The Relationship Between Learning Styles and Student Learning in Online Courses

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ABSTRACT

Just as learning styles affect how students learn in traditional face-to-face courses, learning styles also influence student learning in online courses. This paper reviews multiple research studies that have addressed learning styles and student learning in online courses. Some of these studies have found a relationship between learning styles and student learning, while other studies failed to detect a significant relationship. Since different researchers have used different learning style inventories as research instruments, comparisons can not always be clearly drawn, yet each of these studies contributes a contribution to the field of learning styles and online learning. Conflicting results and a need for a clearer understanding of the relationship between learning styles and student learning in online courses point to a need for future research in this area. An understanding of the relationship between learning styles and student learning in online courses will assist those involved in instructional design and delivery in effectively meeting the needs of all students.

Keywords: Learning Styles, Cognitive Styles, Online Learning, Distance Education, Instructional Design and Delivery

INTRODUCTION

“With the proliferation of distance education, more and more learners are taking online courses” (Hu and Gramling, 2009, p. 125). As online courses become a more common format of instructional delivery, research needs to examine how online learning can best meet students’ needs. As in traditional face-to-face classes, students’ learning styles shape their experiences in online courses (Graf, Liu, & Kinshuk, 2010). Learning styles provide information about differences in students’ learning preferences; therefore, learning styles can suggest ways in which instruction can be best designed in order to support student learning (Akdemir & Koszalka, 2008).

Kemp, Morrison, and Ross (1998) insist that instructors should consider learners’ characteristics, abilities, and experience when designing learning environments. In this way, learning can be flexible and responsive to students’ needs. Akkoyunlu and Soylu (2008) assert that it is essential that instructors are aware of students’ learning styles in order to guide them in the design and management of Web-based learning environments. Fahy and Ally (2005) caution that if students do not have the opportunity to participate in distance learning pursuant to their individual styles and preferences, “the requirement for online interaction may ironically become a potential barrier to learning” (p. 19).

LEARNING STYLE THEORY

The concept of learning styles is grounded in the classification of psychological types. Because of various innate qualities, personality characteristics, values, previous learning experiences, and upbringings, different individuals perceive and process information in different ways. Dunn et al. (1989) provide a simple definition of learning style, “a biologically and developmentally imposed set of personal characteristics that make the same teaching method effective for some and ineffective for others” (p. 50).

Learning style models and inventories have been created by Gardner (1983), Fleming (1987), Kolb (1976, 1985, 1993, 1999, 2005), Felder and Silverman (1988, 1993), Dunn and Dunn (1989), Myers and Briggs (1962, 1985, 1998), Hermann (1982), and many others. Each model has value, as each “advocates acknowledging and honoring the diversity among individuals” (Dunn, 1990, p. 15). These different models have all been widely used and have been evaluated for validity and reliability. “A reliable and valid instrument which measures learning styles and approaches could be used as a tool to encourage self-development, not only by diagnosing how people learn, but by showing them how to enhance their learning” (Coffield et al., 2004, p. 145). When used in this way, learning style inventories can be very useful resources to lead students to academic success. It is imperative that teachers recognize the diversity of student learning styles so that they can address these varied ways of learning in order to effectively teach and reach students.

Learning style theory conjectures that students’ learning styles have an especially strong influence on their learning when students are exposed to an unfamiliar learning environment (Sheard & Lynch, 2003). Since many students experience online learning for the first time in university settings, it can be expected that these students’ learning styles will have a major impact on their learning in online college courses.

LEARNING STYLES AND LEARNING IN ONLINE COURSES

Ford and Chen (2001) conducted a study in which they explored whether matching the instructional style to students’ cognitive style resulted in higher achievement. The researchers used Riding’s Cognitive Styles Analysis, which measures learners’ degree of field dependence. After the participants completed Riding’s (1991) Cognitive Styles Analysis and took a pre-test on HTML, the entire sample population was assigned the task of creating several Web pages using HTML. The researchers split the participants
into four groups. Half of those who were classified as field independent received instruction termed “depth-first” while the other half received instruction entitled “breadth-first.” Half of the field dependent learners also received “depth-first” instruction while the other half received “breadth-first” instruction. The difference in instruction dealt only with the order in which the instruction was presented to students; the content was identical, and both versions were online instructional packages designed for students to use in working with HTML. Ford and Chen administered a post-test after the students had completed the tasks in the unit. The researchers calculated a gain score for each student in order to determine how much students learned from this instructional experience. Task performance for the unit was also assessed, and task gain was calculated. The study’s data showed that matching instruction to students’ cognitive styles produced significant differences in the gain score, while no significant differences were seen in task gain. Ford and Chen (2001) concluded that, “The results of this study combine with those of others to suggest at least the possibility that the notion of matching cognitive and learning styles with information presentation formats may be an important building block in the design of effective learning” (p. 21).

Boles, Pillay, and Raj (1999) conducted a similar study in which participants’ learning styles were assessed. One group of participants received instruction that matched their learning styles while others received instruction that was mismatched. The computer-based instruction consisted of four sessions over a period of four weeks. The findings of this study showed no significant difference between test scores for the matched and mismatched cognitive style groups. There was also no significant difference between scores on individual sub-tasks, however the mean score of the matched group was consistently better than that of the mismatched group on all of these sub-tasks. The mean time that it took the matched group to complete the computer-based instruction sessions was less than the time required for the mismatched group to complete the instruction. This observation shows that learners can learn more efficiently when material is presented to them in a manner that is in accordance with their learning preferences.

Overbaugh and Lin (2006) investigated the effects of learning styles on achievement in Web-based and lab-based undergraduate courses. The researchers used the Paragon Learning Style Inventory, which is based on the same principles and same classification scheme as the Myers-Briggs Type Indicator. The researchers also used Martinez’s Learning Orientation Model. This study showed that introverts perform better in Web-based courses, while extroverts perform better in face-to-face courses. Judgers performed equally well in the face-to-face and the online sections of the course, but perceivers’ achievement declined dramatically in the Web-based section. These results indicate that there is a relationship between individuals’ learning styles and their performance in courses of various formats.

Sheard and Lynch (2003) conducted a qualitative study that explored students’ experiences in a course that was supplemented by online instruction that included discussion forums. The authors described, in detail, five participants’ reactions to the course Web site while noting how their learning styles related to their reactions. Unfortunately, the researchers failed to mention any common trends among the responses of participants with various learning styles. It appears that reflective and active learners were most comfortable using the Web site as a learning tool, while global learners did not find the Web site appealing and struggled to use it. “The data presented here suggests that the relationship between learning style preference and learners’ reactions to online environments warrants further inquiry” (Sheard & Lynch, 2003, p. 255). While the authors state that it was not their intention to focus on learning styles, it became apparent to them that this was an important factor in learners’ responses to online learning. Upon realization of this conclusion, the researchers insist that instructors need to acknowledge the needs of all types of learners. “Future developments in online course provision technology, if such technology is to facilitate truly student-centered teaching and learning, need to be smart enough to respond to the challenge of catering for individual learners’ needs and preferences” (Sheard & Lynch, 2003, p. 256).

Fahy and Ally (2005) studied the relation between learning style and online communication. Forty graduate students who were enrolled in one of two master’s level courses completed Kolb’s LSI. As part of the course, they participated in online discussions. Fahy and Ally recorded that convergers made significantly more postings and longer postings (in word count) than did divergers. It was also noted that accommodators created more scaffolding and engaging sentences than assimilators. Like other studies, this study’s results indicate that a relationship exists between learning style and performance in online courses.

Results of a study conducted by Chapman and Calhoun (2006) showed that learners who are more field-independent derive greater benefit from a computer-based course than those students who are more field-dependent. This is an indication that learning styles are a predictor of student learning in distance education.

Mehlenbacher et al. (2000) researched the relationship between learning styles and academic success in a technology-enhanced technical writing course. The researchers found that reflective and global learners experienced more success than active learners and sequential learners in an online learning environment.

Kinshuk et al. (2009) conducted a study in which the interactions between students’ learning styles, behavior, and performance were analyzed in an online course in which instruction did not match students’ learning styles according to the Felder-Silverman learning style model. The findings showed that learners with strong learning style preferences can benefit from adaptivity in the form of instructional adjustments that coincide with their learning style preferences or in the form of assistance in how to best learn in a course in which such a mismatch exists. Like in the study conducted by Mehlenbacher et al. (2000), participants who were classified as active learners struggled in this online course. Reflective learners were less hindered by the mismatch between instructional approaches and their preferred learning styles, while active learners had more difficulty in coping with the mismatch. The researchers note that this information should alert instructors to make instructional adjustments for active learners or to provide them with assistance in online learning environments in
which instructional approaches are not aligned with active learners’ preferences.

Battalio (2009) conducted a study that sought to investigate the relationship between student learning styles and success with online learning. The Index of Learning Styles (Felder and Soloman, 1991) was used as a research instrument in order to assess students’ learning styles. Concurring with the findings of Mehlenbacher et al. (2000) and Kinshuk et al. (2009), this study reported that reflective learners were significantly more successful with online learning than active learners and also adapted to the online learning environment better than active learners. Contrasting the results of the study conducted by Mehlenbacher et al. (2000), this study’s results also suggested that sequential learners were more successful with online learning than global learners. Data from this study suggests that there is a relationship between learning styles and student learning in online courses. Battalio (2009) takes a position based on this study’s results: student learning styles could be used as a determinant of preferred instructional format and as a measure of students’ potential success with online learning.

DeNeui and Dodge (2006) conducted a study in which they looked at use of the Blackboard Course Management System by students enrolled in introductory psychology courses. The findings of this study “suggest that individual differences in learning styles may influence both how students utilize online components as well as the degree to which students derive benefit from them” (DeNeui & Dodge, 2006, p. 258).

Du and Simpson (2002) explored the effect of learning styles on students’ self-reported enjoyment levels in an online course that used Web CT. Participants completed Kolb’s Learning Style Inventory and then gave reports of their performance and enjoyment level near the end of the course. This study showed that learning styles significantly impact students’ enjoyment level. This is another example of the influence that learning styles have on students’ experiences in Web-based courses.

Schellens et al. (2007) gathered data about students’ learning styles and academic performance in a blended seven-credit course for freshmen. The researchers reported that students’ learning styles significantly influence students’ final exam scores in an online course. Out of four factors that the researchers considered, learning style had the greatest impact on exam scores.

Both Salmon (2001) and Downing and Chim (2004) presented the results of studies that pointed to a relationship between students’ learning styles and their performance in online courses, though the results of their studies conflicted in terms of the ways that students with specific learning styles performed in online learning environments. Salmon (2001) named activists and pragmatists as the “online extraverts” and theorists and reflectors as the “online introverts.” Downing and Chim (2004) found that reflectors flourished in online learning environments, performing as extraverted and active learners. The researchers posited that reflectors thrive as participants in online courses, because online learning affords students time for reflection as well as the opportunity to participate in asynchronous discussions with teachers and other students.

Graf, Liu, and Kinshuk (2010) conducted a study that investigated differences in navigational behavior exhibited by students with various learning styles. The researchers assessed students’ learning styles using Felder and Soloman’s (1997) Index of Learning Styles. The findings of their study indicated that learners with different learning styles navigate online courses differently. The researchers suggest that students’ learning styles can be predicted through the observation of their online course navigational patterns, concurring with other researchers (Cha et al., 2006; García et al., 2007; Graf et al., 2008) who also asserted that learning styles can be identified automatically from students’ behavior in online courses.

Moallem (2007) researched how instructors can incorporate students’ learning styles into the design of instruction and the effects of doing so on students’ learning, attitude, and satisfaction. In this mixed-methods study, the researcher assessed student learning styles using Felder and Soloman’s (1998) Index of Learning Styles Survey. Participants were graduate students taking an introductory instructional technology course. Graded products from the first two units included a team product and participation in a large group discussion that consisted of both synchronous and asynchronous portions. Learning products from the third and fourth units included team products, individual reflective blogs, and discussion forum postings. In reviewing their experiences after completion of the course, reflective students indicated that they wished to spend less time reading and responding to forum postings, while active learners wanted more time to work with team members on the team activity. The researcher remarked, “Integrating learning styles in the design of instructional materials seemed to encourage learners to spend more time interacting with the course content and exploring various instructional materials to achieve learning outcomes” (Moallem, 2007, p. 239). If the consideration of student learning styles in the instructional design process promotes heightened student-content engagement, instructors should allow learning styles to guide their planning.

While multiple studies have pointed to a relationship between learning styles and student achievement, the findings of several other studies (Ingebritsen and Flickinger, 1998; Neuhauser, 2002; DeTure, 2004; Price, 2004; Xu, 2004; Liu, Magjuka, and Lee, 2008; Chen, Toh, and Ismail, 2005; Wang, Hinn, and Kanfer, 2001; and Mupinga, Nora, and Yaw, 2006) have shown no relationship between learning styles and academic success in online and computer-assisted learning environments.

Ingebritsen and Flickinger (1998) aimed to uncover information in order to improve the development and assessment of Web courses that use streaming audio and video technologies. These researchers determined that learning styles do not influence student achievement, but student use of learning strategies correlates positively with student achievement.

Neuhauser (2002) conducted research on an online section and a face-to-face section of the same course, both of which were taught by the same instructor. The findings of this study indicated no significant differences between learning styles and course grades in either section of the course.
DeTure (2004) desired to identify learner attributes that could predict student success in online courses. DeTure assessed students’ learning styles with the Group Embedded Figures Test. DeTure deemed learning styles to be a poor predictor of student success in online courses.

Price (2004) researched the usefulness of Honey and Mumford’s (1994) Learning Style Questionnaire (LSQ) in predicting performance in two course formats: a traditional correspondence course and an Internet version of the same course. The Internet students had access to a course Web site with all interactions being electronic, while the students in the traditional correspondence course communicated by telephone, by mail, and in person. The researchers were also interested in seeing whether students with different learning styles were attracted to different versions of the course. Price (2004) hypothesized that activists would be inclined to enroll in the Internet version of the course. The researcher collected data on students’ final grades and used evaluation questionnaires that inquired about students’ experiences in the courses and their levels of satisfaction. In the conventional group, the pragmatist scores were positively related to overall academic achievement, but these results were not matched in the Internet group. No significant relationships were identified between student LSQ scores and academic achievement. Additionally, no significant relationships were identified between LSQ scores and course preference. Price (2004) concluded, “the LSQ may have been inappropriate or insensitive for measuring individual differences in this situation” (p. 689).

Xu (2004) conducted a mixed-methods study with undergraduate computer science students as participants. This study focused on the effects of learning styles on students’ course performance and final grades in a blended course. The researcher found no relationship between these variables. A concern that this author has regarding the study was the researcher’s lack of consideration of the potential influence of student motivation on the dependent variables.

Liu, Magjuka, and Lee (2008) posited that cognitive styles are a poor predictor of students’ learning in online courses, yet they suggested that cognitive styles could forecast students’ virtual team performance.

Chen, Toh, and Ismail (2005) studied the effects of a virtual reality (VR)-based learning environment on the performance of learners with different learning styles. Participants completed a VR-based pretest and a VR-based posttest that assessed knowledge of traffic signals and traffic rules. In addition to this test, participants completed the Kolb Learning Styles Inventory. The findings showed that learners, regardless of their learning styles, benefit most from the VR guided exploration mode.

Wang, Hinn, and Kanfer (2001) investigated the effects of learning styles on learning outcomes in computer-supported collaborative learning. No significant relationship between students’ learning outcomes and their learning style was indicated by the results. Additionally, no significant difference in satisfaction scores was apparent among the four learning style groups according to the one-way ANOVA. “This study failed to detect any significant interaction between learning style and...a computer-supported collaborative learning environment.” (Wang et al., 2001, p. 82).

Mupinga, Nora, and Yaw (2006) conducted a study, seeking to determine the learning styles, expectations, and needs of online industrial education college students. They also explored how these characteristics can be used to design effective online instruction. In their study, students completed an online Myers-Briggs Cognitive Style Inventory. Students also answered the question, “What are your needs and expectations as an Internet student?” The reliability of this study needs to be questioned on the basis of how participants were permitted to respond to the open-ended question regarding their needs and expectations. Students could choose to email their responses to the researchers, or they could post the responses on a class discussion board. Student responses could be skewed by this factor, because students may not have truthfully reported their needs and expectations, knowing that their peers could read their responses. Participants’ responses may also have been affected by the reading of others’ responses. The researchers found that students in online courses, regardless of their learning styles, expected to have frequent communication with the instructor, regular feedback on their progress, and challenging material. The researchers noted that forty-six percent of the student participants in their study were introverts, sensors, and judgers. They reasoned that introverts are drawn to online courses, because they can complete these independently. The researchers concluded that, “no particular learning styles were found to be predominant among the online students; hence, the design of online learning activities should strive to accommodate multiple learning styles” (Mupinga et al., 2006, p. 188).

**SUMMARY**

Studies conducted by Ford and Chen (2001); Boles, Pillay, and Raj (1999); Overbaugh and Lin (2006); Sheard and Lynch (2003); Fahy and Ally (2005); Chapman and Calhoun (2006); Mehlenbacher et al. (2000); Kinshuk et al. (2009); Battalio (2009); DeNeui and Dodge (2006); Du and Simpson (2002); Schellens et al. (2007); Salmon (2001); Downing and Chima (2004); Graf, Liu, and Kinshuk (2010); and Moallem (2007) suggest a relationship between learning styles and student learning in online learning. Ingebritsen and Flickinger (1998); Neuhauser (2002); DeTure (2004); Price (2004); Xu (2004); Liu, Magjuka, and Lee (2008); Chen, Toh, and Ismail (2005); Wang, Hinn, and Kanfer (2001); and Mupinga, Nora, and Yaw (2006) found no significant relationship between learning styles and academic performance in online courses.

In light of these conflicting results, additional research is necessary in which the relationship between learning styles and academic performance in online courses is explored. The results of future studies may have implications for instructional design and delivery. Boyd (2004) noted a need for research on the relationship between learning styles and distance learning. Gallagher (2007) suggested further research that investigates the characteristics of successful online learners as well as an investigation into whether the characteristics of successful online learners differ from the characteristics of successful learners in face-to-face courses.
This author believes that there is a relationship between learning styles and student learning in online courses, and further exploration of this relationship and its implications for instructional design is necessary. “Online instruction and assessment must balance the requirements of technology, delivery, pedagogy, learning styles, and learning outcomes” (Gayton & McEwen, 2007, p. 130). The achievement of an optimal balance of these requirements will augment the online teaching and learning process.

REFERENCES


