about equally well. Their comparable performance on the tests indicates that the text content of the program is what the students focused on; the presence of multimedia options did not appear to encourage the students to engage in the learning task more or improve their learning of the content. The common complaint from the students was that text-only web programs are boring may have more to do with the amount of text on the POWERPOINT® frames than it does with any lack of "sizzle." In both WBI modules, the amount of text per frame was kept to a minimum, and this smaller "chunking" of information may make the WBI experience more effective and more palatable and could be related to the comparable performance on the two versions. Also, the main points in the text were focused for the learner by an initial question at the top of the frame. While this study was an exploratory one, the finding that the two WBI versions produced comparable outcomes may indicate that WBI designers might devote more research into understanding the learning contexts for which "flashy" multimedia options are an important part of instructional design for WBI programs. User-content interaction strategies are important for learning success in WBI and should be put to the empirical test, especially when the focus is on knowledge, as opposed to skill, acquisition.

SUMMARY AND CONCLUSIONS

The current research provides additional support for those who question the utility of the learning style/instructional design "matching hypothesis." It also provides some findings that, upon further investigation, could lead to changes in commonly held ideas and opinions about the design and implementation of WBI. It appears that designing programs specifically to meet the preferences for each student may not be necessary to improve his or her performance levels. The use of multimedia enhancements not only showed little effect on overall performance, but also showed few differences in likeability. Clearly, there may be a place for multimedia options to enhance learning, and the current findings provide some initial insights into this important arena. Much more research is needed, however, to specify the conditions under which any such facilitation would take place. With the increased use of the web as a teaching and learning tool, further identification of those factors that should or should not be considered when designing such programs will help in achieving that end.

AUTHOR INFORMATION

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