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ABSTRACT
This study compared the relationship between learning style preferences and learner success of students in an online course with an equivalent face-to-face course. Comparisons included maintenance of motivation, task engagement, and cognitive controls. Results revealed significant relationships between preferences and course success on five constructs for the face-to-face students and no significant relationships for the online students. Overall, the findings suggest that students can be equally successful in face-to-face and online environments regardless of learning style preferences.

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Introduction

Whether learning takes place in an institution of higher education or in a private, public, or non-profit organization, participants are expected to learn and subsequently apply their new knowledge. During recent years, innovations in higher education have served as a catalyst for changing relationships among students and teachers (Dziuban & Dziuban, 1997). New advances in Internet-based technology have brought challenges and opportunities to education and training, in particular through online instruction. Online instruction is a form of distance education delivered over the Internet. For many, this type of instruction is perceived as a major breakthrough in teaching and learning because it facilitates the exchange of information and expertise while providing opportunities for learners in distant or disadvantaged locations (Webster & Hackey, 1997).

While online instruction is gaining in popularity, it is not free from criticism. Many educators and trainers are not advocates of online instruction because they do not believe it actually solves difficult teaching and learning problems (Conlon, 1997) while others are concerned about the many barriers that hinder effective online teaching and learning. These concerns include the changing nature of technology, the complexity of networked systems, the lack of stability in online learning environments, and the limited understanding of

how much students and instructors need to know to successfully participate (Brandt, 1996). Online instruction also threatens to commercialize education, isolate students and faculty, and may reduce standards or even devalue university degrees (Gallick, 1998). Although the growth of online programs has been significant in recent years, the capabilities and efficacy of such programs have yet to be fully investigated. Most effort in this area has been devoted to program development while examinations of program quality and effectiveness have been mostly anecdotal in nature (Johnson, Aragon, Shaik, & Palma-Rivas, 2000). While advocates are viewing online instruction as a viable option for all types of learners (Hill, 1997), the issue of using learning styles research to create more positive, effective learning environments for all students is virtually unexplored. With little empirical knowledge about the relationship of learning styles to Internet-based learning environments the need for research in this area is not only timely, but also imperative.

Purpose

The primary purpose of this exploratory empirical study was to compare the relationship of learning style preferences and learning success for students enrolled in an online versus a traditional face-to-face course format. Comparisons included the environmental factors that maintain student motivation in the classroom, task engagement strategies, and cognitive processing habits (cognitive controls).

While attempts have been made to explore the differences in online and face-to-face learning environments, these types of studies are often discounted due to the great dissimilarity between the two learning environments. The goal of this study is not to show that one learning environment is better than the other, instead, this study is an attempt to determine if properly designed environments that differ on many conceptual and practical levels can lead to learning success regardless of student learning style preferences. Studies of this type are important because many of the faculty who are being asked to design and teach Internet-based courses are wondering if all students can actually be successful in these new online

environments. As the evidence mounts in support of the effectiveness of online learning environments, educational research can tackle the more fundamental question of how to optimize instructional designs to maximize learning opportunities and achievement in both the online and face-to-face environments.

Research Questions

This study was designed to answer the following research questions.

1. Are there distinguishable differences in the learning style preferences of students enrolled in an online versus a face-to-face learning environment?
2. How do learning style preferences relate to the student outcomes achieved in online and face-to-face learning environments?
3. What learning style constructs significantly influence student outcomes in both the online and face-to-face delivery formats?

Theoretical Framework

A major limitation of the existing learning style theories and models is that the primary focus is on information processing or cognitive habits. Therefore a more comprehensive theory of learning style was sought to guide the study. Curry's (1991) Theoretical Model of Learning Style Components and Effects was selected. Curry submits that specific information processing habits is only one factor that influences learning styles and/or successful learning. She posits that in order to adequately design educational programs that lead to successful learning, the constructs of motivation maintenance and task engagement must also be considered.

According to Curry (1991), motivational levels are maintained once the learner establishes preferred environmental and social conditions for learning. Factors contributing to motivation include a general sense of self-efficacy and self-control. The engagement level is defined as "the point of contact between the motivational condition of the learner entering the learning situation and the active processing work required by the new learning task" (Curry, 1991, p. 251). A learner's level of task engagement is reflected in the

amount of attention that is paid to features in the instructional situation, how persistent the learner will be, the degree of participation, the enthusiasm, and degree of concentration the learner sustains throughout and beyond the instructional situation. Cognitive controls refer to the information processing habits or control systems that learners bring to learning situations. According to Curry, these cognitive controls take place only after the learner becomes engaged in the task.

Method

Instructional Context

Data were collected from two sections of a graduate level instructional design course for human resource development (HRD) professionals. One version of the course was taught on the campus of a large Midwestern university through a traditional face-to-face format while the other version of the same course was offered totally online, with no direct face-to-face contact between the instructor and the students. Both courses were taught by the same instructor, delivered by the same department, and required the same content, activities, and projects. The instructional treatment of each topic followed the same organization.

Subjects

This exploratory empirical study compared outcome data obtained from students enrolled in one of two versions of a graduate level instructional design course for human resource development (HRD) professionals. Nineteen students, most of whom are pursuing a graduate degree in HRD, were enrolled in the face-to-face course. These students can be viewed as traditional university students who are actively pursuing an advanced degree through full time study on campus. Nineteen students were also enrolled in the online version of the course. These students are also pursuing a graduate degree in HRD through a degree program that is taught completely online. The online group can be viewed as non-traditional because the students are able to complete their advanced degree without ever setting foot on campus.

An important consideration for this type of comparison study is the equivalence of the groups prior to the start of instruction. Official university student records were reviewed to obtain a variety of demographic and academic data for comparison. The slight differences between the two groups in age, the year they received their baccalaureate degree, undergraduate GPA, and years of work experience were non-significant. In addition to these general demographic comparisons, the students were asked to respond to three questions regarding their degree of prior training and experience in the instructional design area. The results of this short questionnaire revealed that both groups of students had very little formal experience in instructional design prior to enrolling in this course. Because the majority of the online group was working full time while they completed the instructional design course, a few of them did have opportunities to design training courses as a part of their jobs. Four of the face-to-face students and eleven of the online students had previous experience designing courses. Of this experience, the majority of the students indicated they had designed two or fewer courses that were less than one-half day in length. Although several online students had prior experience designing courses, only three of them indicated they had formal training in the instructional design process; one as part of his undergraduate coursework and the other two through a 3-day seminar. Three students in the face-to-face group had also indicated previous instructional design training through university courses and workshops.

Instrumentation

Three learning style instruments were selected to measure each one of the learning constructs. These instruments were selected based on Curry's (1991) previous analyses of psychometric evidence showing that each had acceptable levels of internal and temporal reliability as well as construct and predictive validity.

The Grasha and Reichmann *Student Learning Style Scale* (Riechmann & Grasha, 1974) was used to assess motivation maintenance. The SLSS consists of 90 self-report items. A 5-point Likert-type scale describes the

learner along the bipolar scale dimensions of independent vs. dependent, avoidant vs. participant, and collaborative vs. competitive. Task engagement was assessed by the Weinstein, Palmer, and Schulte (1987) *Learning and Study Strategies Inventory*. The LASSI contains 83 items. Subjects are asked to respond to the items on a five-point Likert scale. The items are sorted to ten variables including anxiety, attitude, concentration, information processing, motivation, scheduling, selecting the main idea, self-testing, study aides, and test strategies. Finally, cognitive control functions were assessed through the Kolb (1985) *Learning Style Inventory*. The LSI was developed around Kolb's experiential learning model. The LSI contains 12 sentence stems, each having four sub-items to be rank ordered. Responses are organized into two bipolar concepts: concrete experience vs. reflective observation, and abstract conceptualization vs. active experiementation.

Procedures

All date were collected near the end of the semester as part of a discussion and activity on learning styles. All students completed paper versions of all three instruments. The online students received and returned the instruments through the mail. The face-to-face students completed and returned their instruments during a class session. All instrument data were entered into a statistical analysis package for later analysis. Statistical analyses were conducted using independent t-tests and bivariate correlation analysis. All statistical tests reported in this paper were conducted with a significance level of .05. The search for distinguishable relationships in student outcomes (i.e., content knowledge and quality of course assignments and projects) across learning style preferences was conducted using a combination of performance indicators on class assignments collected during the course.

Results

Learning Style Differences

As shown in Table 1, the results of the independent t-tests indicate no significant differences in the social and environmental (motivation maintenance) preferences between the students of the two delivery formats. Table 1 also reveals that both the face-to-face and online students are comparable in their learning and study strategies with the exception of "study aids." This particular subscale assesses how effective students are at using support techniques and materials above and beyond those required by the course. This result indicates that the face-to-face students reports greater use of such techniques and materials ($M = 30.17$, $SD = 4.76$), $t(34) = 4.10$, $p < .05$. Finally, this table reveals significant differences in the cognitive processing habits of the two student groups. Reflective observation measures the extent to which students learn by watching and doing. The mean difference on this subscale was significant ($M = 30.53$, $SD = 8.57$), $t(35) = 2.18$, $p < .05$, indicating that the online students are more reflective in comparison to their face-to-face counterparts. In addition, the online students report a higher degree of learning by thinking (abstract conceptualization) in comparison to the face-to-face students ($M = 34.74$, $SD = 5.67$), $t(35) = 2.11$, $p < .05$. Finally, significant differences were found on the active experimentation scale, which assesses the extent to which students learn by doing. In this case, the face-to-face students report greater use of this mode of learning ($M = 36.11$, $SD = 8.46$), $t(35) = -2.54$, $p < .05$.

Table 1: Learning Style Differences for Online versus a Face-to-Face Students

Learning Style Instrument	Face-to-Face*	Online*	t	p
Motivation Maintenance Subscales (SLSS)				
Independent	37.21 (3.55)	36.44 (4.90)	0.54	0.58
Dependent	36.79 (4.20)	36.11 (5.80)	0.40	0.68
Avoidant	21.00 (4.61)	23.06 (6.18)	- 1.15	0.25
Participant	41.84 (5.49)	38.89 (4.40)	1.18	0.24
Collaborative	40.58 (6.38)	38.50 (3.97)	1.18	0.24
Competitive	22.63 (5.98)	23.67 (7.40)	- 0.46	0.64
Task Engagement Subscales (LASSI)				
Attitude	35.00 (4.97)	35.00 (3.45)	0.00	1.00
Motivation	34.83 (3.93)	33.33 (4.83)	1.02	0.31
Time Management	30.50 (6.59)	26.83 (6.92)	1.62	0.11
Anxiety	29.89 (7.55)	31.72 (3.69)	0.92	0.36
Concentration	31.00 (4.64)	28.83 (5.75)	1.24	0.22
Information Processing	32.89 (4.78)	31.33 (4.87)	0.96	0.34
Selecting the Main Idea	21.33 (2.93)	20.89 (3.36)	0.42	0.67
Study Aids	30.17 (4.76)	23.78 (4.58)	4.10	0.00**
Self-Testing	29.39 (4.27)	26.94 (5.13)	1.55	0.12
Test Strategies	34.56 (3.81)	34.22 (4.53)	0.23	0.81
Cognitive Control Subscales (LSI)				
Concrete Experience	27.61 (8.12)	25.00 (6.19)	- 1.04	0.27
Reflective Observations	25.22 (5.88)	30.53 (8.57)	2.18	0.03**
Abstract Conceptualization	30.44 (6.67)	34.74 (5.67)	2.11	0.04**
Active Experimentation	36.11 (8.46)	29.16 (8.15)	- 2.54	0.01**

** significant at alpha = 0.05 (2-tailed)*

Learning Style Influence on Student Success

The primary question addressed by this study was to what extent were learning styles correlated with student success when the delivery format was controlled. The data were analyzed using bivariate correlation analysis controlling for the delivery format. As shown in Table 2, a total of five significant correlations were found for the face-to-face students. For the maintenance motivation construct, as the level of avoidance of classroom activities decreased, the course performance increased. As student participation in classroom activities increased, the course performance increased. For the task engagement construct, positive correlations were

found between attitude and course performance as well as time management and course performance. These correlations suggest that as student attitude becomes more positive and the use of time management techniques increase, course performance will increase. Finally, one negative correlation was found for the cognitive controls construct. As abstract conceptualization (learning by thinking) decreased, course performance increased. This particular finding is one that warrants further investigation.

Table 2: Relationship Between Learning Style Preferences and Success in a Face-to-Face Learning Environment

Learning Style Instrument	N	Mean	SD	r	p
Motivation Maintenance Subscales (SLSS)					
Independent	19	37.21	3.55	0.15	0.51
Dependent	19	36.79	4.20	0.19	0.43
Avoidant	19	21.00	4.61	- 0.58	0.00*
Participant	19	41.84	5.49	0.58	0.00*
Collaborative	19	40.58	6.38	0.09	0.69
Competitive	19	22.63	5.98	- 0.00	0.99
Task Engagement Subscales (LASSI)					
Attitude	18	35.00	4.97	0.51	0.02*
Motivation	18	34.83	3.93	0.43	0.07
Time Management	18	30.50	6.59	0.45	0.05*
Anxiety	18	29.89	7.55	0.19	0.44
Concentration	18	31.00	4.64	0.07	0.78
Information Processing	18	32.89	4.78	0.43	0.07
Selecting the Main Idea	18	21.33	2.93	0.26	0.28
Study Aids	18	30.17	4.76	0.32	0.18
Self-Testing	18	29.39	4.27	0.24	0.32
Test Strategies	18	34.56	3.81	0.40	0.09
Cognitive Control Subscales (LSI)					
Concrete Experience	19	27.61	8.12	- 0.25	0.29
Reflective Observations	19	25.22	5.88	0.31	0.19
Abstract Conceptualization	19	30.44	6.67	- 0.56	0.01*
Active Experimentation	19	36.11	8.46	- 0.18	0.44

**significant at alpha = 0.05 (2-tailed)*

The final analysis involved a comparison of learning style preferences and success in the online learning environment. The results from this analysis of the online students' performance showed no significant

relationships between learning style preferences and course performance. These results are presented in Table 3. It is interesting to note that, while there was a significant difference between the online and face-to-face students in terms of cognitive control functions, it seemed to have little impact on course performance.

Table 3: Relationship Between Learning Style Preferences and Success in an Online Learning Environment

Learning Style Instrument	N	Mean	SD	r	p
Motivation Maintenance Subscales (SLSS)					
Independent	18	36.44	4.90	- 0.29	0.23
Dependent	18	36.11	5.80	0.29	0.24
Avoidant	18	23.06	6.18	- 0.03	0.88
Participant	18	39.89	4.40	- 0.02	0.91
Collaborative	18	38.50	3.97	- 0.10	0.68
Competitive	18	23.67	7.40	- 0.35	0.15
Task Engagement Subscales (LASSI)					
Attitude	18	35.00	3.45	0.21	0.38
Motivation	18	33.33	4.83	0.27	0.26
Time Management	18	26.83	6.92	0.06	0.80
Anxiety	18	31.72	3.69	0.05	0.82
Concentration	18	28.83	5.75	- 0.11	0.66
Information Processing	18	31.33	4.87	- 0.22	0.37
Selecting the Main Idea	18	20.89	3.36	- 0.18	0.47
Study Aids	18	23.78	4.58	- 0.07	0.76
Self-Testing	18	26.94	5.13	0.16	0.52
Test Strategies	18	34.22	4.53	0.02	0.90
Cognitive Control Subscales (LSI)					
Concrete Experience	18	25.00	6.19	- 0.00	0.97
Reflective Observations	18	30.53	8.57	0.20	0.41
Abstract Conceptualization	18	34.74	5.67	0.04	0.85
Active Experimentation	18	29.16	8.15	- 0.19	0.43

**significant at alpha = 0.05 (2-tailed)*

Discussion

While both the face-to-face and online students did not vary significantly according to age, year of Baccalaureate graduation, GPA, and experience, they did vary significantly in their learning style preferences

particularly at the cognitive controls level. As expected based on learning theory (Merriam & Caffarella, 1999) these students brought into their respective settings different ways and preferences for learning course content. Obviously, it is these types of differences that, while logical in theory, make designing courses that meet all learning style preferences challenging in practice. The results from the independent t-tests simply reaffirm the proven theory that we all learn differently. Given the differences found between the learning style preferences of these two groups, the results from the bivariate correlation analyses become even more meaningful.

First, even though there were learning style differences found between the face-to-face and online students, the differences were not highly apparent when the delivery format was controlled. Looking at the results from the correlation analysis for all students, motivation was the only variable found to influence course performance. This finding should not be surprising as theory informs us that as motivation increases so does learning (Merriam & Caffarella, 1999). While motivation tends to be an internally driven characteristic, it is also known that external factors such as the teacher, course design, and learning activities can and will influence motivation within the context of learning. The instructor of the course did emphasize this factor strongly as being a factor that greatly influences success in the course. Consequently, this may explain why there was such a high correlation for this factor. This finding reaffirms the fact that educators, regardless of delivery format, should strive to increase and maintain positive levels of student motivation.

Second, the significant results from the correlation analysis for the face-to-face students also serves to reaffirm what we know contributes to positive learning outcomes for students. As student participation increased and avoidance decreased, performance was shown to increase. Because these two variables significantly influenced student outcomes, it suggests that educators need to continually strive for ways of making learning active and participatory for students. Learning theory has shown that adults gain more

from educational experiences when they can be actively engaged. Positive attitudes and increased use of time management techniques influence course performance. These too are logical findings and have been proven in the past (Merriam & Caffarella, 1999).

The surprising correlation was the negative one that existed between abstract conceptualization (learning by thinking) and course grade for the face-to-face students. It may simply be that because the instructional design class was an application, hands-on course, success is perceived to be more dependent upon participation. Another logical explanation, not only for this finding, but also for the others found for the face-to-face students, is that these particular skills and abilities may have been emphasized more strongly in this class format and revealed themselves within the results of the learning style instruments. Although the instruments are designed to obtain an overall assessment of learning across all experiences, it should be acknowledged that students may have been thinking specifically, or at least more, about their respective instructional design courses.

Finally, the most exciting finding from this study is the fact that correlations between learning style and course performance were not found for the online students. Consequently, this finding suggests that learners can be as equally successful in the online environment regardless of learning style. Granted, it does not mean that “anything goes” but that the online course must be developed well in order for learning to occur. This is true regardless of the format or content of any course. However, at a time when criticisms are still being made against the effectiveness and quality of online instruction, these findings from this study help to negate such statements.

Implications

As has been discussed elsewhere, the ultimate question for educational research is how to optimize instructional designs to maximize learning opportunities and achievements in both online and face-to-face environments (Johnson, Aragon, Shaik, & Palma-Rivas, 2000). The findings

of this study show that online learning can be as effective as face-to-face learning in many respects in spite of the fact that students have different learning style preferences. In view of these findings, several implications emerge pertaining to future online program development.

First, this analysis suggests that the development and use of online programs should continue. However, it is important that quality and thoroughness of the design and delivery be the catalyst for ensuring positive online learning experiences. It is logical that if these two factors are not at the forefront of any design effort, learning success may not occur or occur at lower levels. Second, this study suggests that a continued understanding of adult learning theory and learning styles needs to be emphasized among faculty. This is critical if courses are going to be designed to address the various domains of learning. This is especially critical in the online environment where an element of creativity is needed to identify and design educational experiences that can be as active, collaborative, and participatory as those commonly found in the face-to-face environment. Finally, educational practitioners should be aware of their own learning style preferences. We believe this especially true for online learning. The way we learn and the way we were taught will greatly influence the ways we will teach. Knowing our strengths and weaknesses as educators helps us to know where we will be strong and weak in terms of instructional design and delivery. As related to the second point above, designing online instruction that keeps students motivated and active requires thinking outside the box. Unless we know the boundaries of our “boxes,” we run the risk of not incorporating all learning preferences found in our students.

References

Brandt, D. S. (1996, February, 27). *Teaching the net: Innovative techniques in Internet training*. Paper presented at the 11th Annual Computers in Business Conference, Washington, DC. (ERIC Document Reproduction Service No. ED 412 975)

Conlon, T. (1997). The Internet is not a panacea. *Scottish Educational Review, 29,* 30-38.

Curry, L. (1991). Patterns of learning style across selected medical specialties. *Educational Psychology, 11,* 247-277.

Dziuban, J. I., & Dziuban, C. D. (1997-98). Reactive behavior patterns in the classroom. *Journal of Staff, Program, and Organization Development, 15,* (2), 85-91.

Gallick, S. (1998). *Technology in higher education: Opportunities and threats*. University of California at Los Angeles, Los Angeles, CA. (ERIC Document Reproduction Service No. ED 415 929)

Hill, J. R. (1997). Distance learning environments via world wide web. In B. H. Khan (Ed.). *Web-based instruction* (pp. 75-80). Englewood Cliffs, NJ: Educational Technology Publications.

Johnson, S. D., Aragon, S. R., Shaik, N., & Palma-Rivas, N. (2000). Comparative analysis of learner satisfaction and learning outcomes in online and face-to-face learning environments. *Journal of Interactive Learning Research, 11,* 29-49.

Kolb, D. A. (1985). *Learning style inventory and technical manual.* Boston: McBer and Company.

Merriam, S. B., & Caffarella, R. S. (1999). *Learning in adulthood: A comprehensive guide* (2nd ed.). San Francisco, CA: Jossey-Bass.

Riechmann, S. W., & Grasha, A. F. (1974). A rational approach to developing and assessing the construct validity of a student learning style scales instrument. *Journal of Psychology, 87,* 213-223.

Webster, J., & Hackley, P. (1997). Teaching effectiveness in technology-mediated distance learning. *The Academy of Management Journal, 40*, 1282-1309.

Weinstein, C. E., Palmer, D. R., & Schulte, A. C. (1987). *LASSI: Learning and study strategies inventory*. Clearwater, FL: H & H Publishing.

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