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Are Learning Styles a Good Predictor for Integrating Instructional Technology Into a Curriculum?

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Abstract: The purpose of this study was to explore the relationship between learning styles and students' attitudes towards the use of technology in a leisure study curriculum. All 422 subjects completed the Kolb learning style inventory (LSI) and a computer attitudes survey (CAS) developed by the authors. The LSI is a standardized assessment utilized to identify differences among individual learning styles and corresponding learning environments. The CAS measured students' attitudes towards the use of technology. Multiple regression analysis, used to distinguish whether attitude toward technology could be predicted by gender, class standing, major concentration, and learning style, showed no significant difference. Results supported the literature regarding the steady increase in the use of electronic mail and the Internet by students in higher education.

Keywords: Instructional Technology, Learning Styles, Kolb Learning Style Inventory

I. Introduction.

It has been widely documented and recognized that student success in the classroom depends not only on the intellectual abilities, skills, and talents of the student, but also on the student's learning style (Kolb, 1984). Learning styles are an important variable in processing cognitive information (Davidson, 1990; Kolb, 1984; Rasmussen & Davidson-Shivers, 1998). More specifically, learning styles refers to how individuals learn in terms of their perceptions, processes, and preferences (Kolb, 1984). They are "a cluster of psychological traits that determine how a person perceives, interacts with, and responds emotionally to learning environments" (Heinich, Molenda, Russell, & Smaldino, 1999, p. 406).

Over the years, educators have recognized the importance of learning styles for students as well as teachers and have incorporated a variety of teaching and learning methods and strategies in their pedagogy (Ronchetto, Buckles, Barath, & Perry, 1992; Wynd & Bozman, 1996). Moreover, the 21st Century brings to the classroom a vast array of technologies including CD-ROM, videotapes, multimedia presentation software, world wide web (www) discussion forums, and the Internet. The main role of instructional technologies in higher education is to further effective learning methods and teaching pedagogies in ways that are not possible by using traditional classroom methodologies. With this increase in instructional technologies and the integration of instructional technology into the curriculum, there has been a growing concern among educators regarding the effectiveness of these tools to meet the needs of the students (Brouwer, 1996; Grasha, 1996; Jonassen, 2000; Rintala, 1998). This concern is the culmination of such issues as: (a) the knowledge and skill level of students and instructors regarding the technologies, (b) students' attitudes toward these technologies, and (c) how these technologies influence individual learning styles.

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Other issues that are often discussed in relation to instructional technology integration are whether or not these technologies are using sound pedagogical and/or learning theory principles (Ahola-Sidaway & McKinnon, 1999; Grasha & Yangarber-Hicks, 2000). As observed by Grasha and Yangarber-Hicks, faculty may choose certain instructional media based solely on the fact that the structural features associated with them are interesting and attractive. These motives tend to focus on the unique features that the instructional tool can offer while "issues such as how technology fits into a conceptual framework of principles for how people learn or into a broader philosophy of teaching and learning are seldom raised" (Grasha & Yangarber-Hicks, p. 3). This broader analysis can provide a sound theoretical justification for the new technology.

Although there are studies that address the issues of technology integration into a curriculum (Shneiderman, Borkowski, Alavi, & Norman, 1998; Spotts & Bowman, 1995) and the attitudes of students toward the various technologies being utilized (Morris, 1994; Moss, 2000), there is limited research that links these attitudes to individual learning styles (Kraus & Reed, in press). Henke (2001) further stated, "what seems to be missing is a robust body of literature that describes how learning style theory has been incorporated and tested in actual course design and development" (p. 12). Furthermore, no studies to date have attempted to link learning style of leisure studies students to attitudes toward the use of instructional technology and whether attitudes toward technology could be predicted by gender, class standing, and major area of study.

II. Learning styles.

Kolb (1984) developed a model of experiential learning that identified four learning stages and styles based on whether learners are active or reflective information processors and whether their understandings are based on concrete or abstract perceptions (see Figure 1). The learning style types, identified by Kolb, are: divergent, assimilators, convergers, and accommodators.

- Divergers: Prefer to engage in collaborative open reflection upon their experiences. They develop a range of solutions rather than simply finding the "right" answer.
- Assimilators: Like the process of gathering and reorganizing their reflections and observations into new plans or generalizations.
- Convergers: Prefer to solve problems that have definite answers. They enjoy defining problems, reasoning their way to a solution, and then seeking to put the solution into practice.
- Accommodators: Enjoy tackling problems by trial-and-error and are freely willing to take risks. They prefer a hands-on learning environment.

The major premise of this learning style theory is that individuals use and prefer different learning styles or strategies that correspond to how effective and comfortable they are when learning occurs. Kolb (1976) theorized that learning is a four stage process involving (a) CE, concrete experience – feeling; (b) RO, reflective observation – watching; (c) AC, abstract conceptualization – thinking; and (d) AE, active experimentation – doing. Kolb further stated

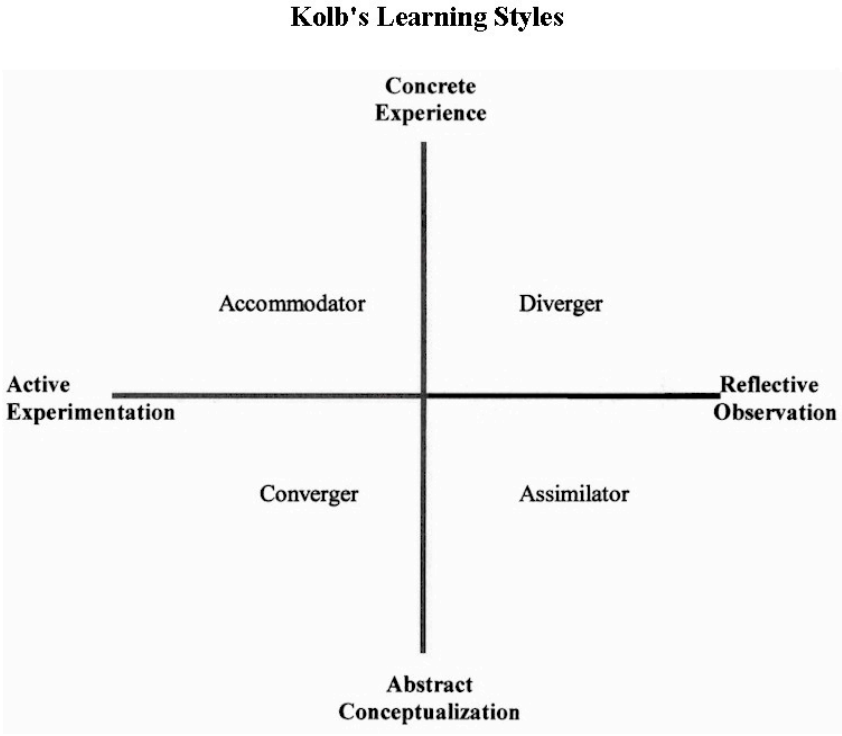

Figure 1. Kolb's Learning Style Types As They Relate to the Four Learning Style Categorizations (Kolb, 1984).

that for a complete learning experience to occur, a successful student functions in all of these domains. In other words, an individual must complete all four of the learning stages. Smith and Kolb (1996) further suggested that learning is a cyclic process involving the four styles of learning. Students should go through the cycle in a sequence beginning with the concrete experience, moving to reflective observation, then to abstract conceptualization and finish at active experimentation. The danger with this theory is that some students prefer one particular style and in the process do not complete the other three types of learning. Harb, Durrant, and Terry (1993) offered two specific reasons for applying the Kolb learning style model to teaching. They suggested that educators should 'teach' to each of the learning styles in order to 'reach' all students. The authors also believed that the model could very well serve as a framework for students' lifelong learning experiences.

III. Purpose of the study.

The purpose of this study was to explore the relationship between learning styles and students' attitudes towards technology use in a leisure studies curriculum A leisure studies curriculum includes course emphasizing philosophy, history, and effective use of leisure; program planning and evaluation; leadership skill development; facility design, organization, and management; administration; and related course work tailored to meet a students professional goals in the recreation, parks, and leisure service profession. Specifically, the researchers were interested in determining whether learning styles, as measured by the Kolb LSI, would influence students' attitudes or preferences toward faculty integration of technology into the various major courses.

It was postulated that the learning styles might in fact influence student attitudes toward instructional technology. The data collected focused on student learning styles, student demographics, computer skills, and attitudes toward the use of instructional technology.

IV. Research Methodology.

The sample for this study was drawn from a leisure studies curriculum at a large Midwestern university. All students in 66 undergraduate courses offered in this department served as the total population. These courses included all sections of all courses offered in the undergraduate program during the fall semester of the 2001-2002 academic school year. There were a total of 671 students enrolled in these courses. Of the total number, 422 different students completed the Kolb Learning Style Inventory and the computer attitudes survey (CAS) for a 63% response rate. Due to the varying knowledge, skill, and interest levels of the instructors in the department, the sample included courses that incorporated not only a range of instructional technologies, but also a range of frequency levels with regard to the uses of these technologies. A self-administered questionnaire was distribution to all students during the eighth week of the sixteen week semester. The researchers reviewed the Study Information Sheet with each class as a whole to ensure that all students were aware of the information contained in the questionnaire. The course instructors were not present at the time of the questionnaire distribution, completion, and collection in order to ensure that participation was strictly voluntary and anonymous.

V. Instruments.

Two separate instruments were used for data collection.

Learning style inventory. The Kolb (1984) Learning Style Inventory (LSI) was administered to ascertain differences among individual learning styles and corresponding learning environments. This instrument, frequently used within many areas of study and research, is a method of assessing a student's learning style preference (Garner, 2000). The Kolb LSI describes the way a student learns and contains 12 statements with a choice of 4 endings. Each student ranks the endings from most to least like he or she learns. The resulting scores identify an individual's learning style as one of four types: diverger, assimilator, converger, and accommodator (see previous discussion).

The Kolb LSI was chosen because the inventory is relatively simple to administer and score as well as the fact that it has demonstrated a high degree of reliability with coefficient alpha reliabilities ranging from .81 to .87 for the four learning style scales (Willcoxson & Prosser, 1996). Evidence of adequate construct and predictive validity of the four factors forming two bipolar dimensions has also been found for this instrument (Loo, 1999; Willcoxson & Prosser, 1996).

Computer attitudes survey (CAS). A questionnaire was developed by the researchers which contained three sections: (a) personal information, (b) personal use of computers, and (c) attitudes toward the use of technology. The first section gathered information on demographic variables such as age, gender, class standing, major, and computer skill level. The second section requested specific information about the respondents' personal use of computers and related technologies. A scale was provided to guide the responses for these 11 questions. This scale provided five options regarding how frequently the respondent uses the specified technology: (a) never – at no time do I use the computer for this purpose, (b) rarely – less than 5 hours a week, (c) sometimes – more than 5 hours a week but less than 1 hour a day, (d) often – more than 1 hour a day but less than 4 hours a day, and (e) frequently – more than 4 hours a day.

The third section of the questionnaire asked students to indicate how they believed the specified instructional technologies had either facilitated or distracted from their achievement of the objectives of the courses. A scale was provided to guide the responses; the range of the scale extended from –5 to +5 with 0 being undecided. The negative end of the scale was labeled with the following sentence: "This technology generally distracts me from achieving the objectives of the course." The positive end of the scale was labeled as: "This technology generally facilitates my achievement of the objectives of the course." A total of 12 questions addressed technologies such as on-line quizzes, course websites, and interactive CD-ROMs. The responses in this section were totaled to provide a score ranging from +70 to –70. This score was used as the dependent variable during the data analysis phase of this study.

Prior to the actual study, a pilot study was conducted using the Kolb LSI and the CAS. Both were used in order to test the validity of the attitude survey, and also to test the distribution process. Since the CAS was developed specifically for this study, a principal components analysis (PCA) was used to analyze the data gatherer in the attitude toward technology section was conducted. The Cronbach alpha represented a value of .84.

VI. Results.

A. Demographics.

The first section of the CAS contained several demographic questions addressing the respondents' gender, age, class standing, major, and computer skill level. Of the 422 survey respondents, 56.9 % were female. A total of 212 (50.3 %) of the respondents were either 20 or 21 years of age. The majority of the students were juniors and seniors (30.1% and 32.9%, respectively). In regards to academic program majors, the Therapeutic Recreation major (19.2%) and Tourism Management major (19.0%) were the two largest majors represented by the respondents. When assessing student's computer skill level, the majority (55.2%) of the students believed they had "average" computer skills.

The academic department chosen as the sample for this study offers students five different major emphases: Outdoor Recreation and Resource Management, Park and Recreation Management, Recreational Sport Management, Therapeutic Recreation, and Tourism Management. Until students at this institution decide on a major, they are classified as "University Division." Table 1 presents a profile of the students in the study using a cross-tabulation with the Learning Style Inventory categories.

B. Descriptive analysis of the Kolb learning style inventory.

The Kolb LSI provided data regarding how many students were classified according to the four learning styles. The results from the data set revealed that 124 (31.9 %) of the students were classified as "accommodating," 106 (27.2 %) in the "diverging" category, 101 (26%) were classified as "assimilating" (26.0%), while only 58 (14.9%) students were classified in the category of "converging." These results are not at all surprising for leisure studies students even though they differ from the norm as established by Kolb. Recreation and leisure service is a people oriented profession (Edginton, Hudson, Dieser, & Edginton, 2004)and most professionals in the field prefer "hands-on" experiences and action over theory. Many consider multiple perspectives by brainstorming, observing, and gathering information, and then reflecting before acting.

Table 1. Characteristics of the Sample.

	Learning Style Inventory (LSI)				
	Accommodating	Diverging	Converging	Assimilating	
	N	N	N	N	Total
By Major					
Outdoor Recreation	17	14	12	14	57
Park and Recreation	4	4	3	3	14
Recreational Sport	9	9	4	8	30
Therapeutic Recreation	30	15	13	16	74
Tourism	21	21	8	24	74
University Division	8	9	0	5	22
Other	35	33	17	31	116
Total	124	105	57	101	387
By Gender					
Male	81	55	33	51	220
Female	43	50	24	50	167
Total	124	105	57	101	387
By Class					
Fr	11	16	5	15	47
So	32	20	7	22	81
Jr	41	27	18	31	117
Sr	37	42	21	31	131
Grad	3	0	4	2	9
Total	124	105	55	101	385

A one-way ANOVA was used to compare the data gathered from both the Kolb LSI (4 groups) and the CAS (total attitude score) in order to determine if learning styles of students act as a predictor of their attitudes toward technology use in a recreation course. Although ANOVA is not a statistical analysis that deals with prediction, it can identify if further prediction analyses are needed.

This analysis was chosen for this study to identify if the group means for each of the four learning styles differed with relation to the total attitude score (calculated from responses in section 3 of the CAS). The ANOVA table (Table 2) identified no significant difference between the four learning styles as compared to the total attitude score. The between groups f value of .450 was not significant at the $p < .05$ level.

C. Positive attitudes toward the use of technology.

The CAS included 12 questions addressing the respondents' attitudes regarding how they thought the specified technologies had either facilitated or distracted from their achievement of the objectives of the courses they have taken. Table 3 presents the mean scores from the CAS for each of 12 instructional technologies and the percentage expressing a positive attitude (those greater than 0 on the CAS). Course websites, one to one communication using email, multimedia, and the Internet used by the professor in class scored the highest among the 12 technologies.

Table 2: Analysis of variance for learning styles.

Source	Sum of squares	Mean square	*Df*	*F*	*P*
Between groups	315.644	105.215	3	.450	.717
Within groups	85748.685	233.648	367		
Total	86064.329		370		

Note. Significance at the p < .05 level.

Table 3. Positive attitudes towards the use of technology.

Attitude	N	M	%
Course website	417	3.59	81.1
Email (one to one)	417	2.77	63.8
Multimedia	418	2.48	56.5
Internet (used by professor)	418	2.47	57.9
Internet (IUCAT, Knowledge Base)	416	2.05	47.5
On-line quizzes	415	1.77	40.5
On-line course evaluations	417	1.66	37.4
Interactive CD-ROM	418	1.57	35.3
Class discussion forum	417	1.51	36.0
Music CD	418	1.41	35.4
Class listserv	413	1.26	27.3
DVD	418	1.04	25.5

D. Multiple regression analysis.

A standard multiple regression analysis was conducted to distinguish whether attitude toward technology could be predicted by gender, class standing, major, and learning style. Table 4 illustrates the correlations between the independent variables (gender, class standing, major emphasis, and learning style) and the dependent variable (attitude total score). No relationship was found between student attitudes toward technology as they related to gender, class standing, major emphasis, or learning style. The highest correlation within this analysis was only -0.183.

Only 1 % (r^2 value= .010) of the students' attitude toward technology was explained by the independent variables of gender, class standing, major emphasis, and learning style. The statistical significance of the prediction equation was analyzed by looking at the ANOVA table. This dataset showed a significance of .878 at the p = .477 level. This result was concluded to be not significant since the alpha level determined a priori by the researchers to be used for significance was p = .05.

VII. Discussion.

Results from the study were not anticipated by the researchers. Learning styles, even controlling for gender, age, major, etc., did not predict the aggregate CAS. This lack of support for the influence of preferred learning styles on the attitudes toward instructional technology may be caused by a number of factors. The fact that no matter how a student prefers to learn, students of this age group seemed to have been exposed to, and formed their own opinions toward, the

various technologies before they have even reached the collegiate level. Many junior high and high school instructors are exposing students to an increasing number of technologies so that the use of the technologies is more "normal" than "out of the ordinary." This familiarity may also be why learning style had no significant relationship with attitude toward technology.

The learning style that consistently included the fewest numbers of students across the variables was Converging. In this leisure studies curriculum, regardless of how the students were categorized (gender, age, class standing, major, and computers skill level), Converging was seen as the least common category 88% of the time. Accommodating seems to be the highest overall with 56% of the time it being the highest category and 32% of the time it is the second highest category.

Table 4. Multiple regression analysis: correlations.

Variables	1	2	3	4	5
1. Attitude total score	-	-.065	-.064	-.017	-.029
2. Gender		-	.006	.021	.101
3. Class standing			-	-.183	-.001
4. Major emphasis				-	-.002
5. Learning style					-

Accommodators typically enjoy dealing with problems by trial-and-error and are willing to take risks. These traits describe a personality that is more comfortable in a hands-on learning environment. Knowing this, one may conclude that a student's utilization of technology for his/her personal use may support how he/she prefers to learn in the classroom. If students prefer to be risk takers and learn through trial-and-error, then they may choose to utilize technologies that are frequently learned via this process. For example, the Internet, email and multimedia are all technologies that can be learned either through the use of a manual or simply through the trial-and-error process. Although there is no way of identifying how the students in this study learned their computer skills, it is clear what types of technology they use most often.

The results of this study showed that the majority of students in the leisure studies curriculum were quite comfortable with computers; the majority of the students classified their computer skill level as "average." Course web sites, "one to one" communication via email, and multimedia all scored high on the positive end of the scale on the CAS used in this study. The findings of this study clearly agree with the frequent use of computers for "one to one" communication (email) and web surfing that is supported in the literature regarding the steady increase in the use of electronic mail and the Internet by students in higher education (Goggin, Finkenberg, & Morrow, 1997; Maughan, 1998). The Internet allows for independent learning where students can interact not only with their instructor and classmates, but also with experts and other interested learners from around the world.

The Converging learning style, which was the least common learning style among this sample, can be described as the preference for solving problems that have definite answers. In the leisure studies field, there are often no definite or over-arching answers and solutions to problems typically needed to be created based on experience and the situation. The lack of Convergers in this study may be due to the fact that these learners are not attracted to the leisure studies discipline. Other majors, such as math and science, may provide these types of answers, and therefore, attract more of the Converging style learners.

Overall, the descriptive data regarding the personal use of computers and the students' attitudes toward the use of technology in the classroom appeared to support the current literature

on the subject (Alonso, 1995; Shneiderman et al., 1998). The lack of differences found between learning styles and attitudes toward technology were surprising. There appears, however, to be ample reasons why this result may have occurred. In addition, a possible limitation of the study was the fact that students were selected from only one school. Hence, due to the confinement of research to one institution, it is not possible to generalize the findings across other student populations at other universities. Further studies involving a more generalizable sample could provide additional insight regarding learning styles and attitudes toward the use of technology.

A limitation of this type of study is the lack of control of the type and extent or frequency of instructional technology used in different courses. Student "attitudes" may be more reflective of the appropriate vs. the inappropriate use of different technologies rather than reflective of the technology itself. The use of a technology (i.e., web page) as an instructional aid may be appropriate and beneficial or simply a complication. The lack of data concerning the ease with which different instructors used instructional technology is another variable that could have influenced the results.

VIII. Conclusion.

Even though numerous studies (Johnson & Lobello, 1996; Jones, Reichard, & Mokhtari, 2003; Sims & Sims, 1995) have concluded that learning styles play an important role in the learning process, a focus on student learning styles alone is not enough. There are few empirical studies that have explored learning styles as a predictor of college student attitudes toward the use of technology. The results of this study support the concept that instructional technology is perceived by learners to provide a supportive learning environment regardless of learning style. This is a result which would support the further development of this methodology to enhance the learning of all students. Whether this methodology is truly "learning style neutral" would be difficult to access but the data from this study indicates that students of all learning styles have positive attitudes toward the technology.

Further research could investigate the question of whether students' personal use of technology could be used as a predictor of their preferences for how technology is integrated into teaching by an instructor. If students are more familiar with certain technologies in their personal lives (i.e., Internet, discussion boards), then these technologies may be utilized by instructors to positively influence the learning process. Also, instructors' preferences for specific technologies should be investigated regarding how much of an influence they have on which technologies they use, how they use them, and the frequency of their use in the classroom. These three components (technology, student preferences, and instructor preferences) all interrelate as they influence the teaching/learning process. All of these areas should be investigated further if a more in-depth analysis of how technology influences learning is to be assessed.

New technological innovations will provide instructors and students alike with tremendous opportunities to enhance student learning. Instructors must make these technologies available to all students by providing a number of different learning options that take into account a variety of learning styles. If instructors simply use these technologies because they are unique and exciting, sound and effective pedagogical principles that should provide the basis of all instruction are completely ignored (Ahola-Sidaway & McKinnon, 1999; Brouwer, 1996; Grasha & Yangarber-Hicks, 2000; Rintala, 1998). Additional studies of this nature will help to solidify the perceived, and often assumed, positive effects of all educational technologies as they are used for classroom instruction.

The task of trying to understand the future influences of instructional technologies is a challenging one since technology is shaped by so many factors associated with both faculty and students. Rintala (1998) and Brouwer (1996) each warned against accepting all new

technologies into the educational framework without investigating whether they are appropriate and useful. All too often instructors blindly use new technologies because of perceived benefits for the students and the educational process, but additional empirical evidence is needed to identify whether students are receiving these expected benefits. In addition, while the focus on learning styles is extremely important, studies on the dynamics involved in the various teaching styles are also needed (Grasha & Yangarber-Hicks, 2000). Lastly, it would be interesting to examine how students with different learning styles compare the uses of technology to traditional classroom activities (e.g. e-mail questions/discussions versus classroom interaction). This approach might yield differences among the learning styles and may lead to ways to further enhance learning through technology.

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