

An Analysis of the Relationship between Learning Styles and Interaction
in Online Discussions in Distance Education Courses
at the University of Wisconsin-Stout

by

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A handwritten signature in black ink, reading "Howard D. Lee", is written over a horizontal line.

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ABSTRACT

With a rising number of online courses, there is also an increasing demand for meeting online learners' needs. In order to create meaningful online learning experiences, it is thus important to determine how online learners differ in regard to their learning styles. This study used an online survey to examine the relationship between students' learning styles and their interaction in online discussions. It identified the learning styles of students enrolled in online courses offered by the University of Wisconsin-Stout as part of the Graduate Certificate in E-Learning and Online Teaching between Summer 2007 and Spring 2008.

Students' learning styles were measured using the Index of Learning Styles (ILS) which consists of four learning style dimensions (active-reflective, sensing-intuitive, visual-verbal, sequential-global) and results in a strength score for each dimension. The ILS revealed that though all learning styles were represented in the sample, students had a strong preference for the

visual learning style. On average, students made five original and six responses postings on up to four days per week irrespective of their learning style. Two-thirds of students had taken at least five online courses and 84% rated their experience with online discussions as 'excellent', 'very good', or 'good'.

Even though a possible trend towards a relationship between two learning style dimensions (sensing-intuitive, sequential-global) and the frequency of access to the discussion forum, the number of response postings, and the number of required postings was found, the statistical results were not significant enough to make general conclusions about the relationship between students' learning styles and their interaction in online discussions.

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Chapter I: Introduction

Background

Over the past decade, the number of online courses offered by institutions of higher education has steadily increased. This increase is in large part due to the growth in the demand for flexible learning options that allow learners to build on their education while working or raising children. According to the National Center for Education Statistics (2004), the number of students enrolled in online courses almost doubled between 1997-1998 and 2000-2001; moreover, the percentage of postsecondary institutions that offer online courses rose from 34% in 1997-1998 to 56% in 2000–2001. These figures indicate that the number of online courses is likely to further increase in the future.

Associated with this increased demand for online education is the need to offer online courses that meet the students' needs. With an online education market that is increasingly facing competition, colleges and universities are no longer in a position to ignore the necessity to match their course offerings with the needs of learners. "Each student comes to class with certain learning experiences, expectations, and needs that have to be addressed, and to which instructors need to be sensitive, to maximize the student's learning experiences" (Mupinga, Nora, & Yaw, 2006, p. 185).

However, online students vary, not only in regard to their experiences and expectations, but they may also differ in their learning style. "Proponents of learning styles claim that they influence a student's ability to participate successfully in an online course" (Santo, 2006, para. 6). Some learners prefer written information and facts; others have a preference for visual clues such as graphics and videos, while some learn best when provided with verbal instructions or an opportunity to interact with others (Felder, 1996). Thus, "the more the distance education teacher knows about the individual student within the whole class, the more elegant the application of

education tools to the learning situation” (Simonson, Smaldino, Albright, & Zvacek, 2006, p. 163).

One of the most commonly used tools for online courses is the asynchronous discussion, also known as threaded discussion (Baglione & Nastanski, 2007). Threaded discussions are usually embedded in the course management software where they allow instructors to post questions or discussion topics, and learners can respond to these prompts by reading and posting comments. Moreover, online discussions provide an opportunity for active participation and interaction with students and the instructor. “Various studies have shown that online interaction helps learner construct new ideas actively and communicate valuable perspectives across different learners and groups” (Lee & Lee, 2006, p. 84).

One of the biggest advantages of “threaded discussions is that it supports the flexibility needs of the adult learner, while allowing time for research and reflection and reducing participation anxiety for shy students” (Lee & Lee, 2006, p. 140). Learners may participate when they feel they are going to be most productive because they do not have to follow a fixed time-frame (Baglione & Nastanski, 2007). In fact, “the online discussion board provides a unique potential that is not automatically present in a face-to-face situation” (Levine, 2007, p. 67). As a result, online discussions may play an important role for the interactive design of online learning environments.

Nevertheless, interactions in online courses differ significantly from those in the traditional classroom (Thurmond & Wambach, 2004). This is in large part due to the different communication tools and technologies that are employed in online courses. Instructors and students have to rely on tools such as e-mails, message boards, and discussion forums to interact with each other. In addition, it is important to bear in mind that interaction does not simply take place but must be deliberately considered in the course design process (King & Doerfert, 1996).

This design process depends on the underlying instructional philosophy, meaning that it is the instructional design and not the delivery system which may ultimately limit the quality of online courses. Thus, “it is the responsibility of the institution and the instructor to provide a learning environment in which the learner has the opportunity for appropriate interactions with content, the instructor, and other students” (Moore, cited in Berge, 1999, p. 9).

In order to create this kind of learning environment, it seems essential to consider student characteristics and learning styles (Mupinga, Nora, & Yaw, 2006). Though the overall number of postsecondary institutions that offer online courses is increasing, many colleges and universities do not provide students with an opportunity to assess their learning style (Papp, 2001).

Moreover, many students simply enroll in online courses due to their convenient, flexible schedule but they do not consider their learning style in the decision making process. But “students need to understand their own learning styles and the level of interaction that they need to sustain their interest in a [online] class” (Devi, cited in Bocchi, Eastman, & Swift, 2004, p. 246).

In fact, learners who enjoy the social nature of the traditional classroom environment or who prefer to listen to lectures might not like online learning (Jana, 1999). This indicates that learning styles might indeed influence students’ success in online courses. Moreover, research on threaded discussions indicates that online discussions may be particularly suitable for certain personality types (Lee & Lee, 2006). Though these findings do not directly relate to learning styles, they suggest that extroverted learners like to express themselves verbally, making them more likely to participate in asynchronous discussions, while introverted learners tend to be thoughtful and reflective, which might make them seem passive or uninvolved. Another study suggests that though there seemed to be no relationship between learning styles and critical thinking, “individual learning styles affected how learners participated in the [online] discussion”

(Conceição, 2004, p. 3). While some learners contributed real-life examples, others provided in-depth reflections on the discussion topics. Furthermore, a study conducted by Sabry and Baldwin (2003) found that learners seem to have “different perceptions of different types of web-based interactions” (p. 452).

However, the research regarding the relationship between learning styles and online discussions is rather controversial. Mupinga, Nora, and Yaw (2006) for example reported that they did not find a particular style to be prevailing among the students they surveyed for their study. Another study on the influence of learning styles on student performance in online courses found that student learning styles did not have any impact on mean test scores or on the overall reaction to the module contents (Harris, Dwyer, & Leeming, 2003). In addition, critics of the research on learning styles argue that learning styles theory faces three major problems: unclear definitions, weakness in reliability and validity of instruments, and unequivocal identification of learner characteristics (Curry, 1990). Nevertheless, supporters of learning styles claim “that understanding how learning styles affect learner’s success in online discussion forums can assist instructors in providing better guidelines to learners when designing online courses” (Conceição, 2004, p. 4).

Although there is no generally accepted definition of learning styles, they can be described as “the characteristic cognitive, affective, and psychological behaviors that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment” (Keefe & Monk, cited in DeBello, 1990, p. 203). Felder and Soloman (n.d.) described four learning style dimensions that can be measured by the Index of Learning Styles (ILS). “This instrument is designed for adults and assesses learning preferences on four dimensions that can be theoretically matched to instructional elements in Internet-based courses” (Doherty, 2000, p. 11).

Based on the previous analysis of the relationship between learning styles and online discussions, it seems reasonable to assume that learning styles might impact students' success as online learners; more precisely, learning styles might influence students' interactions in online discussions. For this reason, this study intends to address the need to further explore the relationship between learning styles and interactions in online discussions in distance education courses at the University of Wisconsin–Stout.

Overall, the University of Wisconsin-Stout offers 22 different programs which are offered either online only or in a hybrid course format. This includes programs for both undergraduate and graduate students, as well as programs designed to meet the needs of professionals in various fields (University of Wisconsin-Stout, 2007). In addition, online courses are offered through the professional development program of the School of Education. These courses aim at K-12 and technical college instructors interested in art, reading & literacy, teaching writing, using technology, e-learning, instructional strategies, educational leadership, and school library and media applications (University of Wisconsin-Stout, 2008a). Distance education courses at the University of Wisconsin-Stout are either taught by faculty members who also teach these courses in the traditional classroom setting or by online instructors who only teach selected professional development courses.

According to Vandervelde (2006), student enrollment in the University of Wisconsin-Stout's School of Education online professional development courses is rising. Enrollment has increased by 69% between 2004 and 2005. The main reasons for learners to enroll in these courses are convenience and flexibility. "With 95 percent of students holding full-time teaching schedules, learning remotely is for many the only opportunity to learn and teach at the same time" (p. 1). Overall, 55% of students enrolled during the spring of 2005 had previously earned a master's degree or higher and 41% intended to renew their teaching license by enrolling in

online professional development courses. Furthermore, 87% of online professional development students enrolled during the spring of 2005 were at least 31 years old and about 33% were 50 or older.

Statement of the Problem

The number of research studies conducted at the University of Wisconsin–Stout that focus on the relationship between student learning styles and online discussion participation is limited. However, instructors using asynchronous discussions may need to better understand this relationship in order to provide students with valuable online learning experiences. This understanding will help them to account for learner differences in regard to learning styles and to consider these differences for the interactive design of online courses.

Purpose of the Study

The purpose of this study is to determine the influence of students' learning style preference measured by Felder and Soloman's Index of Learning Styles (ILS) on the level of interactions in online discussion forums (based on the number and frequency of postings) in distance education courses offered through the University of Wisconsin–Stout. Data will be collected in the summer of 2008 through an online survey, which will be sent to students who have previously been enrolled in distance education courses at UW-Stout. By analyzing the correlation between learning styles and interaction in online discussions, this study aims at providing information that will support online instructors' decisions regarding the design of online discussion forums.

Research Questions

This study will attempt to answer the following questions:

1. What learning styles exist among students enrolled in distance education courses offered through the University of Wisconsin-Stout?

2. Is there a difference in the distribution of learning styles between students?
3. How does the number of online discussion posts relate to different learning styles?
4. How does the frequency of online discussion posts (e.g. once a week, twice a week, everyday) relate to different learning styles?
5. What is the relationship between learning styles and online discussion participation?

Importance of the Research

This study is important for the following reasons:

1. The number of courses offered online is steadily increasing, requiring colleges and universities such as the University of Wisconsin-Stout to base their distance education courses and programs on the latest research findings about online learning and teaching. Since distance education is still a relatively young sub-discipline of education, some characteristics of online courses have been studied in greater detail than others. To improve the quality of online courses and programs, additional research is needed to better understand how learning styles impact the effectiveness of distance education courses.
2. Online instruction differs from instruction in the traditional classroom. Instructors who teach online must become aware of these differences in order to effectively facilitate student learning. Moreover, online instructors should select instructional activities that meet the needs of learners. To be able to meet these needs, instructors should consider students' learning styles.
3. Discussion forums represent one tool for interaction in online courses. Though not all instructors make use of asynchronous discussions as a means for facilitating online learning, many courses "use the threaded discussion forum as a central locus of course

activity” (Lowes, Lin, & Wang, 2007, para. 2). For this reason, it seems important to assess the relationship between learning styles and interaction in online discussions.

Assumptions of the Study

The study will be based on the following assumptions:

1. Students participating in this study have taken at least one online course offered through the University of Wisconsin-Stout. They may have been enrolled during Summer 2007, Fall 2007, or Spring 2008; moreover, students may have taken more than one online course during this time period.
2. Participants will answer all questions included in the online survey to the best of their knowledge. They will neither skip questions nor randomly select survey answers. In addition, the study assumes that participants have not recently taken the learning style inventory incorporated in the survey instrument.
3. It is assumed that students have a well-defined preference for one of the learning styles included in the ILS. A further assumption is that a difference in the distribution of learning styles exists, meaning that some learning styles will occur more often than others. It is also presumed that each learning style will be represented in the sample.

Limitations of the Study

The study will be based on the following limitations:

1. The student population analyzed for the purposes of this study will be limited to distance education students; this means that results will not be generalizable to other student populations at UW-Stout.
2. Student participation in online discussions might not only depend on the preferred learning style, but on other variables such as motivation, personality, individual experiences, or environmental factors (time, place, noise, etc.).

3. The number of online courses taken in the past might influence the way students interact in online discussions, since students will have experience with the mechanisms of making posts and responding to other students.
4. The study will also be limited in regard to the number of participants; it may not be possible to select a sample size which is large enough to allow for representative results.
5. Students may not respond according to their personality but they may answer questions based on what they deem socially desirable. As a result, students' responses may be biased towards what they think makes them appear in a good light; they may be reluctant to admit bad habits or inappropriate attitudes.

Definition of Terms

The following terms are defined for the purpose of this study:

Asynchronous communication. Any form of technologically mediated communication which does not depend upon instructors and students being present together at a specific time and/or place to conduct learning/teaching activities (Berge, 1999).

Discussion forum. A feature included in the user interface of most learning management software systems that allows online learners to participate in electronic discussions by exchanging messages that are usually ordered according to date or topic.

Distance education. Form of education which is characterized by a learning situation where instructor and students are separated by time and space but connected via technology or the Internet.

Interaction. Two-way computer-mediated communication between individuals that is characterized by its collaborative nature and chance for active learning and may occur either synchronously or asynchronously in distance education courses.

Learning style. “The complex manner in which, and conditions under which, learners most efficiently and most effectively perceive, process, store, and recall what they are attempting to learn” (James & Gardner, 1995, p. 20).

Online discussion. Form of discussion that takes place in online learning environments and allows learners to interact with each other without being constrained by time or space.

Original posting. Online discussion posting which is made as a response to a question posted by the instructor or contains a question about course contents; form of posting that establishes a new thread in asynchronous online discussions.

Personality. Refers to an individual’s traits and characteristics that help to explain differences that exist between human beings in regard to attitudes, behaviors, and habits.

Response posting. Online discussion posting which is made as a response to another student’s posting; form of posting which adds to an existing thread in asynchronous discussions.

Threaded discussion. Form of online discussion which allows participants to directly respond to each other’s postings by displaying all the responses made to the original posting as well as the responses made to the secondary postings, while at the same time forming a thread that allows students to lead conversations with simultaneous subconversations.

Chapter II: Literature Review

Introduction

This chapter will provide an overview of the literature pertaining to learning styles. It will describe several learning style models, citing a number of learning style inventories associated with these models, and discuss the relevance of learning styles for online learning. Moreover, the chapter will provide a review of the literature on interaction in online courses; it will summarize findings on the different forms of interactivity in web-based learning environments. Finally, the chapter will discuss the role of online discussions, outlining important characteristics of this instructional method, and explaining how learning styles might influence students' participation in online discussions.

Learning Styles

While most researchers agree that each learner has a preferred way of processing information and interacting with his or her learning environment, no universal definition of the term 'learning style' exists (James & Gardner, 1995). In addition to the confusion of definitions regarding learning style concepts, there is a large discrepancy in the way these concepts are used to predict learning styles (Curry, 1983). Furthermore, "the evidence gathered to support various conceptualizations varies radically in terms of psychometric standards" (p. 1). Though a vast amount of learning style research has been conducted since its beginnings in the 1960's, the research has mainly lead to a high degree of confusion regarding terminology and conceptualization. Among other things, a great deal of confusion exists in regard to the terms 'cognitive style' and 'learning style' (Bonham, 1989). Thus, in this study the term 'learning style' will be used to describe an individual's learning preference.

Learning Style Models

A large number of different learning style models can be found in the literature. Each model uses its own definition of the term 'learning style', which makes it rather difficult to describe these models. A helpful framework for organizing the growing number of learning style models was developed by Curry (1983); she used a metaphor that compares the layers of an onion to the different levels of personality traits. "At the core of the onion is style in the sense of basic personality traits" (Swanson, 1995, p. 2). Theories corresponding to this layer focus on the influence of these basic personality traits on acquiring and integrating new information. The second layer, which is based on the information processing model, refers to an individual's preferred way of processing information and the third layer refers to a person's instructional preference (Curry, 1983). Using Curry's framework, the following paragraphs briefly discuss a number of learning style models.

Personality Models. One of the most popular personality models in learning style research is the Myers-Briggs Type Indicator (MBTI). The MBTI was developed in the 1940's by Isabel Myers and her mother Katherine Briggs who based their research on Jung's theory of personality types (Denham, 2002). As stated by Butler and Pinto-Zipp (2005), the MBTI measures personality traits rather than learning styles and extends the personality dimensions originally developed by Jung to include four dimensions: introvert-extrovert, sensing-intuition, thinking-feeling, and judging-perceiving. The inventory includes 126 questions and takes about 30-45 minutes to complete; it can be administered by a large number of professionals, with career counselors being the most common profession (Denham, 2002). According to Denham, the MBTI is "a highly reliable and valid personality inventory" (p. 3).

A more recently developed personality-based model is the one formulated by Richard Felder and Linda Silverman. This model was originally "designed to capture the most important

learning style differences among engineering students and provide a good basis for engineering instructors to formulate a teaching approach that addresses the learning needs of all students” (Felder & Silverman, cited in Felder & Spurlin, 2005, p. 103). The Felder-Silverman model consists of four different learning style dimensions including sensing versus intuitive, visual versus verbal, active versus reflective, and sequential versus global. Each of these dimensions is similar to the ones used by other learning style models, although they are not exactly the same; the sensing-intuitive dimension, for example, directly corresponds to the MBTI. The following is a brief summary of the four dimensions described by Felder and Spurlin (2005):

Sensing (concrete, practical, oriented towards facts and procedures) or intuitive (conceptual, innovative, oriented toward theories and underlying meanings);
visual (prefer visual representations of presented material, such as pictures, diagrams, and flow charts) or verbal (prefer written and spoken explanations);
active (learn by trying things out, enjoy working in groups) or reflective (learn by thinking things through, prefer working alone or with two familiar partners);
sequential (linear thinking process, learn in incremental steps) or global (holistic thinking process, learn in large leaps). (p. 103)

These dimensions served as the basis for the development of the Index of Learning Styles (ILS), which was initially created in 1991 and later published as a pencil-and-paper version on the Internet (Felder & Spurlin, 2005). In 1997, the authors added an online version that allows individuals who complete the inventory online to immediately receive results. However, it is important to note that these results represent only behavioral tendencies and not reliable indicators of strengths and weaknesses. As stated by Felder and Spurlin, the primary goal of the ILS is to help instructors select learning activities that match with students’ learning styles. In regard to the instrument’s psychometric qualities, several studies indicate that the ILS seems to

be a valid, reliable instrument that offers more consistency and predictive value than other commonly used learning style inventories (Felder & Spurlin, 2005; Litzinger, Lee, Wise, & Felder, 2007; Papp, 2001; Zywno, 2003).

Information Processing Models. These models deal with the way people process information. Probably the best known instrument which falls into this category is Kolb's Learning Style Inventory (Swanson, 1995). This inventory is based on Kolb's theory of experiential learning which characterizes learning as a four-step process: concrete experience, reflective observation, abstract conceptualization, and active experimentation. Based on these steps, Kolb developed four different learning style types including divergers, assimilators, convergers, and accommodators. The inventory "consists of 36 words in 9 groupings of 4 each" (Papp, 2001, p. 17). Students are asked to rank each set with 1 equaling a description least like themselves and 4 bearing the highest resemblance. Each of the four word columns corresponds to the learning style types listed above. However, according to Santo (2006), Kolb's Learning Style Inventory has been criticized for its low reliability.

Another instrument based on the information processing model is the Gregorc Style Delineator (DeBello, 1990). Gregorc's model assumes that each learning style represents a combination of distinctive, observable behaviors which offer clues in regard to how an individual's mind functions and how this functioning relates to his or her environment. According to the model, each person is equipped with a predisposition to learn in a certain way. To describe these tendencies, Gregorc uses four different characterizations including abstract, concrete, random, and sequential which are combined into several learning styles. These styles "include concrete sequential, abstract sequential, concrete random, and abstract random learners" (Swanson, 1995, p. 6). While concrete sequential learners have a preference for hands-on learning, abstract sequential learners are good at decoding information. Concrete random

learners, on the other hand, learn best by using a trial-and-error approach, and individuals with an abstract random learning style prefer unstructured activities and information. As stated by DeBello (1990), Gregorc uses a self-report inventory in which individuals have to rank four words in each of ten different sets, which is similar to the format used by Kolb.

Instructional Preference Models. Learning style models in this category focus on classroom interactions. One of these instruments is the Grasha-Reichmann Student Learning Style Questionnaire (GRSLSQ), which was designed for use with students at the college level (Blakemore, McCray, & Coker, 1985). The instrument aims at determining how learners interact with their environment and how they learn different contents. The GRSLSQ uses six scales including independent, dependent, avoidant, participant, competitive, and collaborative; the independent-dependent dimension assesses the intellectual curiosity and initiative of students while the avoidant-participant dimension refers to a learner's preference for traditional teaching methods. The last dimension, competitive-collaborative, describes the degree to which individuals engage in cooperative activities. Overall, the questionnaire contains 90 items which are answered by indicating "the degree to which statements apply to oneself" (p. 51).

Learning Styles and Distance Education

Courses offered through distance education programs differ from courses in the traditional classroom setting. The main difference lies in the spatial and temporal separation of the instructor from the students. Hence, the instructional delivery of online courses varies too. However, a study conducted by Gunawardena and Boverie (1993) could not establish a connection between learning styles and students' interaction with media and methods of instruction. Another study which focused on learning styles and students' perceptions of Internet-based methods of instruction among community college students did not find a significant correlation either (Doherty, 2000). Nevertheless, Gunawardena and Boverie indicated

that learning styles may affect student satisfaction in online courses. A similar result was found by Simpson and Du (2004), who suggested that though learning styles may not impact participation in online courses, they might significantly influence a student's enjoyment level. Furthermore, Diaz and Carnal (1999) argued that "students enrolled in an online class are likely to have different learning styles than equivalent on-campus students" (p. 135). In their comparison of online and on-campus students, they found online students to be more independent and driven by intrinsic motivation, while on-campus students seemed to prefer the traditional classroom setting where they can work in groups and receive more immediate feedback from classmates and the instructor.

In regard to the frequency of learning styles, a study by Mupinga, Nora, and Yaw (2006) found that no particular learning style was predominant among the undergraduate students they surveyed using the Myers-Briggs Cognitive Style Inventory. Though they were able to identify a number of expectations for online learners such as timely communication with the instructor and prompt feedback on assignments, they did not find a prevailing learning style. Thus, they recommended using online learning activities that appeal to more than one learning style.

Though there may not be a predominant learning style for online learners, online learners might differ from traditional students in other ways. For example, they might differ in regard to their academic achievement. In a study conducted by Neuhauser (2002), two sections of a course were compared: one section was taught online, while the other section was taught face-to-face. The results showed that there was neither a difference in test scores, nor in assignments, participation, or final grades between the two sections. A study by Harris, Dwyer, and Leeming (2003) indicated that neither learning styles, nor the version of an online course module seemed to have an influence on test scores or students' reaction to the learning module. Moreover, the authors reported that learning style seemed not to be related to learners' overall performance.

However, Gee (1990) suggested that “learning style preferences may affect academic achievement and attitude of students involved in distance education settings” (p. 1). Another study, which tried to establish a connection between learning styles and critical thinking, did not find a relationship between student learning styles and critical thinking, but claimed that individual characteristics may influence students’ critical thinking skills in online courses (Conceição, 2004).

Contrary to some of the studies discussed above, results of a study by Garland and Martin (2005) suggested a difference in the learning style of online learners and students who participated in face-to-face instruction; in addition, gender seemed to play a role for the relationship between student learning styles and engagement. The authors also argued that by using a learning style inventory at the beginning of the course, instructors could tailor the course to meet the needs of students with the predominant learning style. Moreover, by using information on learning styles and gender differences, instructors could “include the necessary components in the online course that facilitate student learning” (p. 78).

Interaction in Distance Education

According to Kearsley (1995), “one of the most important instructional elements of contemporary distance education is interaction” (para. 1). Even though it is widely acknowledged that a high level of interaction has a positive impact on the effectiveness of distance education courses, it remains unclear if interaction does lead to an improvement of the quality of student learning in these courses. As Kearsley pointed out, interactivity is a rather complex concept that is not uniformly defined. It can refer to the interactions between course contents, students, and the instructor, as well as to the time dimension of interactions, meaning that interactions can either be synchronous or asynchronous. Moreover, Kearsly suggested that

individuals seem to differ in regard to their predisposition for interaction “depending upon their personality, age or cognitive/learning styles” (para. 6).

A study by King and Doerfert (1996) indicated that while the interaction needs of learners are generally similar, they differ when it comes to delivery methods. It seems that learners’ interaction needs may be influenced by the delivery method which, in the case of King and Doerfert, included face-to-face, voice communications network, and videotape offerings. Based on their findings, the authors suggested that instructors should design programs that focus on interaction, making interaction an integral part of online courses. In other words, King and Doerfert concluded that interaction does not simply occur, but has to be intentionally designed into online courses. In addition, they emphasized that course elements such as contents and delivery methods need to compliment each other and should include “flexible opportunities for interaction” (para. 43).

However, interaction can take on different forms. Moore (1989) distinguished between three different types of interaction: learner-content interaction, learner-instructor interaction, and learner-learner interaction. While learner-content interaction refers to activities such as reading texts or reviewing a slide-show, learner-instructor interaction relates to the presentation of information and the provision of feedback. Moreover, learner-learner interaction occurs in the form of discussions, emails, or chats. Moore argued that “the frequency and intensity of the teacher’s influence on learners when there is learner-teacher interaction is much greater than when there is only learner-content interaction” (para. 7). This may indicate that online courses which consist of self-study modules are less successful than courses that incorporate interactive elements such as online discussions. In fact, Moore suggested that learner-learner interaction seems to be an important aspect of online learning, indicating that this form of interaction might be crucial for the instructional design of online courses.

Hillman, Willis, and Gunawardena (cited in Gunawardena, 1999) observed that the three types of interaction described by Moore (1989) may not be sufficient to represent all the facets of interaction in distance education courses. They argued that a fourth type of interaction, learner-interface interaction, is necessary to take in interactions mediated by technology. According to Hillman, Willis, and Gunawardena, it is important to acknowledge learner-interface interaction as a fourth, distinct type of interaction because it is the mediating element of technology which enables all other types of interaction.

Besides learner-interface interaction, learner-instructor interaction might influence the succession of events in online courses. A study conducted by Dennen, Darabi, and Smith (2007), which focused on learner-instructor interaction in online courses, suggested a difference in the perceived importance of instructor actions in online courses. While instructors believed that student performance was connected to actions focusing on course contents and performance feedback, learners indicated they were truly satisfied if they felt that their interpersonal communication needs were met.

Consequently, as stated by Bender, Brewer, and Whale (2006), “communication between instructor and learner is paramount in their success in the online learning environment” (para. 2). More precisely, it is the means, form, and frequency of communication that determines if online learners are satisfied with their learning experience. Instructors may for example use email, virtual classrooms, or the telephone to communicate with students, providing them with notes, messages, and constructive feedback. In regard to the practice of online courses, Dennen, Darabi, and Smith (2007) thus concluded that instructors should reply to emails and offer feedback in a timely manner; moreover, they suggested that teachers should have “a regular presence in class discussion spaces” (p. 77).

These findings in regard to learner-instructor interaction are supported by the results of another study conducted by Northrup (2002); this study focused on the types of interaction that are most important to online learners. Learners' perceptions were measured through the Online Learning Interaction Inventory, an unpublished instrument developed by the researcher. In terms of interaction, the study looked at "content interaction, conversation and collaboration, intrapersonal/metacognitive skills, and need for support" (p. 219). The results suggested that online learners rank self-regulated learning and timely feedback from the instructor as most important for their learning experience. In fact, participants reiterated "the importance of interaction by requesting interactive elements in their online experiences" (p. 225).

Asynchronous Online Discussions

One such interactive element is represented by online discussions. Online discussions are a very popular method of online interaction (Baglione & Nastanski, 2007). They allow learners to actively engage with contents and to interact with other students and the instructor. One of the advantages of online discussions is that they allow for flexibility in regard to time for formulating questions and responding to discussion postings. In fact, online discussions may allow for "a richer, more vibrant discussion, compared to the traditional classroom" (p. 142) because learners have more time to prepare responses and to reflect on the topics. Moreover, the environment's anonymity may help learners who otherwise feel reluctant to participate in discussions to interact with others.

However, the anonymity usually associated with online discussions is not the only distinguishing feature of online and face-to-face discussions. Tiene (2000) observed four different elements which may be helpful for differentiating between asynchronous online discussions and face-to-face discussions: access, timing, mode of expression, and visual clues. One of the most obvious differences is the use of technology. In order to participate in online

discussions learners need access to computers and the Internet, implying that technical difficulties might interfere with a student's ability to participate in online discussions. As stated by Tiene, "another important difference is the timing with which the discussions are conducted" (p. 373). While face-to-face discussions take place synchronously, most online discussions occur asynchronously. This means that participants can contribute to the discussions at any time that is convenient to them, which may lead to delays between contributions. As a result, asynchronous online discussions typically require a longer time-frame. In addition to timing, the mode of expression is different in online discussions. In contrast to face-to-face discussions, participants have to rely on written communication. But though writing may be more accurate and based on its permanence useful for reviewing contributions, it also requires more time and does not allow learners to take advantage of vocal clues. Lastly, "the visual clues involved in a face-to-face discussion are largely lost in the online experience" (p. 373). Even though emoticons are sometimes used to represent body language they can not be equated with human gestures, meaning that "communication dynamics are limited, body language is unobservable and, therefore, learning possibly reduced" (Baglione & Nastanski, 2007, p. 140).

Other researchers focusing on discussion participation found additional differences. A study by Card and Horton (2000) which compared courses using computer-mediated communication with face-to-face courses indicated that there was no difference in the achievement of learning objectives and student satisfaction. Nevertheless, the study found a difference in the degree of interaction between students, suggesting that the level of interaction was higher in the face-to-face environment.

Another study by Meyer (2002) showed that though discussions can be successful in both learning environments learners using asynchronous discussions seemed to spend more time on course goals, appreciating the additional time provided for reflection on course contents. Meyer

argued that students might also use this time for asking questions or for participating at greater length in the discussions. Moreover, she indicated that a learner who “processes information by talking and who enjoys the give-and-take of discussion may feel disadvantaged in the online setting” (p. 62). This means that online discussions may be more advantageous to students who need time to reflect on their learning and to contribute to the discussions. Besides time, Meyer’s study focused on higher-order thinking, suggesting that students who participate in threaded discussions seem to rely on higher-order thinking skills for composing messages.

Other studies address the relationship between asynchronous discussions and critical thinking skills. Greenlaw and DeLoach (2003), for instance, examined the use of online discussions for teaching critical thinking, suggesting that “electronic discussion appears to provide a natural framework for teaching critical thinking” (p. 36). However, they argue that like any other teaching method online discussions need to be carefully prepared; moreover, they point out that students should learn about argumentation prior to participating in online discussions and that learners need to be familiar with the course materials in order to participate successfully.

Similar results were found by Maurino (2007), who conducted a metanalysis on studies examining the relationship between critical thinking and threaded discussions. For the purpose of her metanalysis, Maurino reviewed research studies for findings regarding “participation quality, participation quantity, critical thinking skills and deep learning, and recommendations” (p. 241). She concluded that most studies indicate that threaded discussions allow for the development of critical thinking skills even though research does not necessarily provide evidence for this claim. Maurino also reported that several studies called for a higher level of instructor involvement, although most of them solely focused on the role of students.

Another important aspect of online discussions mentioned in the literature is their potential for interaction and cognitive engagement. Zhu (2006) found that these two factors are

essential for the construction of new knowledge. However, she also points out that a number of factors may impact interaction and cognitive engagement in online discussions. These factors include “the instructor’s presence, role, and expectations, which may be clarified in terms of discussion goals, and facilitation, and discussion questions, class size, delivery format, percentage of final course grade, gender, and student academic maturity” (p. 476). Moreover, Zhu argues that learners’ intrinsic motivation as well as their knowledge of and interest in the discussions topic seem to influence the level of interaction and cognitive engagement.

A further study by Hammond (2000) indicated that while students generally value online discussions, they also seem to experience a number of constraints when it comes to their participation in these discussions. Among other things, learners have to deal with inhibitions, which may be more difficult to overcome for introverted students. In addition, factors such as time, available resources, and the nature of the course as well as the support seem to influence learners experience with online discussions. Nevertheless, Hammond emphasizes that online discussions represent a valuable educational approach which “draws both on knowledge gained from practical experience and that from theoretical insight” (p. 251).

In contrast to the above mentioned studies, Davidson-Shivers, Muilenburg, and Tanner (2001) observed that asynchronous discussions are not necessarily superior to other forms of interaction in online learning environments. In order to determine which discussion mode was more useful for learners, they compared student participation in synchronous and asynchronous online discussions. But though other studies seem to confirm that asynchronous discussions are “the desired mode for on-line learning, the results of this study did not indicate that” (p. 364). In fact, Davidson-Shivers, Muilenberg, and Tanner concluded that learners enjoy both modes of discussion, suggesting that unlike their synchronous counterpart asynchronous discussions provide students with an opportunity for thoughtful responses and reflection. This finding was

confirmed by Lee-Baldwin (2005) who noted that asynchronous discussion forums have the potential to promote reflective thinking.

Furthermore, a study by Sain and Brigham (2003), which compared the use of threaded discussions with assignments on paper, did not indicate a superiority of asynchronous discussions. In fact, the authors found that learners rated their online discussion experience negatively, suggesting that students who completed the written assignments “reported significantly higher levels of learning, interaction with peers and instructors, and satisfaction” (p. 427). Sain and Brigham concluded that threaded discussions per se are not adequate when it comes to generating increased levels of learning, student satisfaction, and interaction in online courses.

Personality Types and Distance Education

As discussed earlier, the concept of learning styles is rather complex and no universal definition of the term ‘learning style’ exists. It is difficult to clearly differentiate between the term ‘learning style’ and other closely related concepts such as personality. Thus, some research studies focus on the influence of personality traits on students’ participation in online courses rather than on the relationship between learning styles and online learning. However, these studies may still be helpful for understanding how individual learners differ in regard to their participation in online discussions.

A study by Kanuka and Nocente (2003), for instance, which examined the relationship between learner personality types and satisfaction in web-based continuing professional development courses, found no correlation between personality and satisfaction with web-based instruction. As stated by the authors, students were satisfied with their online learning experience regardless of their personality style, which was measured through the Millon Index of Personality Styles. Moreover, Kanuka and Nocente (2003) concluded that online learning is

increasingly becoming an important medium for professional development courses and that the main reason for this development lies in the convenience associated with web-based learning. More and more learners seem to prefer online courses, suggesting that they are also more “satisfied with the learning experience” (p. 241).

In contrast to Kanuka and Nocente (2003), Bishop-Clark, Dietz-Uhler, and Fisher (2007) reported that personality may have an impact on students’ satisfaction with online courses. Though they did not find a relationship between personality and student performance, their results showed that personality may influence student satisfaction. More precisely, Bishop-Clark, Dietz-Uhler, and Fisher suggested that “extraverts report having a more difficult time relating to other students in the class though they scored higher on participation” (p. 503). The authors also indicated that students with a preference for thinking did better than feeling students, who had a tendency to feel isolated in the online learning environment. In addition, their findings suggested that “while Extraverts performed better in electronic discussions than Introverts, they also reported it is more difficult to relate to other students in the course” (p. 503). This implies that the extroversion/introversion personality dimension may influence students’ success in online discussions.

A study by Lee and Lee (2006) seems to support this connection. Lee and Lee investigated the effect of different group compositions based on personality types as indicated by the Myers-Briggs Type Indicator on interaction in asynchronous discussions. Students were divided into three groups consisting of introverts, extroverts, and a mix of introvert-extrovert individuals. The study’s results suggested that students in the extrovert and mixed group composed more messages compared to the introvert group. In addition, “the extroverted and mixed groups’ learners showed more social, interactive, and cognitive interaction than those of the introverted group” (p. 83). Based on these findings, Lee and Lee concluded that

asynchronous online discussions may not be suitable for introverts because this type of learner seems to be apt to take a passive role in the discussions. Moreover, introverted learners seemed to prefer answering questions rather than coming up with new questions, suggesting that the immediate feedback and ideas provided by extroverts may encourage introverts to actively participate in online discussions. Extroverted learners, on the other hand, “can benefit from in-depth discussions, due to the logical and in-depth arguments made by introverted learners” (Lee & Lee, 2006, p. 92). Overall, Lee and Lee came to the conclusion that a mix in the composition of groups may be best for promoting student learning.

Similar results were found by Ellis (2003), who examined the relationship between personality type and participation in asynchronous online discussions by using the Myers-Briggs Type Indicator to identify students’ personality. According to Ellis, it seemed that student attitudes towards discussion participation were influenced by their personality, “particularly on the dimensions introversion/extroversion, sensing/intuition and thinking/feeling” (p. 111). While asynchronous online discussions tend to allow introverts to spend more time composing messages, they tend to allow sensing individuals to learn about new concepts without being pressed for time. All in all, Ellis concluded that group composition based on the distinction between extroverts and introverts may result in a more productive learning environment.

Another study by Offir, Bezalel, and Barth (2007), which focused on the relationship between cognitive styles and student achievement in a videoconference-based course, indicated a correlation between students’ cognitive styles and their achievement level. More precisely, the authors found differences in the achievement level of introverts and extroverts, which they attributed to the general differences that exist in individuals with these cognitive styles. For example, “extroverts prefer interactive activities with people, whereas introverts prefer situations that enable solitude and concentration” (p. 15). Offir, Bezalel, and Barth concluded that a

reduced level of interaction in the videoconference-based learning environment may lead to a loss in interest on part of the extrovert students, decreasing their attention and achievement, while introverts may be comfortable with the distance from the lecturer because they learn best in a setting that is free of distractions from others. On the whole, the study's results showed that the technological characteristics of videoconference-based distance education courses differ in regard to their effect on students with diverse cognitive styles.

Summary

The review of the literature on learning styles revealed that even though the concept of learning styles is widely acknowledged, there is a lot of controversy when it comes to definitions and conceptualizations. Moreover, there is no uniform opinion in regard to the connection between learning styles and distance education. Some authors suggest that learning styles may affect students' satisfaction with online courses (Gunawardena & Boverie, 1993; Simpson & Du, 2004), while others authors did not find a connection between students' performance in online courses and their learning style (Harris, Dwyer, & Leeming, 2003; Neuhauser, 2002).

Another important aspect of online learning discussed in the literature is interaction. Though interaction can take place in form of learner-content, learner-instructor, and learner-learner interaction (Moore, 1989), it seems that learner-instructor interaction in form of emails and feedback is the most crucial form of interaction when it comes to the satisfaction of online learners (Dennen, Darabi, & Smith, 2007).

As to the use of asynchronous online discussions, Tiene (2000) found that they differ from face-to-face discussions in regard to access, timing, mode of expression, and visual clues. They may thus be more suitable for reflective learners (Meyer, 2002); in addition, they may help students develop critical thinking skills (Maurino, 2007).

Besides asynchronous online discussions, personality was found to have an influence on students' interaction in online courses. But while some authors argue that an individual's personality may influence his or her satisfaction with online learning (Bishop-Clark, Dietz-Uhler, & Fisher, 2007; Ellis, 2003; Lee & Lee, 2006), other researchers did not find a connection between these two variables (Kanuka & Nocente, 2003). Overall, the literature on learning styles suggests that it may be best to have online groups that consist of students with different learning styles (Ellis, 2003; Lee & Lee, 2006).

Chapter III: Methodology

Introduction

The purpose of this study was to determine the influence of students' learning style preference measured by Felder and Soloman's Index of Learning Styles (ILS) on the level of interactions in online discussion forums in distance education courses offered through the University of Wisconsin–Stout. This chapter will discuss the characteristics of the sample, the instrument used to gather data, the data collection procedure, the data analysis process, and the limitations which apply to the methodology.

Subject Selection and Description

Participants in this study consisted of students who have taken online professional development courses at the University of Wisconsin-Stout in past semesters. More precisely, the study concentrated on students enrolled in courses offered as part of the Graduate Certificate in E-Learning and Online Teaching (University of Wisconsin-Stout, 2008b). This certificate is intended for both professionals and individuals without any previous knowledge of e-learning and aims at helping participants understand the complexities underlying the process of online learning and teaching. Students may take individual certificate courses to fulfill their professional development goals, or they may take all five courses required for the graduate certificate. The certificate comprises four regular online courses, including E-Learning for Educators, Assessment in E-Learning, Instructional Design for E-Learning, and Creating Collaborative Communities in E-Learning, and a practicum which is taken after students have successfully completed the other courses. The Graduate Certificate in E-Learning and Online Teaching is primarily designed for professionals such as instructors in technical colleges or

higher education, K-12 instructors, corporate trainers, curriculum consultants, administrators, and educators interested in broadening their knowledge of e-learning.

All participants selected for the study had previously been enrolled in at least one of the online courses offered as part of the Graduate Certificate in E-Learning and Online Teaching. Most of them are adult learners who hold full-time teaching positions and prefer online professional development courses due to their convenience and flexibility (Vandervelde, 2006). Study participants were selected based on class rosters for courses offered during Summer 2007, Fall 2007, and Spring 2008, including all certificate courses except for the practicum. The class rosters were requested from the online professional development coordinator at UW-Stout and originally lead to the compilation of a list of 231 UW-Stout student email addresses. Due to duplicates caused by students taking more than one course the list had to be revised, resulting in a final list of 139 student email addresses.

Instrumentation

The ILS was used to assess students' learning styles (see Appendix A). In addition, a number of questions developed by the researcher were used to gather information about students' online discussion participation and their demographics characteristics.

The ILS represents a 44-question instrument designed to assess four different learning style dimensions (Felder & Spurlin, 2005). It is based on the learning style model developed by Felder and Silverman in 1988. This model was initially created to identify learning style differences among engineering students as a means to help instructors choose more adequate teaching methods. The ILS is made up of four scales, including sensing-intuitive, visual-verbal, active-reflective, and sequential-global, and according to Felder and Spurlin students tend to have a preference for one of the two extremes in each of these four dimensions. Each dimension in turn includes 11 forced-choice items; beginning with question one each questions collects data

pertaining to one of the four scales. For example, question one refers to the active-reflective learning style dimension while question number two refers to the sensing-intuitive dimension, question three refers to the visual-verbal dimension, and question four refers to the sequential-global dimension. This pattern is continued throughout the ILS, resulting in an alternation in the learning style dimension that is being tested. Though the order is different from more common patterns such as random ordering or ascending ordering from simple to complex, the order of items is beneficial for statistical analyses because responses can easily be scored by assigning them to one of the four learning style dimension in order of their appearance in the survey. Based on the arrangement of questions, it is also unlikely that individuals are able to predict which learning style dimension is being tested by a particular question.

When taking the ILS, students have to complete sentences by selecting one of two options provided to them; these options represent opposite ends of the dimensions outlined above (Litzinger, Lee, Wise, & Felder, 2007). Each option (a or b) corresponds to one or the other category of the respective dimension. For scoring purposes, all 'a' responses are counted, resulting in a number between 0 and 11 for one dimension (Felder & Spurlin, 2005). This score indicates how strong the preference for a learning style is. "Using the active-reflective dimension as an example, 0 or 1 'a' responses would represent a strong preference for reflective learning" (p. 104), while 10 or 11 'a' responses would indicate a strong preference for active learning. For each dimension, the smaller number is subtracted from the larger one, resulting in a number accompanied by a letter (e.g. 5 b) for each dimension. The number indicates the preference strength, while the letter stands for the learning style dimension (e.g. active vs. reflective). Overall, learners may have a balanced score (1-3), a moderate preference (5 or 7), or a strong preference (9 or 11) for a learning style (Felder & Soloman, 1994).

Several studies have been conducted to determine the reliability and validity of the ILS. According to Felder and Spurlin (2005), “the test-retest reliability of the ILS scores is satisfactory” (p. 107); the authors also found a convergent construct validity. Another study, conducted by Zywno (2003), indicated that the ILS seems to be a suitable psychometric tool for assessing learning styles. Moreover, Litzinger, Lee, Wise, and Felder (2007) found results which “show that the original version of the ILS generates data with acceptable levels of internal consistency reliability, and that evidence for its construct validity from both factor analysis and student feedback is strong” (p. 316). Furthermore, a comparative study concerned with the use of different learning style instruments found that the ILS “seems to have more consistent and applicable predictive value than the other scales [analyzed for the purpose of the study]” (Papp, 2001, p. 19).

The ILS is available free of cost to individuals who want to assess their learning style preferences and to faculty and students at educational institutions who want to use the instrument for research activities within the institution. It is not permitted to distribute the material outside the institution or to use it for commercial purposes. A copyright notice has to be included on all copies or sections of the material that is being used.

In addition to the ILS, eight questions developed by the author were used to gather information about students’ interaction in online discussions (see Appendix B). These questions referred to the frequency with which students usually access the discussion form (e.g. 1-2 times per week), as well as the frequency with which they usually make original postings (e.g. 3 days) and responses to other students’ postings. Moreover, questions on the number of original postings and responses to postings by other learners were included in the survey instrument. In order to learn more about the relationship between students’ learning style and their participation in online discussion, questions about the number of their postings compared to the number of

required postings, their satisfaction with the number of postings they usually make, and their overall experience with online discussions were included in the survey. Besides questions about online discussion participation, six questions pertaining to demographic data were included (see Appendix C). These questions referred to participants' gender, age, employment status, computer experience, number of previously taken online courses, and preferred way of communication. All questions developed by the researcher were based on information found in the literature reviewed in chapter two as well as on the research questions formulated in chapter one. Though the questions were not tested by means of a pilot study, the author consulted with UW Stout's research associate to discuss the design and ordering of questions.

The survey instrument consisted of four pages. The first page contained information about the study's overall goal as well as the risks associated with participation in the study. A consent statement was included that needed to be checked off before participants could move on to the next page. The second page consisted of the ILS, which was adapted for use within an online survey. The third page comprised all questions pertaining to online discussions, and the fourth page contained all questions relating to demographic information about the sample population. This sequence of items was chosen to reflect the descending importance of questions: the most important questions were placed at the beginning of the survey while the least important questions were positioned at the end.

A two-by-two matrix was used to analyze the relationship between research questions and survey items (see Appendix D). Research questions were put on the x-axis and survey questions were vertically listed on the y-axis. The matrix showed that both the research questions pertaining to students' learning style preferences, as measures by the ILS, and the research questions about online discussion participation were covered by the survey.

Data Collection Procedures

The ILS, along with the additional questions about interaction in online discussions, was given to students in the summer of 2008. An online survey was used to gather data for the purposes of this study. This survey was created using the SelectSurvey tool available through the University of Wisconsin-Stout. An advance-notice email with information about the purpose of the study was sent to students three days prior to emailing the survey invitation. The purpose of the first email was to gain students' attention and to increase their readiness to participate. The second email, the survey invitation, contained a link to the survey website which could be used by students to access the survey. Four days after sending out the survey invitation, a follow-up email was sent to remind students of the survey and to ask them to complete the survey if they had not already done so. The data was automatically collected through the SelectSurvey tool which allows registered users to view reports and export data to other programs such as SPSS and Microsoft Excel.

Data Analysis

The data collected through the SelectSurvey tool were exported for further analysis. In order to determine if a relationship between students' learning styles and their interaction in online discussions exists, the ILS was scored to obtain information about the number and distribution of learning styles represented in the sample. The learning style scores were transferred to an Excel spreadsheet to analyze the data. In addition, SPSS was used to run more complex statistics to find out if a correlation between the four learning style dimensions of the ILS and the frequency and number of online discussion postings exists. It was expected that the frequency and number of postings would relate to a student's learning style. For instance, it was anticipated that active learners would post more often than reflective learners. Besides for

identifying correlations, the statistical analysis program was used to compute descriptive statistics based on the demographic questions included at the end of the survey.

Limitations

This study is subject to several methodology limitations:

1. The study was limited to students who have taken one or more online course offered as part of the Graduate Certificate in E-Learning and Online Teaching during Summer 2007, Fall 2007, or Spring 2008. As a consequence, caution has to be used in regard to the generalizability of results. Though the study aims at providing representative results, the number of participants may not be large enough to warrant generalizations. In addition, students who decided to complete the online survey may not constitute a representative sample of all individuals enrolled in the Graduate Certificate in E-Learning and Online Teaching.
2. Due to the fact that the survey was conducted anonymously, there is no way to prove that the person who responded to the survey was actually the person who received the survey invitation; other individuals may have taken the survey instead.
3. Answers provided within the scope of the online survey may have been influence by various factors, including time of day, computer experience, environmental conditions (e.g. light, heat, noise), or biased responses. Since these factors can not be controlled by any means, students' responses may have been influenced by them, and thus their responses may not represent their true learning style preferences.
4. The four learning style dimensions of the ILS are no absolute measure. Instead, a student's learning style can change over time or it may be affected by educational experiences (Felder & Spurlin, 2005). Students who have taken several online courses may respond differently from those who have taken only one course.

5. Though the ILS represents a reliable, valid instrument in itself, the results of the ILS may have been influenced by factors such as the adaptation for the online survey or the combination with other survey questions. Its reliability and validity may have been compromised by the survey development process.
6. Some of the questions included in the survey were specifically designed for the purpose of this study; these questions may not measure what they are supposed to measure. Moreover, these questions may not yield reliable results because they have not been tested prior to utilizing them in the survey.

In addition to the limitations listed above, there are several other disadvantages often associated with conducting online research (Wright, 2005). Even though it may be relatively easy to establish an email list, Wright states that there is no guarantee that survey invitations sent out to those email addresses will lead to the intended results. For example, email addresses may no longer be in use or individuals may not respond to all the questions. Another issue discussed by Wright is self-selection. He argues that in any online community there are some individuals who are more likely to take an online survey than others which may inevitably lead to a systematic bias. Based on this problem it becomes more difficult for researchers to make generalizations about their findings, because the data obtained may not represent the sample population properly. Thus, Wright concludes that though online surveys usually have about the same or even a better return rate than mailed surveys, the best way to obtain reliable results is to replicate a study or to conduct multiple surveys targeting the same population.

Chapter IV: Results and Discussion

Introduction

The purpose of this study was to analyze the relationship between learning styles and students' participation in online discussions in distance education courses at the University of Wisconsin-Stout. More precisely, the study looked at students enrolled in online courses offered as part of the Graduate Certificate in E-Learning and Online Teaching during Spring 2007, Fall 2007, and Spring 2008. Data used for the purpose of this study was collected by means of an online survey created using the SelectSurvey tool that is available through UW Stout.

In order to determine if a statistically significant relationship between students' learning styles and online discussion participation exists, data about students' learning styles, as measured by the ILS, and the frequency and number of their postings were analyzed. In addition to identifying students' learning styles and their distribution within the sample, statistical data analysis was conducted using the Pearson chi-square statistic to test for independence and the Phi coefficient as a measure of the strength of relationships between variables. This chapter will provide information about the study's results and summarize these results in consideration of the research questions cited in chapter one.

Demographic Information

There were 231 students who were initially included in the class rosters for the online courses under consideration. Of those, all duplicates were eliminated. The term 'duplicates' refers to students who were enrolled in more than one certificate course between Summer 2007 and Spring 2008. This elimination process resulted in the compilation of a final list of 139 UW-Stout student email addresses. An email containing a link to the online survey was sent to these 139 students. Thirty-seven responded to the survey; however, five survey responses were classified as incomplete because the respondents had answered none of the 59 questions.

Apparently they just opened the survey and looked at it. Thirty-two students actually completed the study, therefore representing 23% of the total possible participants.

Of the 32 respondents, 25 (78%) were female and 7 (22%) were male. The majority of respondents (67%) were at least 36 years old; only three individuals (10%) were either 25 years or younger or between 56 and 65 years old and ten individuals (31%) indicated that they were between 46 and 55 years old. The following Table 1 summarizes these findings.

Table 1

Number of Respondents by Age and Gender

Age	Gender		Total	Percent
	Female	Male		
25 years and younger	2	1	3	10%
26-35 years	6	1	7	23%
36-45 years	6	2	8	26%
46-55 years	8	2	10	31%
56-65 years	2	1	3	10%
Total	25	7	31	100%
Percent	78%	22%	100%	

Note. One respondent did not specify age

In addition to age and gender, information about students' employment status was collected. The term 'employment status' refers to an individual's state of employment; an individual can either be actively working, seeking employment, or not currently be looking for employment (e.g. student). About half of the study's respondents (48%) indicated that they currently work as K-12 instructors (32%) or technical college instructors (16%). Three respondents (9%) were seeking employment and only two respondents (6%) stated they were students. See Table 2 for details.

Table 2

Number of Respondents by Employment Status

Employment status	Number of respondents	Percent
K-12 instructor	10	32%
Technical college instructor	5	16%
Technology specialist	3	9%
Seeking employment	3	9%
Corporate trainer	2	6%
Instructional designer/curriculum consultant	2	6%
Student	2	6%
Administrator	1	3%
Other ^a	4	13%
Total	32	100%

^aNavy, special education teacher, university instructor, college instructor

Besides data pertaining to student's employment status, information about the number of previously taken online courses, students' computer skills, and their preferred way of communication was collected. Over half of the respondents (56%) had taken seven and more online courses while only three respondents (9%) had taken one or two courses (see Table 3).

Table 3

Number of Online Courses taken by Respondents

Number of online courses	Number of respondents	Percent
1 – 2 courses	3	9%
3 – 4 courses	5	16%
5 – 6 courses	6	19%
7 and more courses	17	56%
Total	31	100%

Note. One respondent did not specify number of online courses

Asked about their level of computer skills, the majority of respondents (60%) indicated they were proficient users. Furthermore, slightly more than half of the respondents (56%) stated that they preferred email over other ways of communication such as face-to-face communication and telephone (see Table 4).

Table 4

Computer Skills and Preferred Way of Communication

Skills	Number of respondents	Percent
Expert	10	31%
Proficient	19	60%
Good	3	9%
Total	32	100%

Communication

Email	18	56%
Face-to-face	12	38%
Telephone	2	6%
Total	32	100%

Learning Style Inventory

In order to analyze the relationship between learning styles and online discussion participation, students' learning styles as measured by the ILS were analyzed. Following the scoring method described by Felder and Spurlin (2005), students learning style scores were calculated by assigning a value of one to each of the 11 questions in the four learning style dimensions; the smaller number was then subtracted from the larger one and the letter from the

larger number was taken over, leading to a value between 1 and 11 as well as a letter for the learning style dimension (e.g. 3 a on the active-reflective dimension would indicate an individual with preference for active learning). For each learning style dimension learners could have either a slight preference (1 or 3), a moderate preference (5 or 7), or a strong preference (9 or 11) for a learning style (Felder & Soloman, 1994). The learning style scores were transferred to an Excel spreadsheet to analyze the data.

Of the 32 respondents who completed the learning style inventory, 14 students (44%) were active learners while 18 students (56%) were identified as reflective learners. The same ratio was found for the second learning style dimension, the sensing-intuitive dimension; 14 respondents (44%) were identified as sensing learners compared to 18 respondents (56%) who were found to be intuitive learners. In the third learning style dimension, which distinguishes between visual and verbal learners, 27 students (87%) were found to be visual learners while only four students (13%) were identified as having a preference for verbal information. Finally, there was an even distribution of learning styles in the fourth dimension; 16 respondents (50%) were found to be sequential learners and 16 respondents (50%) turned out to be global learners. The following figure summarizes these findings.

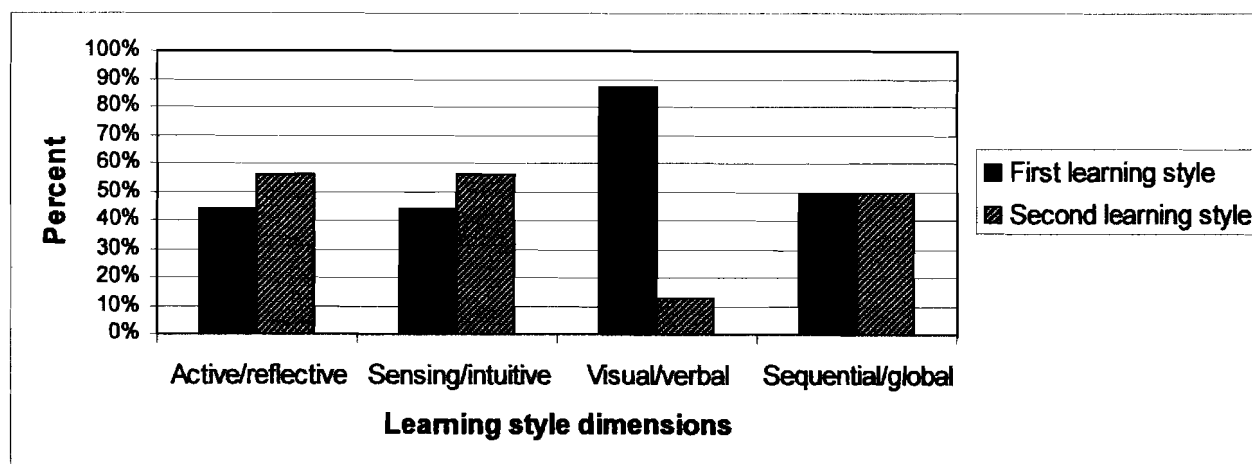


Figure 1: Learning Styles of Students

The overview of learning style scores in Table 5 shows that the average student had a fairly balanced score on the active/reflective ($M = .41$, $SD = 5.28$), the sensing/intuitive ($M = -.03$, $SD = 6.31$), and the sequential/global ($M = .34$, $SD = 5.67$) learning style dimensions. Students expressed a slight preference ($M = -3.50$, $SD = 5.67$) for the visual learning style. Negative numbers in Table 7 refer to the 'a' dimension of a learning style category; positive numbers refer to the 'b' dimension (e.g. -11 would indicate a score of 11 a).

Table 5

Distribution of Respondents' Learning Style Scores

Learning style dimension	Min	Max	Mean	Standard deviation
Active/reflective score	-9	11	.41	5.28
Sensing/intuitive score	-11	9	-.03	6.31
Visual/verbal score	-11	11	-3.50	4.84
Sequential/global score	-11	9	.34	5.67

The following Figures 2 through 5 sum up the distribution of responses from the learning style inventory. Figure 2 reveals that respondents had a preference for the reflective learning style (56%), as shown by the bar size for the slight and strong preference.

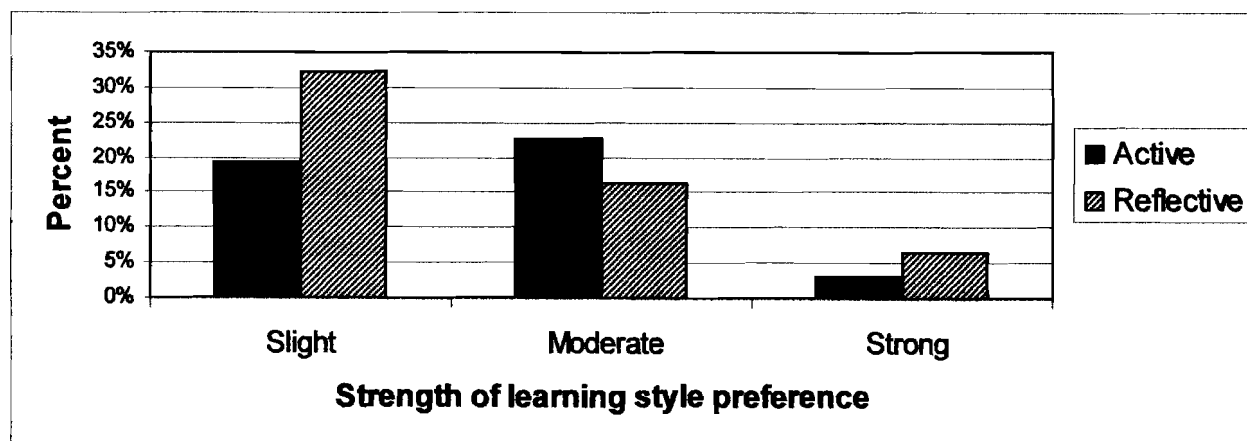


Figure 2: Distribution of Active-Reflective Learning Style Scores.

Figure 3 indicates that the majority of students (56%) can be categorized as intuitive learners; with exception of the strong preference intuitive learners outnumbered respondents with a sensing learning style.

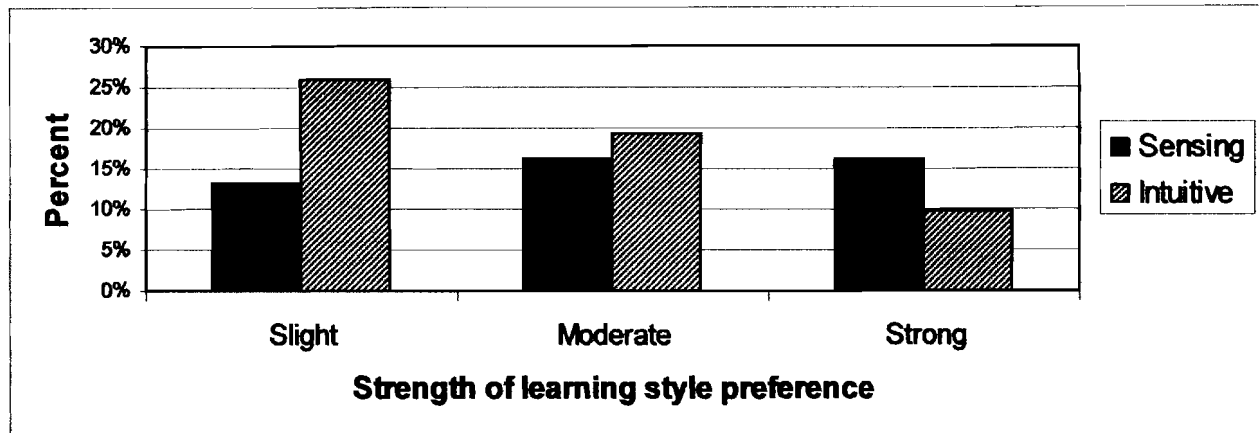


Figure 3: Distribution of Sensing-Intuitive Learning Style Scores.

Figure 4 shows that the majority of students (87%) had a preference for the visual learning style; respondents with a visual learning style preference outnumbered respondents with a verbal learning style preference (13%) on all three strength levels.

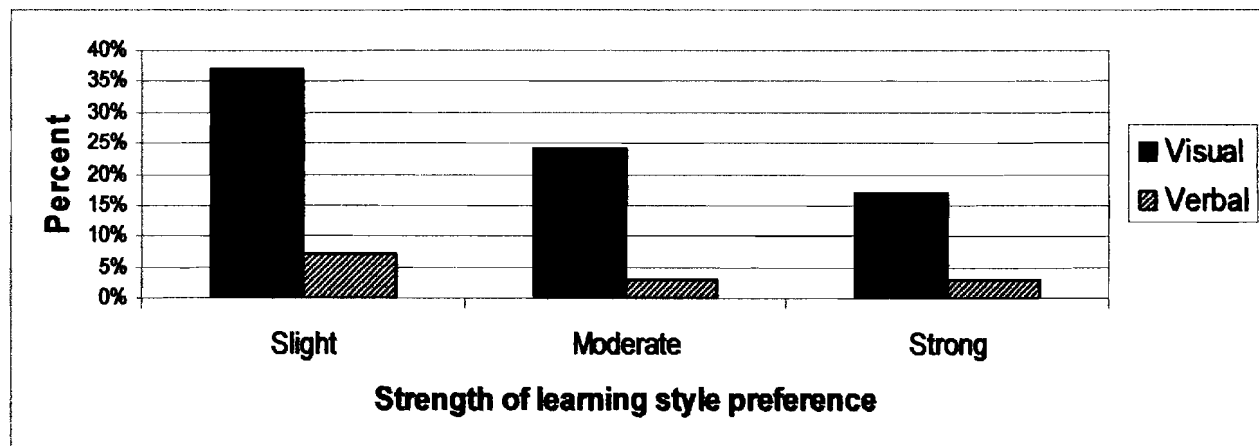


Figure 4: Distribution of Visual-Verbal Learning Style Scores.

Finally, Figure 5 indicates that there was almost no difference in the distribution of students' learning style scores for the sequential/global learning style dimension.

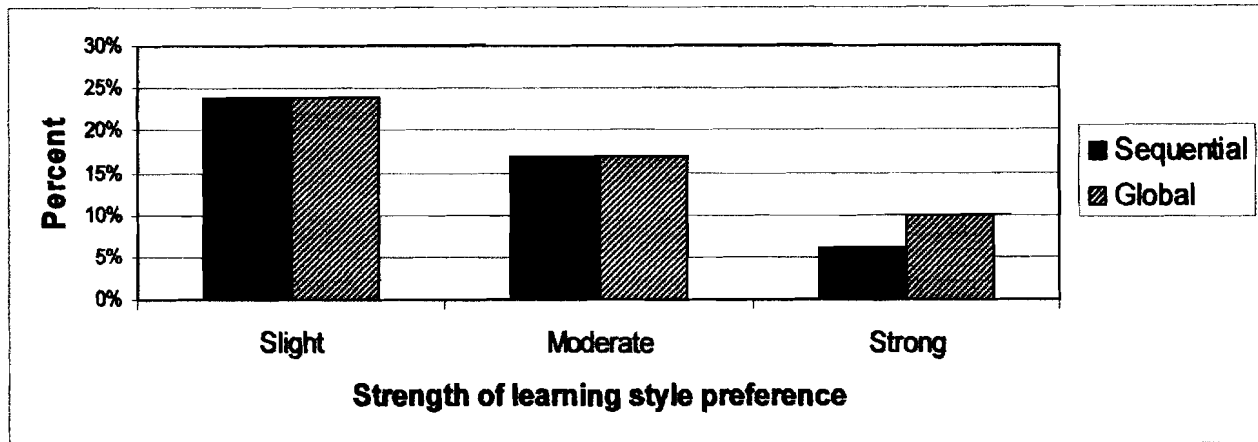


Figure 5: Distribution of Sequential-Global Learning Style Scores.

Online Discussion Questions

The summary of responses to the online discussion questions in Table 6 shows that the average student was fairly balanced in regard to the frequency and number of postings. On average, respondents did access the discussion forum eight times per week ($M = 8.13$). The mean number of days on which respondents made an original posting was four ($M = 3.59$). Moreover, students responded to other students' postings on average on four days ($M = 4.09$) and indicated that they make about five original postings ($M = 4.91$) and six response postings ($M = 5.63$) per week.

Table 6

Distribution of Responses to Online Discussion Questions

Question	Min	Max	Mean	Std. deviation
Forum access	3	11	8.13	2.69
Frequency original postings	1	7	3.59	1.43
Number original postings	1	10	4.91	2.56
Frequency response postings	2	7	4.09	1.51
Number response postings	2	10	5.63	2.85

Table 7 summarizes the study's findings regarding the frequency and number of online discussion postings. About half of the respondents (53%) indicated that they access the discussion forum one to eight times per week while two-thirds of the respondents (75%) stated that they usually make an original posting on one to four days per week. Furthermore, most respondents (65.6%) made one to five original postings per week; on average, they responded to other students' postings on one to four days per week. Slightly more than half of the students (56.3%) indicated that they usually make one to five response postings per week.

Table 7

Overview of Online Discussion Questions

Frequency/number	Number of respondents	Percent
Forum access		
1 – 8 times per week	17	53.1%
9 and more times per week	15	46.9%
Frequency original postings		
1 – 4 days per week	24	75.0%
5 – 7 days per week	8	25.0%
Number original postings		
1 – 5 postings per week	21	65.6%
6 and more postings per week	11	34.4%
Frequency response postings		
1 – 4 days per week	21	65.6%
5 – 7 days per week	11	34.4%
Number response postings		
1 - 5 responses	18	56.3%
6 and more responses	14	43.8%

In regard to the number of required postings, the majority of respondents (62.5%) indicated that they would like to post either more often (56.3%) or less often (6.2%). However, 12 students (37.5%) reported that they post as often as required. Asked about the overall satisfaction with the number of their discussion postings, two-thirds (75%) said they were satisfied with the number of their postings. Only five students (15.6%) indicated that they would like to post more often and three students (9.4%) said they would like to post less often. As to the experience with online discussions, the majority of respondents (65.6%) rated their experience as 'excellent' or 'very good' while eleven respondents (34.4%) said their experience was only 'good', 'satisfactory', or 'very unsatisfactory'.

Relationship between Learning Styles and Online Discussions

In order to decide if a relationship between learning styles and the frequency and number of postings as well as students' overall experience with online discussions exists, SPSS was used to create crosstabulations for the four learning style categories (active-reflective, sensing-intuitive, visual-verbal, sequential-global) and the eight discussion questions (see Appendix B). Based on these crosstabulations, Pearson Chi-Square values were calculated for all variable combinations to determine if a statistically significant relationship exists. In addition, two symmetric measures, Phi (Φ) and Cramer's V, were computed to make predictions about the strength of the potential relationships (Morgan, Leech, Gloeckner, & Barrett, 2004).

At first, all variable combinations violated the condition necessary for using the Pearson Chi-Square test; this condition states that no more than 20% of cells should have expected frequencies of less than five (Morgan, Leech, Gloeckner, & Barrett, 2004). Consequently, the answer categories for the discussion questions had to be merged, which made it possible to create two-by-two crosstabulations. As a result, the number of variable combinations which violate the Pearson Chi-Square condition was reduced; however, it was not possible to obtain valid values

for all variable combinations because a large number of variable combinations continued to violate the Chi-Square condition. Thus, the following table shows only variable combinations with valid Chi-Square values.

Table 8

Correlations between Learning Styles and Online Discussion Questions

Question	Learning style dimension							
	Act/ref		Sns/int		Vis/Vrb		Seq/glo	
	Φ	p	Φ	p	Φ	p	Φ	p
Forum access	-.181	.305	.071	.688	.037	.835	.438	.013 ²
Number original posting	-. ¹		-. ¹		-. ¹		.329	.063
Frequency response posting	-. ¹		-. ¹		-. ¹		.329	.063
Number responses posting	.143	.419	.143	.419	-. ¹		.378	.033 ²
Required postings	.033	.854	-.358	.043 ²	-. ¹		-.516	.003 ²
Experience	-. ¹		-. ¹		-. ¹		-.197	.264

Note. ¹ No values shown due to violation of condition for chi-square test. ² Statistically significant results. *p < .05

As Table 8 shows, the number of variable combinations with a statistically significant relationship is rather limited. Only four variable combinations out of originally 32 had a level of significance smaller than .05. The level of significance (p), which is equivalent to the probability of making a Type I error of rejecting the null hypothesis although it is true, represents the likelihood that the results did not occur by chance (Morgan, Leech, Gloeckner, & Barrett, 2004). If p is smaller than the predetermined level, which is usually .05, the results are statistically significant, meaning they did not likely occur by chance. Furthermore, the null hypothesis which assumes that there is no relationship between the variables can be rejected. Thus, though this study did not use hypotheses, p was used to draw conclusions about the significance of the results.

Table 9 summarizes the findings for the variable combination between the frequency of discussion forum access and the sequential/global learning style dimension; the table indicates that sequential and global learners are significantly different when it comes to the frequency with which they usually access the discussion forum ($X^2 = 6.15$, $df = 1$, $N = 32$, $p < .05$). Sequential learners are more likely to access the discussion forum one to eight times per week; compared to sequential learners, global learners are more likely to access the discussion forum nine and more times per week. Phi, which indicated the strength of the relationship, is .438, and thus a weak positive association between the two variables exists.

Table 9

Frequency of Discussion Forum Access and Sequential/Global Learning Style Dimension

Learning style	Frequency discussion forum access		X^2	Φ	p
	1 – 8 times per week	9 and more times per week			
Sequential	12	4	6.15	.438	.013
Global	5	11			

Table 10 provides an overview of the findings regarding the combination the number of response postings and the sequential/global learning style dimension. The results suggest that sequential and global learners differ significantly in regard to the number of response postings they make ($X^2 = 4.57$, $df = 1$, $N = 32$, $p < .05$). Sequential learners are more likely to make two to five responses to other students' postings while global learners are more likely to make six and more responses per week. Phi is .378, which indicates a weak positive relationship between the two variables.

Table 10

Number of Response Postings and Sequential/Global Learning Style Dimension

Learning style	Number of response postings		X ²	Φ	p
	2 – 5 responses	6 and more responses			
Sequential	12	4	4.57	.378	.033
Global	6	10			

Table 11 summarizes the findings for the combination between the required number of postings and the sensing-intuitive learning style dimension. The findings indicate that sensing and intuitive learners are significantly different when it comes to the number of their postings compared to the number of required discussion postings. Sensing learners are more likely to post as often as required while intuitive learners are more likely to post more or less often than required. Phi, which stands for the strength of the association, is -.358, indicating a weak negative relationship.

Table 11

Required Postings and Sensing/Intuitive Learning Style Dimension

Learning style	Required postings		X ²	Φ	p
	more/less often	as often as required			
Sensing	6	8	4.09	-.358	.043
Intuitive	14	4			

Table 12 provides an overview of the findings regarding the number of required postings and the sequential/global learning style dimension. The results suggest that sequential and global learners differ significantly in regard to the number of their postings compared to the required number of postings ($X^2 = 8.53$, $df = 1$, $N = 32$, $p < .05$). Sequential learners are more likely to post as often as required; by contrast, global learners are more likely to post more or less often than required. Phi is $-.516$, indicating a weak negative relationship between the two variables.

Table 12

Required Postings and Sequential/Global Learning Style Dimension

Learning style	Required postings		X^2	Φ	p
	more/less often	as often as required			
Sequential	6	10	8.53	-.516	.003
Global	14	2			

Summary

The study identified the demographics and learning style preferences of students who have previously been enrolled in courses offered as part of the Graduate Certificate in E-Learning and Online Teaching. It also identified the frequency and number with which students usually participate in online discussions and students' overall rating of their satisfaction and experience with online discussions. Moreover, the study analyzed the relationship between students' learning styles and their online discussion participation.

The results of the study showed that the majority of students were female (78%) and that most learners (67%) were at least 36 years old; in addition, about half of the students (48%) indicated that they currently work as K-12 or technical college instructors. Two-thirds (75%) of

students in the study had taken at least five online courses. Moreover, the majority of learners (60%) stated that they were proficient in regard to their computer skills and most (56%) preferred email over other forms of communication. This finding confirms that email is the most popular way of communication for online learners and that learners tend to choose “email as their preferred type of correspondence” (Bender, Brewer, & Whale, 2006, para. 31).

It was also found that learning style preferences were not evenly distributed. In general, respondents indicated that they had a preference for the reflective, intuitive, and visual learning styles. Students had a strong preference for the visual learning style; 27 students (87%) were found to be visual learners. No difference in the distribution of learning styles was found for the sequential/global dimension.

Chapter V: Summary, Conclusions, and Recommendations

Summary

Due to a growth in the demand for flexible learning options, the number of online courses offered by colleges and universities is steadily increasing. Closely related to this trend is the need to provide online learning experiences that account for student's characteristics and learning styles (Mupinga, Nora, & Yaw, 2006). While considerable research has been done regarding learning styles and students' satisfaction in online courses (Doherty, 2000; Gunawardena & Boverie, 1993; Simpson & Du, 2004), little research has been done on the relationship between learning styles and distance education compared to the number of studies focusing on learning styles in the traditional classroom (Kanuka & Nocente, 2003).

The purpose of this study was to investigate the relationship between students' learning style preferences and their interaction in online discussions in distance education courses offered by UW Stout's School of Education as part of the Graduate Certificate in E-Learning and Online Teaching. In order to determine if a relationship between students' learning styles their participation in online discussions exists, an online survey was used to gather data. The survey consisted of the ILS as well as eight online discussion and six demographic questions. It was the goal of this study to find out what learning styles students have and whether or not a difference in the distribution of learning styles exists. Furthermore, the study examined the relationship between the frequency and number of discussion postings and students' learning styles in order to allow for conclusions regarding the relationship between learning styles and interaction in online discussions.

Data analysis was performed using Microsoft Excel and SPSS. Students' learning style scores were entered into an Excel spreadsheet for further analysis while all other data were directly transferred from the SelectSurvey tool. SPSS was used to compute crosstabulations for

all variable combinations under consideration (see Table 8). In addition, SPSS was used to compute the Pearson chi-square statistic to test for independence and the Phi coefficient to measure the strength of relationships between variable combinations.

Conclusions

In this section, each research question from chapter one is restated and answered based on the findings of the data analysis.

Research Question # 1 - What learning styles exist among students enrolled in distance education courses offered through the University of Wisconsin-Stout?

It was found that all learning styles identified by the ILS were represented in the sample. Of the 32 respondents who completed the online survey, 14 students (44%) were active learners and 18 students (56%) were reflective learners. The same ratio was found for the sensing-intuitive learning style dimension: 14 respondents (44%) were sensing learners while 18 respondents (56%) were identified as intuitive learners. In regard to the third dimension, which distinguishes between individuals with a preference for visual or verbal input, 27 students (87%) were found to be visual learners while only four students (13%) were verbal learners. Lastly, there were 16 respondents (50%) who had a preference for the sequential learning style and 16 respondents (50%) who were global learners (see Figure 1).

With regard to the literature on learning styles and online discussions, it was found that asynchronous discussions allow learners to reflect on course contents and to spend more time composing their responses. According to Meyer (2002), this form of discussion may thus be more suitable for reflective learners. Active learners who enjoy the liveliness of face-to-face discussions might not be as satisfied with asynchronous online discussions. Though this study found that slightly more students were reflective learners (56%), it was not possible to establish a connection between the active-reflective learning style dimension and the frequency and number

of students' online discussion postings. However, the study found that 88.9% of reflective learners were satisfied with the number of their postings, compared to only 57.1% of active learners.

Research Question # 2 – Is there a difference in the distribution of learning styles between students?

The study's findings show that learning style preferences were not evenly distributed. Overall, respondents had a preference for the reflective, intuitive, and visual learning styles. As to the active-reflective and sensing-intuitive learning style dimensions, students had only a slight preference for the reflective and intuitive learning style. However, it was found that they had a strong preference for the visual learning style: 27 respondents (87%) were found to be visual learners. In regard to the sequential/global learning style dimension, no difference in the distribution of learning styles was found. The sample included an equal number of sequential and global learners.

In regard to the composition of online groups, two authors came to the conclusion that it may be best to have mixed groups that consist of learners with different learning styles (Ellis, 2003; Lee & Lee, 2006). Since each learning style is characterized by a number of strengths and weaknesses, students seem to benefit from collaborating with students who have different learning styles. For example, active learners may encourage reflective learners to actively engage in online discussions. The results of this study showed that there was a fairly well-balanced distribution of learning styles in the sample; except for the visual-verbal learning style dimension, students did not have a strong preference for one of the two learning styles included in the four learning style dimensions. This indicates that the considered courses seem to be productive learning environments which promote student learning through a mix of learning

styles. However, this finding may only hold true for the sample used in this study and may not be transferable to the population at large.

Research Question # 3 – How does the number of online discussion posts relate to different learning styles?

Irrespective of their learning style, respondents indicated that they make between one and more than ten original postings per week. On average, students made about five original postings per week. As to the number of response postings, respondents stated that they make between two and more than ten response postings per week. The minimum of two response postings per week may be due to the number of required postings; most online courses require students to make a certain number of postings per week. The average student made about six response postings per week (see Table 6). In regard to the relationship between the number of online discussion postings and students' learning styles, no statistically significant results were found, suggesting that students made the same number of discussion postings irrespective of their individual learning style.

A review of the literature pertaining to learning styles revealed that there is no consent as to whether or not learning styles may influence how students interact in online learning environments. While some authors did not find a connection between learning styles and students' performance in online courses (Harris, Dwyer, & Leeming, 2003; Neuhauser, 2002), others argue that learning styles may influence learners' satisfaction with online learning (Gunawardena & Boverie, 1993; Simpson & Du, 2004). Though this study did not find a relationship between learning styles and the number of online discussion postings, it found that the majority of students (65.6%) had either 'excellent' or 'very good' experiences with online discussions, suggesting that they were satisfied with this form of instruction. Another 18.8% of

respondents indicated that their experience with online discussions was 'good', indicating that overall 84.4% of students were satisfied with this instructional method.

Research Question # 4 – How does the frequency of online discussion posts (e.g. once a week, twice a week, everyday) relate to different learning styles?

Independent of their individual learning style, respondents indicated that they usually access the discussion forum at least three times per week; at the most, respondents stated they log in to the discussion forum more than 11 times per week. On average, students made an original posting on four days per week, with one day being the minimum and seven days being the maximum. As to the frequency of response postings, the average respondent made a response posting on four days per week; however, the minimum number of days on which students made a response posting was two days and the maximum number of days was seven days (see Table 6). In regard to the frequency of online discussion postings and students' learning styles, no statistically significant results were found, suggesting that students posted on the same number of days irrespective of their individual learning style.

In terms of the literature on learning styles many authors use the term 'personality' instead of 'learning style', though both concepts intend to measure the same traits. Moreover, the views concerning the connection between personality and online learning differ. Bishop-Clark, Dietz-Uhler, and Fisher (2007) for example reported that personality may influence students' satisfaction with online courses. In addition, they stated that extroverts, who according to Felder and Spurlin (2005) are similar to active learners, tend to score higher in regard to their participation. This finding was confirmed by this study. While the majority of reflective learners (61.1%) accessed the discussion forum three to eight times per week, the majority of active learners (57.1%) accessed the discussion forum nine and more times per week. Active learners thus accessed the forum more often than reflective learners.

Research Question # 5 – What is the relationship between learning styles and online discussion participation?

The findings of the study suggest a possible trend towards a relationship between individual learning style dimensions (sensing-intuitive, sequential-global) and the frequency of access to the discussion forum, the number of response postings, and the number of required postings. Sensing learners were found to be more likely to post as often as required while intuitive learners were found to be more likely to post more or less often than required. According to Felder and Soloman (n.d.), sensing learners prefer well-known methods and have an aversion to surprises while intuitive learners do not like repetitions; these characteristics may provide an explanation for the study's findings. Sensing learners seem to prefer to stick to the requirements while intuitive learners seem to adapt their number of postings to the situation at hand.

Another finding of the study was that sequential learners are more likely to access the discussion forum up to eight times per week while global learners are more likely to access it nine and more times per week. As stated by Felder and Soloman (n.d.), global learners tend to learn in large steps while sequential learners follow linear steps. Global learners may thus have to access the discussion forum more often to understand the contents. This may also explain why global learners were found to make significantly more response postings than sequential learners and why they tend to post more or less often than required compared to sequential learners who are more likely to post as often as required. Since global learners need to get the big picture before they fully understand something new, they may have to ask more questions or clarify what other students have written in their posts before they comprehend something. Furthermore, they may post more or less often than required because their way of learning is characterized by

sudden understanding, meaning that they may post more often to get a better understanding or less often because they have not yet fully understood the details.

Despite these findings in regard to a relationship between learning styles and online discussion participation, it was not possible to obtain valid correlation values for many of the 32 variable combinations under investigation (see Table 8). Moreover, the correlations for the variable combinations described above were not very strong, indicating that they may not be very reliable and thus cannot be used to make generalizable statements.

In other words, the statistical tests used to determine if a relationship between students' learning styles and their interaction in online discussions exists, did not yield sufficient evidence. Though it was found that there may be a trend towards relationship between individual learning style categories and the frequency and number of postings, the results were not significant enough to allow for general conclusions about the relationship between learning styles and online discussion participation.

Recommendations

1. This study has been limited to students enrolled in courses offered as part of the Graduate Certificate in E-Learning and Online Teaching during Summer 2007, Fall 2007, and Spring 2008; in order to get more meaningful results, other online learning populations should be studied.
2. One of the major limitations in regard to the study's results was the low response rate of the online survey. Though the survey was sent out to 139 students, only 32 students actually completed the survey. It may thus be advisable to select a larger sample size to increase the return rate. Moreover, Schaefer and Dillman (1998) suggest that the success of online surveys may depend on the number of contacts made, indicating that multiple contacts will increase the response rate for e-mail surveys. Another factor may be

personalization. According to Schaefer and Dillman, “it seems important that e-mail messages be sent directly to individual respondents, not part of a mailing list” (p. 381). In order to increase the response rate for online surveys it may thus be essential to use recipients’ names instead of a general salutation. Schaefer and Dillman (1998) also state that it may make sense to use a mixed mode survey strategy consisting of e-mails and other methods. By using a mixed mode strategy, it can be ensured that even people whose email addresses are not available or who do not use their email addresses are reached. Finally, the authors suggest that the return rate for online surveys may depend on the comprehensibility of the texts. Schaefer and Dillman argue that “item nonresponse to e-mail surveys could be lower if the answer format is convenient” (p. 382). It may thus be important to test questions prior to including them in an online survey.

3. The Index of Learning Styles was used to determine students’ learning styles. It represents only one of many learning style inventories that are available for accessing learning style preferences. Using other learning style inventories may be useful for obtaining comparative results, and it may also help to improve the ILS.
4. Some of the survey questions were specifically developed for the purpose of this study. As a consequence, they might not have measured what they were supposed to measure. In order to yield reliable and valid results, these questions should be more carefully reviewed and tested by means of a pilot study.
5. The literature on learning styles does not agree on the role that learning styles play for online learners. Gee (1990) and Santo (2006) agree that they can influence how students experience learning in an online environment, while others suggest that there is no connection between learning styles and variables such as academic performance, student satisfaction, or online discussions (Bishop-Clark, Dietz-Uhler, & Fisher, 2007; Kanuka &

Nocente, 2003). It is thus important to continue to investigate the relationship between students' learning styles and their interaction in online discussions.

6. Due to the fact that the number of online courses is likely to further increase in the future, it seems imperative that instructors familiarize themselves with the concept of learning styles. Though there is still a lot of confusion concerning the concept of learning styles, it is nevertheless important for instructors to consider learning styles in the process of designing online learning experiences. As this study showed, there is more than one learning style among online learners, and thus there should be more than one approach to online teaching.

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Appendix A

Index of Learning Styles¹

1. I understand something better after I
 - a) try it out.
 - b) think it through.
2. I would rather be considered
 - a) realistic.
 - b) innovative.
3. When I think about what I did yesterday, I am most likely to get
 - a) a picture.
 - b) words.
4. I tend to
 - a) understand details of a subject but may be fuzzy about its overall structure.
 - b) understand the overall structure but may be fuzzy about details.
5. When I am learning something new, it helps me to
 - a) talk about it.
 - b) think about it.
6. If I were a teacher, I would rather teach a course
 - a) that deals with facts and real life situations.
 - b) that deals with ideas and theories.
7. I prefer to get new information in
 - a) pictures, diagrams, graphs, or maps.
 - b) written directions or verbal information.
8. Once I understand
 - a) all the parts, I understand the whole thing.
 - b) the whole thing, I see how the parts fit.
9. In a study group working on difficult material, I am more likely to
 - a) jump in and contribute ideas.
 - b) sit back and listen.
10. I find it easier
 - a) to learn facts.
 - b) to learn concepts.

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11. In a book with lots of pictures and charts, I am likely to
 - a) look over the pictures and charts carefully.
 - b) focus on the written text.
12. When I solve math problems
 - a) I usually work my way to the solutions one step at a time.
 - b) I often see the solutions but then have to struggle to figure out the steps to get to them.
13. In classes I have taken
 - a) I have usually gotten to know many of the students.
 - b) I have rarely gotten to know many of the students.
14. In reading nonfiction, I prefer
 - a) something that teaches me new facts or tells me how to do something.
 - b) something that gives me new ideas to think about.
15. I like teachers
 - a) who put a lot of diagrams on the board.
 - b) who spend a lot of time explaining.
16. When I'm analyzing a story or a novel
 - a) I think of the incidents and try to put them together to figure out the themes.
 - b) I just know what the themes are when I finish reading and then I have to go back and find the incidents that demonstrate them.
17. When I start a homework problem, I am more likely to
 - a) start working on the solution immediately.
 - b) try to fully understand the problem first.
18. I prefer the idea of
 - a) certainty.
 - b) theory.
19. I remember best
 - a) what I see
 - b) what I hear
20. It is more important to me that an instructor
 - a) lay out the material in clear sequential steps.
 - b) give me an overall picture and relate the material to other subjects.
21. I prefer to study
 - a) in a study group.
 - b) alone.

22. I am more likely to be considered
 - a) careful about the details of my work.
 - b) creative about how to do my work.

23. When I get directions to a new place, I prefer
 - a) a map.
 - b) written instructions.

24. I learn
 - a) at a fairly regular pace. If I study hard, I'll "get it".
 - b) in fits and starts. I'll be totally confused and then suddenly it all "clicks".

25. I would rather first
 - a) try things out.
 - b) think about how I'm going to do it.

26. When I am reading for enjoyment, I like writers to
 - a) clearly say what they mean.
 - b) say things in creative, interesting ways.

27. When I see a diagram or sketch in class, I am most likely to remember
 - a) the picture.
 - b) what the instructor said about it.

28. When considering a body of information, I am more likely to
 - a) focus on details and miss the big picture.
 - b) try to understand the big picture before getting into the details.

29. I more easily remember
 - a) something I have done.
 - b) something I have thought a lot about.

30. When I have to perform a task, I prefer to
 - a) master one way of doing it.
 - b) come up with new ways of doing it.

31. When someone is showing me data, I prefer
 - a) charts or graphs.
 - b) text summarizing the results.

32. When writing a paper, I am more likely to
 - a) work on (think about or write) the beginning of the paper and progress forward.
 - b) work on (think about or write) different parts of the paper and then order them.

33. When I have to work on a group project, I first want to
 - a) have "group brainstorming" where everyone contributes ideas.
 - b) brainstorm individually and then come together as a group to compare ideas.

34. I consider it higher praise to call someone
a) sensible
b) imaginative.
35. When I meet people at a party, I am more likely to remember
a) what they looked like
b) what they said about themselves.
36. When I am learning a new subject, I prefer to
a) stay focused on that subject, learning as much about it as I can.
b) try to make connections between that subject and related subjects.
37. I am more likely to be considered
a) outgoing.
b) reserved.
38. I prefer courses that emphasize
a) concrete material (facts, data).
b) abstract material (concepts, theories).
39. For entertainment, I would rather
a) watch television.
b) read a book.
40. Some teachers start their lectures with an outline of what they will cover.
Such outlines are
a) somewhat helpful to me.
b) very helpful to me.
41. The idea of doing homework in groups, with one grade for the entire group,
a) appeals to me.
b) does not appeal to me.
42. When I am doing long calculations,
a) I tend to repeat all my steps and check my work carefully.
b) I find checking my work tiresome and have to force myself to do it.
43. I tend to picture places I have been
a) easily and fairly accurately.
b) with difficulty and without much detail.
44. When solving problems in a group, I would be more likely to
a) think of the steps in the solution process.
b) think of possible consequences or applications of the solution in a wide range of areas.

Appendix B

Online Discussion Questions

1. How often do you usually access the discussion forum?
(e.g. to read postings, to check for new postings)?
 - 11 or more times per week
 - 9 - 10 times per week
 - 7 - 8 times per week
 - 5 - 6 times per week
 - 3 - 4 times per week
 - 1 - 2 times per week

2. On how many days do you usually make an original posting?
(e.g. answer a discussion question, ask a question about course contents)?
 - 7 days
 - 6 days
 - 5 days
 - 4 days
 - 3 days
 - 2 days
 - 1 day

3. On average, how many original postings do you make per week?
 - 1 2 3 4 5 6 7 8 9 10 and more

4. On how many days do you usually respond to other students postings?
(e.g. to provide comments, to answer questions)?
 - 7 days
 - 6 days
 - 5 days
 - 4 days
 - 3 days
 - 2 days
 - 1 day

5. On average, to how many postings by other students do you respond per week?
 - 1 2 3 4 5 6 7 8 9 10 and more

6. Compared to the number of required postings, do you post
- more often
 - as often as required
 - less often
7. In general, do you feel satisfied with the number of postings you make?
- Yes, I am satisfied.
 - No, I would like to post more often.
 - No, I would like to post less often.
8. How would you rate your overall experience with online discussions?
- Excellent
 - Very good
 - Good
 - Satisfactory
 - Very unsatisfied

Appendix C

Demographic Questions

1. What is your gender?
 - male
 - female

2. What is your present age?
 - 25 years and younger
 - 26 – 35 years
 - 36 – 45 years
 - 46 – 55 years
 - 56 – 65 years
 - over 65 years

3. What is your current employment status?
 - Technical college instructor
 - K-12 instructor
 - Instructional designer/curriculum consultant
 - Administrator
 - Technology specialist
 - Corporate trainer
 - Seeking employment
 - StudentOther, please specify _____

4. How would you rate your computer skills?
 - Expert
 - Proficient
 - Good
 - Satisfactory
 - Unskilled

5. How many online courses have you taken up to now?
 - 1
 - 2
 - 3
 - 4
 - 5
 - 6
 - 7
 - 8 and more

6. What is your preferred way of communication?
 - Face to face
 - Telephone
 - Mail
 - Email
 - Other

Appendix D
Matrix of Research and Survey Questions

Survey questions	Research Questions				
	Question 1 Learning styles	Question 2 Distribution	Question 3 Number posts	Question 4 Frequency posts	Question 5 Relationship
1	x	x			x
2	x	x			x
3	x	x			x
4	x	x			x
5	x	x			x
6	x	x			x
7	x	x			x
8	x	x			x
9	x	x			x
10	x	x			x
11	x	x			x
12	x	x		Questions 1 through 44: Learning Style Inventory	x
13	x	x			x
14	x	x			x
15	x	x			x
16	x	x			x
17	x	x			x
18	x	x			x
19	x	x			x
20	x	x		x	
21	x	x		x	
22	x	x		x	
23	x	x		x	
24	x	x		x	
25	x	x		x	
26	x	x		x	
27	x	x		x	
28	x	x		x	
29	x	x		x	
30	x	x		x	
31	x	x		x	
32	x	x		x	
33	x	x		x	
34	x	x		x	
35	x	x		x	
36	x	x		x	
37	x	x		x	
38	x	x		x	
39	x	x		x	
40	x	x		x	
41	x	x		x	
42	x	x		x	
43	x	x		x	
44	x	x		x	
45				x	x
46		Questions 45 through 52: Online Discussions		x	x
47			x		x
48				x	x
49			x		x
50				x	x
51					x
52					x
53	Questions 53 through 58: Descriptive Statistics				
54					
55					
56					
57					
58					