A QUALITATIVE INVESTIGATION OF HOW INSTRUCTORS COMMUNICATE WITH STUDENTS AND THE TOOLS THEY USE TO PROMOTE DIALOGUE IN ONLINE POST-SECONDARY MATHEMATICS COURSES

By

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To Isabella, Sebastian, and Dan

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By

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Post-secondary online education affords students the opportunity to take entire degree programs at a distance without walking into a traditional classroom. In order to do so, all courses must be taken online including math. Historically, math has been taught through lecture delivered from the instructor to student. However, the transition from traditional to online courses changed how knowledge is exchanged and how communication takes place when separated by time and location. Research has shown that communication through reciprocal dialogue and course structure are significant components in online courses.

Quantitative measures have been able to calculate the frequency and types of communication, while beginning research using a qualitative methodology began to address specifically how instructors communicate online and the best practices they employ in this environment. Although limited in post-secondary math courses, the purpose of this study is to investigate how instructors communicate with students in an online environment, what tools they use to promote communication, and how instructors structure a course to increase communication in online courses.

Using qualitative methodology, semi-structured interviews were conducted with six post-secondary online math instructors to ascertain how they communicate with their students, the tools that they utilize to do so, and how they structure the course. The study found that the instructors used a variety of communication means such as email, forum posts, and discussion boards to interact with their students. They were open and accommodating to the students' needs and communication preferences. The instructors used a variety of tools such as discussion boards, videos, and synchronous sessions to increase the communication with their students. The results from this study point at several implications regarding the training of instructors in terms of communication, communication tools, videos, discussions, and course structure.

CHAPTER 1
INTRODUCTION

Online education is quickly becoming an alternative to traditional education (Bejerano, 2008). Distance education programs were developed to serve students who could not attend courses on campus. In its traditional format, student interactions were supported through correspondence or independent study in which the student mailed their work and/or used computer technologies to communicate with their instructor. Little to no contact was maintained with peers since students were often enrolled in independent courses. As technology expanded, it increased the options available for both instructor-to-student and student-to-student communication. Ribsamen (2000) reported that the Internet boom in the late 1990s brought about developments in media and multimedia which promoted an evolution in distance education programs. During this time, mixed media courses, hybrid or blended learning courses, started to emerge as well as fully online programs. Though often referred to interchangeably, there is a distinct difference between distance education and online education. Traditional distance education concerned the autonomy of the learner (Moore, 1997) in addition to the privatization of learning (Ribsamen, 2000). Online education is associated with active learning through socialization and group interactions (Bejerano, 2008).

Enrollment in online courses offered by higher educational institutions have dramatically increased over the past decade. The economic downturn of early 2010 has spurred the demand for online courses and programs, with approximately three-quarters of institutions compared to one-half reported an increase in face-to-face courses and programs (Allen, Seaman, & Sloan Consortium, 2011). Student enrollment rates in online courses increased by an average of approximately 18.5% from the fall of

2002 to the fall 2010, with a 36.5% surge of enrollments in 2005 (Allen, Seaman, & Sloan Consortium, 2011). By the fall of 2007, 3.9 million college students were taking at least one online course (Doyle, 2009). Just three years later, studies indicated that 6.1 million students were taking at least one online post-secondary course during the fall 2010 term (Allen et al., 2011). According to reports by Allen and Seaman (2006), 46% of postsecondary institutions offer fully online programs and 44% offer online courses. Over 65% of institutions reported that online learning was a critical component of their long-term strategy with for-profit institutions more likely to include online learning as part of their plan (Allen & Seaman, 2011). These figures represent the continued growth and demand for online education.

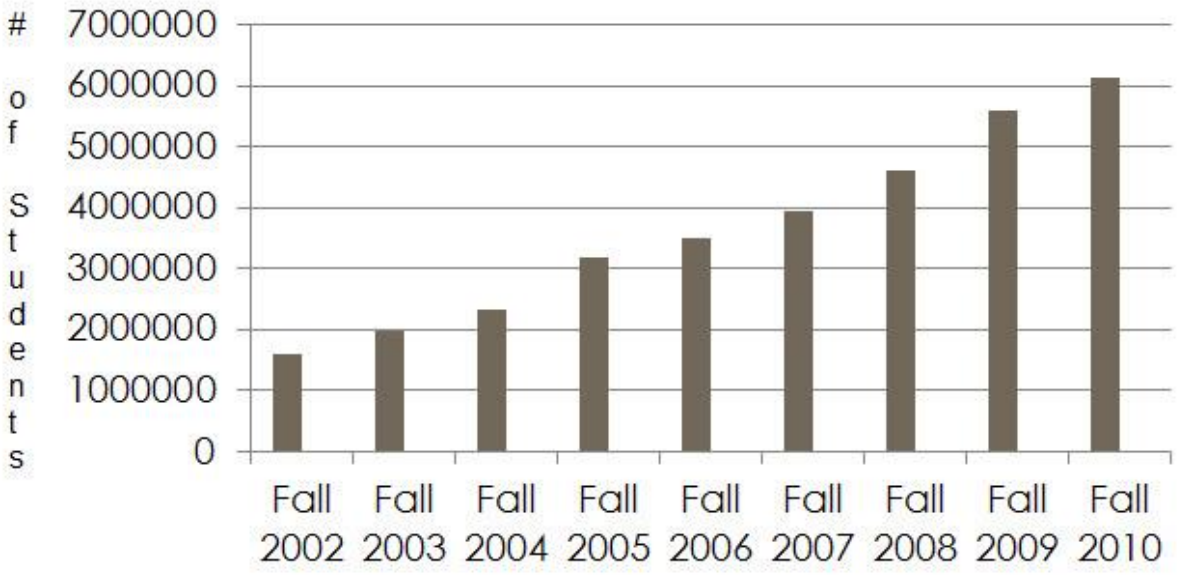

Figure 1-1. Students taking at least one post-secondary online course. Adapted from "Going the Distance: Online Education in the United States," by, I. E. Allen, J. Seaman, & Sloan Consortium. Copyright 2011 by the Sloan Consortium.

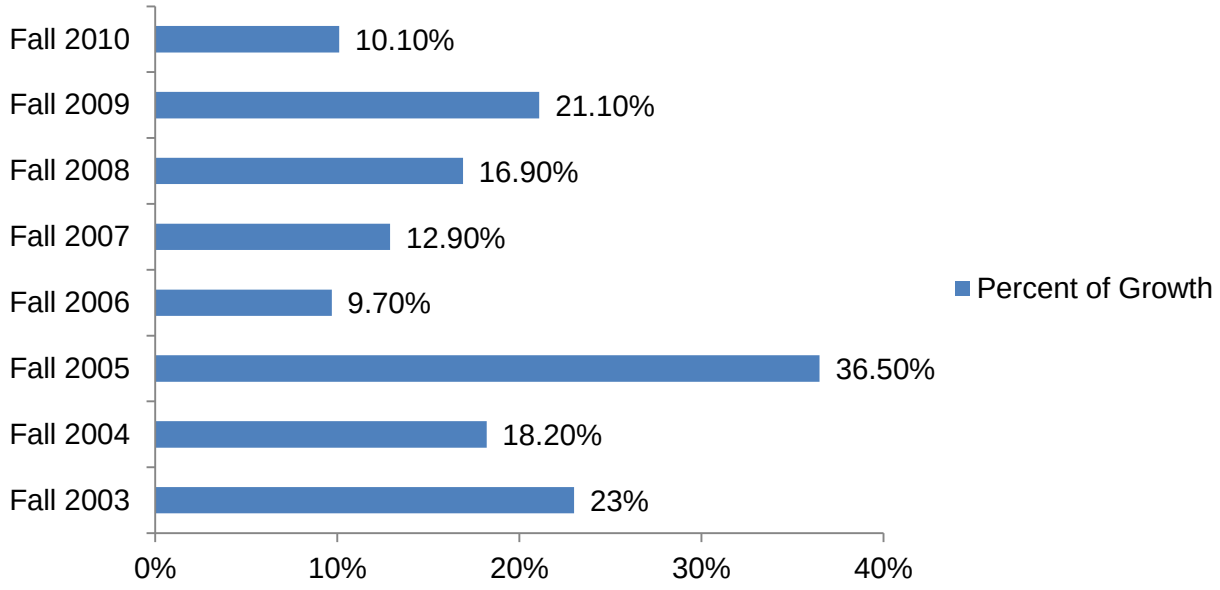

Figure 1-2. The annual growth rate associated with online enrollments. Adapted from "Going the Distance: Online Education in the United States," by, I. E. Allen, J. Seaman, & Sloan Consortium. Copyright 2011 by the Sloan Consortium.

Studying the manner in which students and instructors adapt in an online learning environment is important (Oliver, Osborne, & Brady, 2009); moreover, given the absence of non-verbal expressions and face-to-face communication, students are relegated to written communication in an online course. How each person modifies their communication can shed light on the complex nature of this phenomenon. Students must adapt to asynchronous discussions and interactions with their instructor and peers. Although there is similar pedagogy between face-to-face and online courses, there are important differences including the geographical separation (Moore, 1997). According to Yang and Cornelious (2005), Conceicao (2006), and Jackson, Jones, and Rodriguez (2010) researchers need to study the many facets of the online environment in order to inform our practice in both instructor communication and course facilitation.

Chapter 2 will discuss student and instructor communication and interactions in an online environment and this study will extend the research initiated by Yang and Cornelious (2005), Conceicao (2006), and Jackson et al. (2010). It is anticipated that this research will inform educational practioners about how other instructors communicate and interact with students in online settings. The research will serve as a catalyst to allow practioners to reflect upon their teaching pedagogy as well as improve online communication with students by applying the documented best practices found in this study in their courses. Chapter 2 will serve as an introduction, presenting the theory of transactional distance, research in online education, in addition to the research questions which guide this study.

Transactional Distance

Due to the absence of physical presence in a classroom, the transition of education from face-to-face to online called for new theories to describe this phenomenon. Michael Moore proposed the theory of Transactional Distance defined as "a psychological and communications space to be crossed, a space of potential misunderstanding between the inputs of instructor and those of the learner" (Moore, 1993, p. 23). The theory explains how the instructor, students, and content interact online. It does so using three components, namely structure, dialogue, and autonomy. Although the three elements encompass their own definitions, they are all intertwined thereby elucidating the unique phenomenon that is online education.

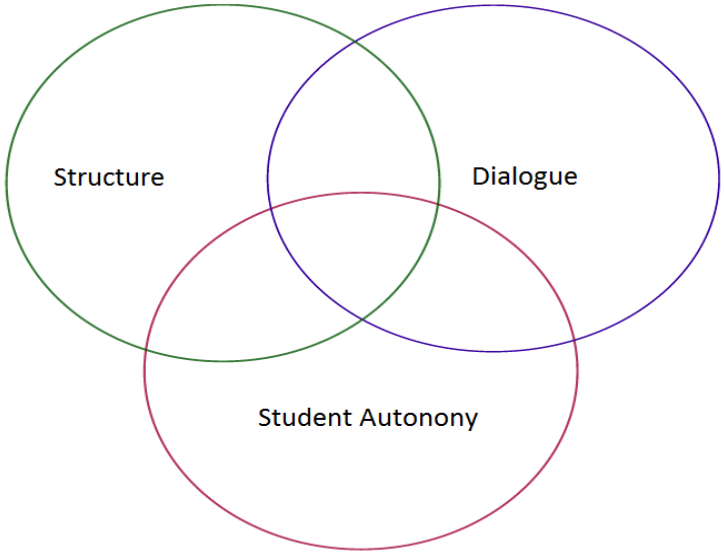

Figure 1-3. Theory of Transactional Distance

The current literature accepts transactional distance as a theory encapsulating the unique nature of the online learning environment (e.g., Saba & Shearer, 1994; Chen & Willits, 1998; Chen, 2001; Shannon, 2002; Huang, 2002; Lemak, Shin, Reed, & Montgomery, 2005; Gokool-Ramdoo, 2008; Shin, 2010, Falloon, 2011). It was proposed that the theory of transactional distance be considered a global theory for several reasons, one being the containment of elements that are inherent in other proposed theories (Gokool-Ramdoo, 2008). Gorsky and Capsi cite three reasons for the importance of the theory, (1) Researchers view it as a basic analytical framework to better understand distance education, (2) Researchers state the need to reduce transactional distance (3) The theory is assumed true and taught in higher learning (2005).

The dialogue component of Transactional Distance Theory is of great importance in an online environment. Moore defines dialogue as “purposeful, constructive and valued by each party. Each party in a dialogue is a respectful and active listener; each

is a contributor, and builds on the contributions of the other party or parties. The direction of a dialogue in an educational relationship is towards the improved understanding of the student" (Moore, 1993, p. 24). Students seeking out online instruction bring with them expectations about interactions and communication with the instructor, students, and content. Students' autonomy further influences how this interaction and communication within the course. Highly autonomous learners can thrive in a less structured environment and thus can be attracted to the attributes of online learning (Moore, 1997). All of these theoretical components are entangled with one another revealing a highly complex structure, which is at the core of online education. Course structure and the instructor's attention to dialogue affect how the course is facilitated (e.g., Vrasidas & McIsaac, 1999; Howland & Moore, 2002). According to Shannon (2002), two organizational and teaching behaviors are critical to overcome the transactional distance, namely the structure elements of course design and organization and the dialogue shared between instructor and students. Therefore, the theory of transactional distance is a sustainable framework that can facilitate our knowledge of online interactions and dialogue.

What the Research Says

Prior research has studied the components of transactional distance in various combinations with and without anticipated learning outcomes (Saba & Shearer, 1994; Bunker, Gayol, Nti, & Reidell, 1996; Chen, 2001; Chen & Willits, 1998; Bischoff, Bisconer, Kooker, & Woods, 1996). These studies primarily focused on the dialogue that occurs in relation to transactional distance with course structure relegated to a secondary or tertiary measure. The literature shows a relationship between increased dialogue and student satisfaction and reported learning gains. However, course

structure is a variable that can determine the extent of dialogue that can occur and ultimately the degree of transactional distance felt among students (Gorsky & Caspi, 2005). Stein, Wanstreet, Calvin, Overtoom, and Wheaton (2005) recognize that the relationship between course structure and the psychological and communication gap resulting from distance learning is scarce in the literature.

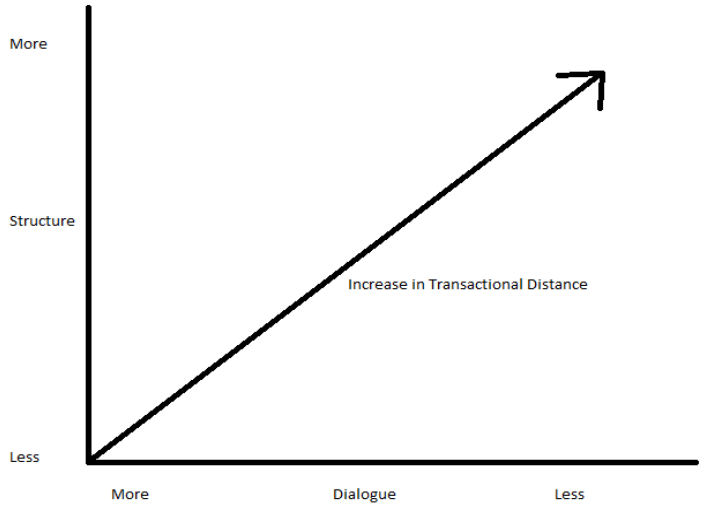

Figure 1-4. Components of Dialogue and Structure in Transactional Distance

Moore did not define how to measure the components of structure, dialogue, and autonomy when he published the theory of transactional distance. This left researchers to interpret and define the terms. These definitions were called into question for their validity and interpretation of the original theoretical premises. Dialogue has been operationalized in a number of studies as the number of communications that occur in an online environment (Saba & Shearer, 1994; Bunker et al., 1996; Bischoff et al., 1998; Chen & Willits, 1998). However, according to Moore's definition, dialogue is not measured by the number of verbal interactions; thus, studies that simply measured the number of communications within a course may not necessarily measure dialogue

(Moore, 1993). Rather, dialogue should lead to the improved understanding by the student. Moore differentiates between dialogue and interaction in the following manner, if student understanding has been achieved, then dialogue occurred. However, if student understanding was not achieved, then it was merely an interaction between both parties (Moore, 1993). The prior studies measured the components of Transactional Distance quantitatively. They all recommended that subsequent research include interviews or observations (Saba & Shearer, 1994; Bunker et al., 1996; Chen, 2001; Chen & Willits, 1998; Bischoff et al., 1996). In addition, the studies measured the effect of dialogue in relation to an outcome variable or after the communication took place.

Key Terms Defined

Depending upon the nature of the study, terms such as communication, interaction, and dialogue can be defined in different ways. Communication is viewed as an exchange of information whether in person, electronically, or through another medium. However, definitions for dialogue become more ambiguous depending on the focus of the study. Some researchers count the number of transactions that occur and label them as dialogue (Saba & Shearer, 1994; Bunker et al., 1996; Bischoff et al., 1998; Chen & Willits, 1998). Moore recognizes three distinct types of interaction, instructor-student, student-student, and student-content (1989), and states that dialogue is an interaction that has positive qualities (1997). These three types of interactions have been notably accepted in the literature while others have proposed other forms such as student-interface (Hillman, Willis, & Gunawardena, 1994).

For the purpose of this study, the following definitions will be adopted:

COMMUNICATION	an exchange of information by speaking, writing, or using some other medium (Oxford dictionary, 2010); the ways in which information is shared
INTERACTION	an exchange between the instructor-student, student-student, or student-content (Moore, 1989)
DIALOGUE	an interaction having positive qualities; purposeful, constructive and valued by each party (Moore, 1997)

Problem Statement

The particulars of how instructors communicate online and how they structure a course to increase dialogue were not addressed by the previously mentioned research. While the role of dialogue is recognized as an integral component in online environments as shown in the research (Saba & Shearer, 1994; Bunker et al., 1996; Chen, 2001; Chen & Willits, 1998; Bischoff et al., 1996), the pedagogical facet informing instructors how to increase dialogue is less clear. This dissertation will investigate how post-secondary mathematics instructors communicate online and the specific tools that they use to increase communication their courses.

Significance of the Study

Outcomes associated with this study are anticipated to have far-reaching effects. As online course offerings continue to increase, so does the need for qualified instructors to fill these roles. At times, new instructors are not versed in online pedagogy (Yang & Cornelious, 2005; Bonk & Dennen, 2003). Often, they are beholden to the specific training offered by their institution (Boling, Hough, Krinsky, Saleem, & Stevens, 2012), which may not address best practices for online environments or the content matter associated with a course. In addition, a learning curve occurs when an instructor moves from the traditional to online environment including the way they

communicate, their attitudes toward technology, and time investments for student feedback and course facilitation (Lei & Gupta, 2010). Learning how to navigate within the modality takes time. Watson and Johnson (2011) claim that there are two main fundamental skills required to teach online: learning the technology and effective online pedagogy. Instructors are thus required to learn a separate set of skills in order to be successful in facilitating online courses. Oliver, Osborne, and Brady (2009) summarize three categories of instructor online competency, which consist of managing the online learning environment, preparing content, and utilizing tools for desired outcomes. This study will inform practitioners about effective ways to communicate online and specific tools that can be used to increase dialogue, which can potentially reduce the transactional distance felt by the students, adding to their pedagogic knowledge.

Additionally, this research has the potential to influence course designers and administrators of online programs. It is anticipated that these individuals will gain additional understanding of how instructors increase dialogue. The best practices of online instructors should be recognized by the faculty and school in order to meet the students' needs in delivering quality virtual education (Lao & Gonzales, 2005). By studying the specific characteristics of how instructors communicate online and what they do to increase dialogue; it is possible to enhance the quality of the courses, increase student satisfaction, and ultimately student learning.

Purpose Statement

The purpose of this study is two-fold; first, I investigated the manner in which instructors communicate with students in online courses. Second, I explored the pedagogical tools that instructors employ to increase communication in online courses.

Methodology

The researcher conducted a qualitative, case study involving in-depth, semi-structured interviews with online math instructors at various post-secondary institutions. The questions posed in this study are addressed through a qualitative, case study. Participants were recruited using convenience sampling (Creswell, 2005).

In-depth, interviews were conducted and recorded over the phone, and later transcribed. The interview questions were semi-structured in order to allow for question probing and clarification. The transcribed interviews underwent several rounds of coding, identifying preliminary, categorical themes. A second coder was used to increase reliability as well as member-checking. A final analysis of the data reported how instructors communicate with students and the tools they use to increase dialogue in online courses.

Research Questions

The following questions frame the study:

1. How do math instructors communicate with students in an online environment?
2. What tools do math instructors use to promote communication in an online course?
3. How do math instructors structure a course to increase dialogue?

Assumptions

There are several assumptions regarding this study. First, it is assumed that instructors communicate with their students in online courses. The second assumption is that instructors strive to increase the dialogue in their online courses through several means including course structure.

Delimitations

The instructors represented in this study are from four different institutions. Math instructors were chosen in order to capture the unique way in which they communicate in this subject area. This was intentional in order to report the views of this specific subgroup. Communication can vary across disciplines, therefore the sample was chosen to control for this factor.

Limitations

There are several limitations associated with this study. A primary limitation is that only instructors teaching online math courses were included. The experience of the instructor, the specific course, and the course content were not variables in selecting the sample. Moore's theory of transactional distance contains three components: structure, dialogue, and autonomy (Moore, 1997). Dialogue is the focus of the study with course structure a secondary component of dialogue. The two components are intertwined and thus cannot be easily separated. The autonomy of the student was not included. The inclusion of all three components requires a study outside of the boundaries of the present research.

Research Bias

The researcher has been in the education field for eight years and teaching online courses for the past five years. Additionally, she has taken over 26 online courses as a student and taught over 90 sections of online mathematics at the secondary level. The experience and participation in online education gives the researcher a unique outlook of transactional distance, dialogue, and its effect in online courses.

Organization of the Study

This study is divided into five chapters. Chapter 1 introduces the nature of the study, including the problem statement, purpose, and signficance. Chapter 2 begins by introducing the theoretical framework of the research and the findings from the literature. The study's methodology, data collection, and analysis are discussed in Chapter 3. The results from the study is reported in Chapter 4. Chapter 5 concludes with a discussion of the results in addition to implications and directions for further research.

Definition of Terms

ASSESSMENTS	the evaluative components included in a course; may include quizzes, exams, reflections, writings, and discussions
AUTONOMOUS STUDENT	a student responsible for his or her learning
COGNITIVE PRESENCE	the degree to which students construct and confirm meaning through reflection and discourse (Garrison, Anderson, & Archer, 2001)
COMMUNICATION	an exchange of information by speaking, writing, or using some other medium (Oxford dictionary, 2010); the ways in which information is shared
COMMUNITY OF INQUIRY	theoretical framework which includes social, cognitive, and teaching presence
COURSE STRUCTURE	the design and location of instructional materials in an online course
DIALOGUE	an interaction having positive qualities; purposeful, constructive and valued by each party (Moore, 1997)
DISCUSSION FORUM	an asynchronous forum used as a tool to house student and instructor commentary on a set topic
DISTANCE EDUCATION	correspondence courses developed for students unable to attend campus; communication through mail or electronic means
IMMEDIACY BEHAVIORS	the attempt, on behalf of the instructor, to reduce the social distance between the instructor and student (Arbaugh, 2001)
INSTRUCTOR PRESENCE	perceived appearance of the instructor in a course
INTERACTION	an exchange between the instructor-student, student-student, or student-content (Moore, 1989)
ONLINE COURSE	education delivered through an electronic medium over the *internet without face-to-face contact*
PRESENCE	perceived appearance of the instructor in a course
SELF-DIRECTED LEARNERS	students who are independent, can manage their work and responsibilities, set goals, and evaluate/reflect upon said goals

SELF-DIRECTED LEARNING	the process in which an individual takes the initiative to diagnose learning needs, make goals, identify resources, implement learning strategies, and evaluate learning outcomes (Knowles, 1975)
SOCIAL PRESENCE	the degree to which participants feel affectively connected to one another in an online environment (Swan & Shih, 2005)
TEACHING PRESENCE	incorporates design and organization of a course, facilitation of discourse, and direct instruction (Anderson, Rourke, Garrison, & Archer, 2001)
TRADITIONAL EDUCATION	education that includes lecture, students, an instructor, and synchronous discussion (Moore, 1973)
TRANSACTIONAL DISTANCE	theoretical framework that includes the structure, interaction, and autonomy in relation to online courses; a spectrum of connectedness the student feels to the instructor or course; greater transactional distance results in increased perceived distance while less transactional distance results in decreased perceived distance with the instructor and instructional components.

CHAPTER 2
LITERATURE REVIEW

Online education has been growing at an aggressive rate over since the mid '90s. "Over 4.6 million students were taking at least one online course during the fall 2008 term, a 17% increase over the previous year" (Allen & Seaman, 2010, p.1). The demand for online course offerings is affecting colleges and universities across the globe. Allen and Seaman (2010) report that 66% of post-secondary institutions reported an increased demand for new courses while 73% have seen an increase for existing online offerings. It is anticipated that this demand will continue to increase as long as students are satisfied with the instruction and education they receive (Kim & Bonk, 2006).

Purpose

The purpose of Chapter 2 is to provide a research-based context for this dissertation. The chapter will introduce the theory of transactional distance as it relates to communication in online education, synthesize empirical research that has been conducted in the field, highlight gaps in the literature, and discuss the need for further research. The topics of online communication and interaction, types of interaction, instructor presence, immediacy behaviors, math, and computer mediated communication as they relate to online education will be the focus of the review. Instructors have the ability to structure a course to increase dialogue by adding discussion forums, sending out frequent communications, and providing individual feedback to students. Therefore, the literature review is being viewed through this perspective of instructor-controlled communication. Additionally, the chapter will discuss the demographics and other characteristics of students who are attracted to

online learning and will explore the relevant themes found in the literature. The following questions frame the study:

1. How do math instructors communicate with students in an online environment?
2. What tools do math instructors use to promote communication in an online course?
3. How do instructors structure a course to increase dialogue?

Several databases were used to search for the empirical studies and research for this literature review such as Education Full-Text, JSTOR, ERIC, ProQuest, and Google Scholar. The following key terms were employed in a primary search: *transactional distance theory*, *online communication, online interaction*s, *student satisfaction in online courses*, *perception of student learning online, instructor presence*, *immediacy behaviors, teaching online math, online learning, distance education, student satisfaction, and self-directed learners*. Search findings were limited to the past decade with the exception of original, seminal works and theoretical frameworks. In the subsequent searches, the author looked for references cited in the preliminary findings.

Articles that did not focus on the themes of this literature review or did not discuss communication or interaction in online education were excluded. Research involving online course communication and interactions, online presence, immediacy behaviors, student satisfaction, and self-directed learners were inclusionary themes for this literature review. In addition, background research of the topic was incorporated in the literature search. The history, benefits, significance, and theories surrounding online education were included in the development of this review.

There are many empirical studies within the broader context of online education. It was important to focus on the themes discussed in this literature review therefore, exclusions were necessary. Research which looked at communication through different

medias, learning objects, chat, etc., although noteworthy, were not germane in this review of the literature.

Theoretical Framework

Online education can be viewed through several theoretical lenses. For the purpose of this literature review, only the theory of transactional distance will be discussed. Community of Inquiry, Andragogy, and Transformative Learning Theory were considered in the review of theoretical frameworks in the field. These theories were excluded however since they do not fully capture the phenomenon being studied in this project. Although they aid in elucidating the type of learner in online education and other online constructs, it is secondary to the focus of this review. It is through careful examination of transactional distance that shareholders of online education can study and inform their practice. This section will introduce, define, and discuss the conceptual components of this theory as it relates to online education.

Theory of Independent Learning and Teaching

Building upon Dewey and Bentley's idea of 'transactions' (1946) and work from Boyd and Apps (1980), Moore linked transactions to the online environment thereby developing the theory of transactional distance. Dewey and Bentley (1946) defined transaction as, "systems of description and naming are employed to deal with aspects and phases of action, without final attribution to elements or other presumptively detachable or independent entities, essences, or realities, and without isolation of presumptively detachable relations from such detachable elements" (p. 133). This definition was followed up by a series of characterizations to illustrate the range of the definition. They were trying to replicate the scientific nature of theory in the behavioral sciences. Students, in the pursuit of knowledge, create artifacts when learning. These

behaviors and actions can be observed, as in scientific inquiry, and thus the notion of transaction sought to delineate this process (Dewey & Bentley, 1946). Boyd and Apps saw transactions as "the interplay among the environment, the individuals, and the patterns of behaviors in a situation" (1980, p. 5) and was used to describe adult education. Moore took these ideas and applied them to independent learning by which institutions plan and implement programs based upon the needs of the learners (Moore, 1980). These ideas spurred his earlier theory of Independent Learning and Teaching.

During the 1960s and 1970s open universities, schools without entry requirements, began serving the independent learner. These non-traditional instructional programs of the open universities moved research in a new direction (Moore, 1973). There was such a growth in this area that by 1973 nearly 70% of American colleges and universities offered independent study programs in their academic departments (Moore, 1980). The growing presence of new media enabled these programs to mature and increased the freedom of students to choose how and when they learn (Moore, 1980). Three subsystems existed in Moore's (1973) original theory: learner, teacher, and method of communication. I will first briefly discuss the modalities and the roles of the student and teacher in his original theory before discussing the current constructs of the theory.

Both learning and teaching were thought to be purposeful and deliberate activities according to Moore (1973). His original theory defined an educational system whereby the learner was autonomous and separated from the instructor through space and time. Communication was through print, electronic, or other spatially separated mediums. The biggest difference between the two modalities of learning was the

separation of student and instructor. Moore distinguished between the two by terming them “contiguous” and “distant” situations (1973). Contiguous situations involve the presence of both student and instructor and assume that there is no delay in communication. Class lecture, the students, and synchronous discussion are attributes of this situation. This is referred to as the traditional environment (Moore, 1973).

On the other hand, distance teaching involves the separation of teaching and learning behaviors. Communication between student and teacher is assisted using media, either print or digital. The teacher executes the instructional tasks similar to and different from the traditional methods. Students also accomplish learning tasks through a variety of methods. As the effectiveness of the bridging increases, the less distance exists between the two groups (Moore, 1973).

The next component of Moore’s original theory explains the autonomous learner within the learning system. Due to the nature of the online environment, the learner is expected to accept a high level of responsibility for their learning, whereby the autonomous learner emerges from this construct. Using Murray’s need system as a model, Moore defines autonomy as, “the will and ability to exercise powers of learning, to overcome obstacles for oneself, to try to do difficult learning tasks and to resist coercion” (Moore, 1973, p. 667). The autonomous learner uses the instructor for clarification, assistance, and guidance as they navigate through their learning journey.

Lastly, the teacher’s role differs in the online environment as learner autonomy is increased. The teacher is not guided by lectures and delivering content first-hand. The teacher’s function shifts to one of providing information, advice, and recommendations

and allows the learner to make the decisions (Moore, 1973). This environment requires that teachers respond to students and anticipate future needs and questions.

The traditional school environment was recognized as one having a classroom, lecture, and both teacher and student present. Independent learners were physically separated from a teacher and the communication occurred through print or another form of media (Moore, 1973). The individual student-teacher transaction was modeled on the tutorial system at Oxford and Cambridge and emerged on American campuses after World War I (Moore, 1980). This notion of independent study is one in that "the instructor monitors the student's practice of self-directed inquiry, through which the student acquires competence in study skills and the exercise of self-discipline" (Moore, 1980, p. 17). It is from this distance that Moore's theory sought to define the construct of a non-traditional classroom. The presently accepted theory, transactional distance, will be discussed at further length in this review. The theory of transactional distance has evolved over the past few decades. Structure, dialogue, and autonomy are the three components that define the theory and will be discussed in relation to the online learning environment.

Transactional Distance

The structure component of transactional distance includes the course design and organization. According to Moore (1997), the structure of a program is shaped by its media, philosophy of teachers, personalities of learner, and institutional constraints. Jackson (1968) defines two stages of teaching, the preactive and interactive. The objectives, curriculum, and instructional strategies are determined in the preactive stage while dialogue and interaction through verbal, written, or face-to-face contact occurs

during the interactive stage (Moore, 1980). Physical contact is not required during the interactive stage which is applicable in the online environment.

When a program is highly structured, the transactions between student and instructor are high (Moore, 1997). The high structure limits the amount of dialogue that can occur with little deviation from the prescribed curriculum. The transactional distance can be reduced by increasing the dialogue through teleconferencing or well-structured print materials (Moore, 1997).

On the other hand, a flexible structure corresponds to high dialogue and learner control (Sahin, 2008). The autonomy of the learner is increased in less structured programs in that the learners take responsibility and make decisions concerning their course of study (Moore, 1997). Several factors need to be taken into consideration when designing course curriculum, such as the complexity of the content, characteristics, and autonomy of the learners (Moore, 1997). Instructors need to find the right balance in order to maximize learning and increase purposeful dialogue among the participants.

The amount of dialogue that occurs in an online environment varies and is dependent on the structure of the course. Little to no dialogue occurs with one-way media such as television, audiotape, or book (Moore, 1997). The transactional distance is higher in these circumstances since the contact between student and teacher is limited. However, the media can be manipulated to increase the dialogue and lessen the transactional distance. Audio-conferencing and teleconferencing allow for the ability to bridge this distance and promote dialogue.

The presence of media tools do not guarantee that dialogue will occur. A number of factors influence the levels of interaction in an online program. The number of students, frequency of communicative opportunities, emotional and physical environments of students and teachers, personalities, and content has an impact on the amount of dialogue present in a course (Moore, 1997). Courses can be classified as "most distant" to "least distant". Programs of instruction are combining integrative media created by a team in order to increase dialogue and individualization of courseware (Moore, 1973).

Given the nature of an online education program, students are expected to take on a certain level of autonomy. A person who can identify a problem, create and define goals in accordance with the problem, and work towards those goals to achieve success is a fully autonomous learner (Moore, 1980). It is the learner who determines these goals, experience, and evaluation of outcomes, not the teacher (Moore, 1997). Moore (1973) further breaks down this concept into three sets of learning events: establishment, executive, and evaluative. The learner chooses the goals, identifies needed information, and creates short-term objectives during the establishment event. Attending lectures, reading, consulting others, or performing experiments are components of the executive events during which the learner is gathering information and collecting ideas to work towards solving the identified problem. During the last event, evaluative, the learner judges the information and skills acquired while determining the validity of possible solutions. Conclusions and the need for further research occur during this event (Moore, 1973).

Highly autonomous learners can thrive in a less structured environment while less autonomous learners seek out programs with high structure (Moore, 1997). This observation adds great insight as to the characteristics of the current online learner. It should be noted that Knowles' theory of Andragogy is aimed at explaining the characteristics of the adult learner. His theory is based upon four assumptions of maturing individuals: an individual's self-concept moves from one of dependency to self-direction, the accumulation of experience becomes a resource for learning, their readiness to learn increases as the need to cope with real-life tasks and problems increase, and they are performance-centered with a preference for immediate application of knowledge (Knowles, 1970). Although the focus of this literature review is on interactions that occur in online education, the theory of adult learning helps to explain the autonomous nature of individuals as well as those who are attracted to learning in this environment.

The autonomous student is not learning in isolation. The student has the opportunity to seek the assistance of the instructor in order to solicit help in formulating problems, gathering information, or judging progress (Moore, 1973). The act of seeking help is functional and not emotional. The student requests help in order to achieve success not to win approval from the teacher (Moore, 1980). Adult learners are conditioned to rely on the traditional belief of education whereby the instructor is the main disseminator of content in a highly prescribed environment. Educators of adult students must help them to become self-directed and self-reliant as they have little experience in sustaining independence in these types of educational settings (Moore,

1980). Both the learner and teacher need to share responsibility for the transactions that occur in adult learning (Knowles, 1980).

In summary, the theory of transactional distance is comprised of three main components: structure, dialogue, and autonomy. The theory was chosen to serve as the theoretical framework for my research for its explanations and definitions of the transactions that occur in an online learning environment. The course structure and dialogue between student and teacher serve as the basis for future research on how instructors communicate and interact with students in online learning environments.

Communication and Interaction in Online Education

During the review of the literature, several themes emerged relating to communication in the online learning environment. The type of interaction, instructor presence, immediacy behaviors, the self-directed learner, math delivered online, and online faculty training are the themes included in this review. In addition, the existence of these constructs resulted in positive correlations to course satisfaction and perceived learning and will be incorporated in the discussion of the literature. This section will discuss the progression of empirical research and the resulting themes found in the literature. A critique of the methodologies, direction for further research, and significance will conclude the review.

Key Definitions

Terms such as communication, interaction, and dialogue can be defined in different ways depending on the type and focus of the research being conducted. This study ascribes to Moore's theory of Transactional Distance and thus adopts his definitions to clarify the focus of this research. For the purposes of this study, communication, interaction, and dialogue are defined as follows:

COMMUNICATION	an exchange of information by speaking, writing, or using some other medium (Oxford dictionary, 2010); the ways in which information is shared
INTERACTION	an exchange between the instructor-student, student-student, or student-content (Moore, 1989)
DIALOGUE	an interaction having positive qualities; purposeful, constructive and valued by each party (Moore, 1997)

Progression of Research

When Michael Moore proposed the theory of transactional distance, he called for scholars to empirically test the theory for its merits. This call was met with a series of studies testing the components of the theory (Saba & Shearer, 1994; Bunker et al., 1996; Bischoff et al., 1998; Chen & Willits, 1998). A review of the research showed that the types of studies progressed in stages based upon the findings and suggestions for new research. This section will discuss how the research has evolved over the past two decades.

Early researchers (Saba & Shearer, 1994; Bunker et al., 1996; Bischoff et al., 1998; Chen & Willits, 1998) tested the components of the theory. Several attempts were made to support transactional distance in online education. These studies were separate and not equal, defining terms differently, including varying components of transactional distance and even looking at probable learning outcomes. The research was somewhat successful although the validity of some studies was called into question (Gorsky & Caspi, 2005). Gorsky and Caspi expressed concern for the lack of construct validity in some of the earlier studies and called the operationalization of the components into question (2005). Since Moore did not explicitly state how to operationalize the variables within his theory, each researcher created their own

definition. This led others (Chen, 2001; Giossos, Koutsouba, Lionarakis, & Skavantzos, 2009) to question the constructs and validity of their research.

Moore's original definition of dialogue did not delineate it as the number of communications that took place within a course. However, several studies (Saba & Shearer, 1994; Bunker et al., 1996; Chen & Willits, 1998; Bischoff et al., 1996) operationalized dialogue in this manner. Moreover, structure was defined in a number of ways including pace, content, feedback, and sequence (Saba & Shearer, 1994), activities and the number of students (Bischoff et al., 1998), instructional design (Bunker et al., 1996), and organization and implementation (Chen & Willits, 1998). The variance among the definitions was called into question by researchers such as Gorsky and Caspi (2005) citing a lack of original scientific theory due to its absence of universal operational definitions. However, the theory survived and moved in a different direction in the next round of studies. Citing the prescriptive nature of the theory, Gorsky and Caspi stated the theory did not elucidate was real dialogue looked like and how it worked in the learning environment (2005). This suggestion was taken into consideration (e.g., Swan, 2001; Stein et al., 2005; Shea et al., 2006; Jackson et al., 2010) and thus the next round of studies prevailed.

The application of transactional distance theory was used in relation to student outcome variables such as satisfaction and perceived learning (Swan, 2001; Stein et al., 2005; Jackson et al., 2010). Continued research supported the theory citing that it was considered applicable to the online environment and worthy of further research using transactional distance a supporting theoretical framework (Giossos et al., 2009). Continuing with quantitative measures, several studies (Swan, 2001; Stein et al., 2005;

Shea et al., 2006; Jackson et al., 2010) sought to find a relationship between the components of transactional distance and student satisfaction or learning.

Swan (2001) found that several factors influenced students' satisfaction and perceived learning, including interaction with instructors, clarity of design, and active communication with peers. As the levels of interaction increased with content, the instructor, and other students, their perceived satisfaction and leaning also increased in comparison to those who reported fewer interactions (Swan, 2001). This conclusion was supported in an additional study which examined the student satisfaction and perceived learning in relation to two of Moore's components of transactional distance, structure and dialogue viewed as interaction (Stein et al., 2005). Leaners who were satisfied with the course structure and learner-initiated interaction reported that they perceived an increase in perceived knowledge (Stein et al., 2005). This finding supports Moore's proclamation that course structure and dialogue affect the level of transactional distance reported (1993).

Continuing the nature of these relationships in the online environment, Shea, Li, and Pickett (2006) conducted research to find a connection between perceived teaching presence and students' sense of learning community. They found a relationship between the two constructs. The respondents were more likely to report higher levels of learning and community when their instructors exhibited teaching presence and when they reported effective instructional course design and organization (Shea et al., 2006). The importance of these findings support the development of learner's connectedness to the course and their perceived learning, in addition to informing instructor decisions

about course design and online pedagogy to enhance the learning environment (Shea et al., 2006).

The evolution of the research led to the call for qualitative studies (Swan, 2001) to examine how these constructs interrelate as viewed from both the student and instructor perspective. Once the theory was established as relevant in online settings and the components pointed towards positive relationships regarding outcome variables, the next step was to ascertain personal experiences from students and instructors.

Several studies answered the call for context-rich data in the form of qualitative interviews (e.g., Lao & Gonzales, 2005; Su, Bonk, Magjuka, Liu, & Lee, 2005; Conceicao, 2006; Lewis & Abdul-Hamid, 2006). The research started with interviews from students and instructors regarding their perceptions of online learning environments (Lao & Gonzales, 2005). Several themes emerged from these interviews including the development of a learning community, having the right technology and equipment, instructors' knowledge in terms of course rigor, and time factors of online courses (Lao & Gonzales, 2005). These findings were a starting point to uncover how both students and instructors viewed online courses. They served to illustrate that reflection is vital to the continued success in online learning.

A similar case study was conducted which investigated instructor and student perceptions according to Berge's four dimensions of instructor roles: pedagogical, managerial, social, and technical (Li et al., 2005). The findings corroborated Berge's contention that instructors hold different roles in varying degrees when teaching online (Li et al., 2005). There was strong support for pedagogical roles which include course

design, promoting professional aspirations, providing timely and quality feedback, and facilitating discussion (Li et al., 2005). The results indicated that the online learning environment is a complex system with various roles and variables at play. Instructor perceptions of course facilitation vary and lend itself to further exploration in this area.

Continued research by Roblyer and Wiencke (2003), Lewis and Abdul-Hamid (2006), and Conceicao (2006) sought to expound the online facilitation practices of faculty. The research that emerged was consistent with online best practices. In an effort to understand how instructors engage students in learning and build community, Lewis and Abdul-Hamid interviewed instructors using criterion sampling (2006). Several themes emerged when attempting to explain how effective practices are applied in the online setting. Instructors from this study cited fostering interaction, providing feedback, facilitating learning, and maintaining enthusiasm and organization were strategies that they utilized in their online courses (Lewis & Abdul-Hamid, 2006). About two-thirds of the respondents stated that they required students to make substantive posts in discussion forums or collaborate with other students to maintain class interaction (Lewis & Abdul-Hamid, 2006). Timely and substantive feedback was another best practice mentioned by the instructors. Use of rubrics and continue encouragement of all students were identifiable best practices (Lewis & Abdul-Hamid, 2006). Course organization and instructor presence were cited as practices used to engage students and encourage learning (Lewis & Abdul-Hamid, 2006). There were many similarities noted between best practices in face-to-face and online courses. However, the structure of the online environment is important to promote interactivity. Faculty have to take deliberate actions to plan, maintain, and engage students not only with the course

content, but among one another in order to meet the needs of the students and further learning (Lewis & Abdul-Hamid, 2006).

The qualitative research supported earlier claims for principles of best practices in education. Chickering and Gamson (1987) published seven principles of good practice in undergraduate education. Two decades later, these principles are consistent with empirical findings of online practices. A summary of these principles include encourage contact between students and faculty, develop reciprocity and cooperation among students, encourage active learning, give prompt feedback, emphasize time on task, communicate high expectations, and respect diverse talents and ways of learning (Chickering & Gamson, 1987). Chizmar, Walbert, and Hurd applied these principles in undergraduate online courses finding that the principles are supported through instructors' use of technology (1999). Three conclusions were made including prompt feedback on questions and assignments, choosing diverse learning tools to interact with the content, and encouraging student use of technology to communicate ideas and critiques with students and the instructor (Chizmar et al., 1999).

Roblyer and Wiencke (2003) observed the lack of definition regarding interactive qualities in online courses. They claim that this deficit hindered the transfer of theory to research design and practice. In response to this observation, they developed a rubric to assess and encourage interactive qualities in online courses. Research showed that increased interaction is correlated to higher achievement and satisfaction (Zirkin & Sumler, 1995) and distance courses need to employ different means of interaction than traditional courses in order to pervade interactive qualities in instruction (Rheingold, 2001). Roblyer and Wiencke identified three characteristics that define interaction,

namely the type of interaction by members involved in the exchange, the characterization or interaction as message transmission, and interaction as social and psychological connections (2003). In designing their rubric, they concluded that interaction is achieved through a complex system of social, instructional, and technological variables. Student engagement and learning is the most meaningful type of interaction, and student engagement can be increased when learning is structured around collaborative experiences (Roblyer & Wiencke, 2003). Their rubric included five elements on a five-point scale where a higher number indicated a high level of interactive qualities. The five elements are social/rapport building designs for interaction, instructional designs for interaction, interactivity of technology resources, evidence of learner engagement, and evidence of instructor engagement (Roblyer & Wiencke, 2003). This rubric was a next step in allowing instructors to rate and reflect upon their online pedagogy.

In summation, the research followed a natural progression of understanding the components of transactional distance as it relates to online education. First, the theory was studied for its component parts and how they interact in online environments. Although claims were made about their construct validity, the theory is still widely accepted and used as a theoretical foundation in online education research. Next, outcome variables, student satisfaction and perceived learning, were measured using the components of transactional distance. A strong correlation between them moved the research in a different direction. The call for qualitative studies to explain how this phenomenon expresses in online environments was the next theme in the literature. Lastly, these studies served to identify best practices in online education settings which

can be transferred into practice. However, the body of research neglected to focus on and substantiate exactly how and what instructors do to increase dialogue in their online courses.

Types of Interactions in an Online Environment

An interaction can be understood as actions among individuals or with content (Moore, 1989). Moore characterized three types of interactions in online settings including instructor-student, student-student, and student-content (1989). These interactions seemed all-inclusive when describing the nature of communication in online courses. However, it was argued that a fourth interaction was present. Hillman, Willis, and Gunawardena proposed a student-interface interaction to explain the interaction that takes place between the student and the electronic classroom (1994). Anderson rejected the fourth interaction claiming that the learner-interface interaction was a component of each other interaction when they occur at a distance and should not be considered unique (2003). A meta-analysis comparing different modes of distance education supported the three types of interaction: instructor-student, student-student, and student-content and associated them with increased learning outcomes (Bernard, Abrami, Borokhovski, Wade, Tamin, Surkes, & Bethel, 2009). This section will discuss the three agreed upon interactions and how they relate to online education.

Instructor to Student

Historically, knowledge was transferred from instructor to student in a hierarchical relationship. The instructor was the main provider of information and transferred this knowledge to students through lecture. Students then regurgitated the information back to the instructor, usually through tests. The resulting scores were a measure of the amount of knowledge retained by the students. However, this model of

learning has been challenged in the online learning environment. The instructor-student relationship is now a holarchical one, resulting in shared power and distribution (Steinman, 2007).

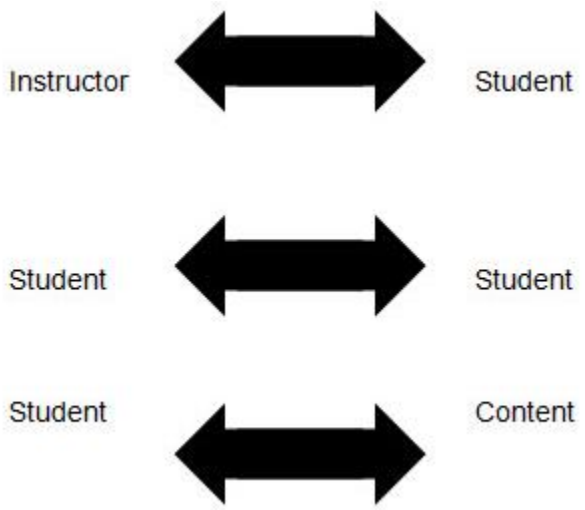

Figure 2-1. Types of Interaction in Online Environments

The amount of transactional distance in an online environment affects the student satisfaction and learning in a course. According to Steinman (2007), when students feel a separation or break in the communication between themselves and the instructor, transactional distance increases. This increase in transactional distance leads students to feel less satisfied in a given course and thus can increase attrition rates. When communication is shared and interactive, it reduces the impact of perceived distance between the instructor and student (Steinman, 2007). The amount of communication between instructors and students is a leading factor that reduces the distance between both parties (Brooks, 2003).

Garrison and Cleveland-Innes (2005) studied four courses with varying instructor interaction. The purpose of the study was to measure how graduate students adjust their learning in relation to the setting. Students can ascribe to deep, surface, or

achievement learning approaches (Garrison & Cleveland-Innes, 2005). They concluded that higher interactions via teaching presence contributed to a deeper learning approach on behalf of the students. Courses which exhibited little to no instructor involvement showed no shift towards deeper learning or a drop in approaching learning at a deeper level (Garrison & Cleveland-Innes, 2005). These results indicate that instructor to learner interactions do affect how students approach learning.

Rhode (2009) found that instructor interactions and quality of course content was the most important aspect of a self-paced course. His study surveyed students in a self-paced course for a professional certificate program. Although the generalizability is limited, Rhode's findings are further support that instructor to learner interactions are critical in an online learning environment.

According to Steinman (2007), transactional distance can occur in both an online and face-to-face course. Our prior experience and perceptions of education lead us to believe that physical proximity is required in order to have effective instruction (Steinman, 2007). However, the transactional distance can be reduced in the online environment by using a number of digital resources to bridge the gap between the instructor-student communications.

Several videoconferencing programs exist, such as Skype and Elluminate, which can be incorporated into the online course structure to reduce transactional distance. Instructors can use chat and video to communicate with their students in a synchronous setting. Here, students are able to receive immediate feedback and ask questions. The use of video can allow the participants to see one another thereby decreasing transactional distance. The use of interactive, online tools has shifted the paradigm of

transactional distance from a one-way interaction to a multi-interactive collaborative learning environment (Stein, Wanstreet, & Calvin, 2009). Steinman states, “Students experience increased satisfaction with online courses when the feeling of remoteness is removed” (2007, p. 47). The level of student satisfaction can have a positive impact on student experience and perceived learning.

Student to Student

The relationships among students that exist in the face-to-face classroom differ from those in the online environment. A social element is present in the traditional environment and affords students the ability to interact with one another using verbal and non-verbal cues. However, similar interaction in the online environment is limited mostly to written communication. The perception shifts from individuals to that of a list of unknown names. This lack of personal connection makes it difficult for students to interact and get to know one another (Steinman, 2007). In a study by Ryan, Carlton, and Ali, students reported several feelings in regards to the online learning environment (1998). They felt disconnected from others which led to feelings of isolation. The asynchronous communication affected the flow of ideas and left them feeling further disconnected. Students also missed seeing faces to go with the names in the class (Steinman, 2007).

Picciano (2002) researched student perceptions of online interactions through discussion board postings with fellow classmates. Picciano found that there is a strong, positive relationship between student perceptions of their interaction in the course and their perceptions of the quality and quantity of their learning (2002). When the variables were isolated, the findings were inconsistent. The outcomes are evidence to the fact

that perception is an intricate phenomenon that cannot be fully captured through quantitative measures alone.

Feelings of isolation may be remedied through the use of community building activities. Instructors that are aware of these concerns can take the proper steps to increase student-student cohesion and sense of community. Computer-mediated communication (CMC) including discussion boards, email, electronic whiteboards, and chat rooms can assist educators to create a sense of community and thus increase students' ability to learn (McBrien, Jones, & Cheng, 2009; Steinman, 2007). Interaction is viewed as a critical factor for developing learning communities and engaging learning environments (Rhode, 2009).

Studying the effects of collaborative learning tools, McBrien, Jones, and Cheng surveyed students' perspectives of using Elluminate in an online course (2009). Overall, the students were satisfied with their experience in the Elluminate sessions, and reported an increase in social interaction. Moreover, students were more comfortable expressing their opinions, increased their participation, and reflection time. All students, including those who are identified as shy, were able to communicate in this Elluminate setting, including many of whom may not do so in a traditional classroom setting (McBrien et al., 2009).

Student to Content

The structure of a course affects how a student will interact with it. As the course structure increases, the dialogue tends to decrease (Moore, 1993). "Student-content interaction refers to students interacting with the subject matter under study to construct meaning, relate it to personal knowledge, and apply it to problem solving" (Abrami et al., 2011, p. 86). Moore contended that it is the process of interacting with the content in an

intellectual manner that results in changes with the learner's understanding, perspective, or cognitive structures (Moore, 1989).

The structure of the course should be taken into consideration in instructional design. Effective online pedagogy is not replicating the face-to-face materials and placing them online. Organization, expectations, timeliness, understandable texts, supplemental materials, and technical support are considerations in delivering content online and subsequently setting up the course (Paloff & Pratt, 2001).

A qualitative study by Boling, Hough, Krinsky, Saleem, and Stevens explored both the teacher and student perspectives of online learning experiences (2012). Most respondents reported courses that were mainly text-based and limited student interaction (Boling et al., 2012). The students reporting heavy text-based content and limited instructor-student and student-student interaction stated that they were less satisfied with their online learning experience when compared to students enrolled in more interactive courses (Boling et al., 2012). Therefore, course design and presentation of the content does play a role in student interaction and satisfaction in online courses.

How Instructors Communicate in an Online Environment

Instructors employ a wealth of practices when communicating online (Conceicao, 2006; Lewis & Abdul-Hamid, 2006). It has been substantiated that although both face-to-face and online settings possess interactive qualities, the nature of online communication is different (Reisetter, Lapointe, & Korcuska, 2007). The lack of non-verbal cues in online education requires a different response, which is called immediacy behaviors in the literature (Arbaugh, 2001). Immediacy behaviors include communication that reduces the perceived distance between teacher and student

including timely introductions, positive communication, and flexible availability (Arbaugh, 2001). Moreover, communication does not have to be two-way. Instructor presence is the perception of the instructors' appearance in the course. Instructors can post materials, comment, and provide feedback exclusive of student reciprocity. The notion of instructor presence, defined as the design, facilitation, and direction of cognition for the purpose of learning outcomes, is a recurring theme in the literature (Anderson, Rourke, Garrison, & Archer, 2001; Arbaugh & Hwang, 2006; Shea et al., 2006; Arbaugh, 2010) and thus should not be overlooked in this review. Instructor presence has been positively correlated to student satisfaction and perceived learning (Swan, 2001; Shin, 2003; Jackson et al., 2010). The posting of materials or feedback can influence the dialogue in online settings and thus worthy of inclusion in the literature review.

The literature identified the type of student attracted to online learning. The characteristics of the student impacts the interactions they will have with the instructor, other students, and content. Their level of experience with the internet, technological tools, and online learning affect their subsequent interactions in courses (Vrasidas & McIsaac, 1999). Thus, this section will discuss immediacy behaviors, instructor presence, and self-directed learners in online education.

Immediacy Behaviors

Immediacy behaviors are one way to explain how communication takes place in online learning environments. Many definitions have been noted in the literature. Arbaugh summarized the existing literature and arrived at this definition: "Immediacy refers to communication behaviors that reduce social and psychological distance between people; it includes both nonverbal and verbal behaviors" (2001, p. 43).

Arbaugh contends that although research on immediacy behaviors has its roots in classroom-based research, it is a foundational component for developing community amongst online learners (2010).

Nonverbal immediacy behaviors are associated with physical mannerisms such as eye contact, smiling, body position, and movement. Verbal immediacy behaviors deal with speaking activities which can include addressing one by name, using humor, citing personal examples, and providing feedback (Arbaugh, 2001). Given the nature of online courses, students expect lower nonverbal immediacy behaviors in comparison to the traditional classroom.

Arbaugh's 2001 study of immediacy behaviors and student satisfaction in a Web-based Masters of Business Administration courses, confirmed that appropriate immediacy behaviors enhance student learner and course satisfaction that earlier studies had reported. He concluded that his findings may be generalizable to online courses. Instructors can reduce the transactional distance the online environment creates by engaging in immediacy behaviors which build a sense of community among the students and the instructor-student relationship. Some examples that can influence student interactions include providing personal examples relating to the course material, demonstrating a sense of humor, and inviting students to seek feedback from one another (Arbaugh, 2001). Dialogue of a conversational manner unrelated to course materials can also create a sense of community in the online classroom.

Research by Conaway, Easton, and Schmidt (2005) coded discussion forum postings for various examples of immediacy behaviors including affective, cohesive, and interactive responses. Content extracted from random selection of postings was

analyzed. Immediacy behaviors were present in the discussions although the mean was low on the scale. This research gives us a different perspective, one from that of the student interactions. Discussion forums alone cannot fully capture the full communication in a course. The instructor can increase these behaviors through modeling and become engaged in the discussions to promote student dialogue (Conaway et al., 2005).

Baker (2004) concluded that instructors that displayed immediacy behaviors were rated higher by students than instructors who did not exemplify these behaviors. Baker found a positive relationship between instructor immediacy and affective learning (2004). The significance of the research is that the instructor has an effect on the learning that occurs in the online environment. They set the tone and can promote a sense of community through such pro-social behaviors.

Instructor Presence

When a student walks into a traditional classroom, it is quickly apparent that there is an instructor to guide the class. The instructor's presence is known and the student falls into the role of student allowing the professor to lead the class as expected. However, this differs in an online learning environment. When a student logs into a course, the instructor's presence is not immediately apparent. Rather, the student clicks on the chat room where an instructor introduction is awaiting them. It is only after the student reads the introduction that the instructor presence is known.

Students new to this modality need to quickly adjust. Online programs suffer from a high dropout rate, one reason often cited as a contributory factor is that students' do not feel that the instructor has an online presence (Brooks, 2003). One of the main factors that reduce the distance between students and instructors is the amount of

communication conducted in the course. Grading assignments, spending time in chat rooms, and participating significantly are several ways in which instructors can create an online presence according to Brooks (2003). If students feel that the instructor is readily available and their presence is known, they are less likely to drop out of the course due to isolation and lack of instructor support.

A study by Swan and Shih (2005) found that instructor presence was the sole predictor of satisfaction when other interactions are controlled. It accounts for almost twice the variance in perceived learning. They also found that there is a difference between the social presence of instructors and the social presence of other students. The mixed methodology was able to capture student perspectives and further explain the quantitative findings. Some students expected the instructor to be highly involved while others did not need such interaction to feel satisfied with the instructor and course. The findings confirm that students arrive in class with varying expectations and thus the instructor needs to be cognizant of their needs for the course design and interactions.

Anderson, Rourke, Garrison, and Archer define teaching presence as having three components: instructional design and organization, facilitating discourse, and direct instruction (2001). In addition, the Community of Inquiry framework incorporates teaching presence as one of its three elements (Garrison, 2007). The following discussion will explain how instructor presence is viewed through these lenses.

According to the research, the designing and organizing aspect of teaching presence includes the planning and design of the structure, process, interaction, and evaluation components of the online course (Anderson et al., 2001). These activities correlate with having a classroom prepared on the first day of school. The lectures,

notes, assignments, syllabus, and subsequent materials are posted in the online environment at the start of the course. When the student logs in, they are promptly greeted with the materials that they will need to start. Thus, the instructor presence is visible although the instructor may not be physically present in the classroom.

Facilitating discourse is the second component (Anderson et al., 2001). It includes the means by which students are engaged in interacting and building upon the information provided in the course materials (Arbaugh, 2010). The interaction differs from dialogue where the student may ask questions, clarify information, and seek to reach agreement with the instructor about what is required in the course. The reciprocal discourse makes the instructor's presence known. The instructor may review and comment on student posts, raise questions, move discussions in a required direction, keep the discussion moving efficiently, or reach out to inactive students (Arbaugh, 2010). These actions are similar to the type of dialogue that occurs in the traditional classroom setting.

The last of the teaching presence components deals with the concept of direct instruction (Anderson et al., 2001). Whereas is a traditional classroom the instructor lectures to the students as a form of direct instruction, the communication differs in an online environment. A subject matter expert is required, rather than just a facilitator, in order to check for student understanding, interject comments and clarification, guide the discussions in the right direction, and use scaffolding to bridge the gaps in the learners' knowledge (Arbaugh, 2010). Asynchronous discussions are common in online courses. These forums provide for both the instructor and student to display their presence in the classroom and thus continue communication for clarification and meaning just as in the

traditional classroom setting. This discourse represents the horarchical relationship discussed prior where both the instructor and students are sharing information back and forth. Arbaugh (2010) summarizes that the instructor must play the role of discussion facilitator and content expert in order for online learning to be effective.

Garrison (2007) purports that the community of inquiry framework and its subsequent components to discuss issues that have arisen in the literature. He concludes that the literature claims that teaching presence is a significant factor of student satisfaction, perceived learning, and a sense of community. Moreover, it is the structure or design of the course as well as the leadership provided by the instructor that plays a key role in the interactions and dialogue in higher-order learning (Garrison, 2007).

Garrison (2007) notes that it is important to distinguish between facilitation and direct instruction, although the student may not be able to ascertain and distinguish both of these constructs. Facilitation is thought of as a supporting role where the instructor supports the dialogue but may do little to shape the course of the discussion. On the other hand, discourse is a disciplined inquiry. It requires an expert teacher with the knowledge that the dialogue must take a collaborative role in order for students to build knowledge and gain awareness of the process (Garrison, 2007).

The literature suggested that a course should start with clear expectations, including an outline of student expectations for discussion forums. The internalization and application of course material by the instructor should be required in order to extend students' understanding beyond that of surface knowledge and move towards the

resolution phase as previously discussed. It is through these shared communication expectations that teacher presence is visible to the online learner.

Morgan (2011) conducted a qualitative study which interviewed six instructors and their view of instructor presence. Morgan found that instructors varied their participation in course discussion forums based upon the anticipated outcomes of the course. One instructor viewed the space as a graduate seminar and thus participated more extensively in the discussions. On the other hand, a different instructor did not want to be perceived as an authority figure and attempted to reduce the hierarchy by participating less in the discussions. Both of their students had the highest number of posts in the group which suggest that the instructors were successful in creating an environment in which students wanted to participate (Morgan, 2011). The study gives us great insight into the instructor's perspective of presence and strengthens the argument that qualitative research can better capture the perceptions of the participants. Future research can use interviews to describe the student and instructor perception of presence whereby confirming that course design differs among subjects and that the instructor presence in discussion forums does not fully represent the overall communication in a course.

The prior sections discussed interactions and presence in the online environment. The relationship of the instructor-student, student-student, student-content, instructor presence, and immediacy behaviors were themes that emerged from the literature. A final theme that appeared in the literature was the type of student attracted to online learning. The expectation of the incoming student is an important factor to consider when discussing the construct of online education. These

expectations dictate how the instructor designs the course and communicates with the students. Thus, the next section will discuss the self-directed learner.

The Self-Directed Learner

The concept of the self-directed learner has come into view as online programs continue to expand in colleges and universities. The self-directed characteristic of the adult learner guides those developing courseware and programs for online learning. Knowles describes self-directed learning as, "a process in which individuals take the initiative, with or without the help of others, to diagnose their learning needs, formulate learning goals, identify resources for learning, select and implement learning strategies, and evaluate learning outcomes" (1975, p.18).

The notion of the self-directed learner is gaining notoriety as concepts of 21st century skills are being brought to the forefront of education. The 21st century skills and definitions of the self-directed learner are aligned with one another whereby increasing the students' ability to think, solve, and collaborate with others to accomplish and solve problems. The European Union has developed eight key competencies with regards to managing students' learning and achievements. The fifth key competency, learning to learn, contain the goals of making the learner aware of his/her learning process, develop the learner's skills to solve problems in the learning situation, and build on the learner's existing knowledge whether from prior educational experiences, work, or everyday life (Bergstrom, 2010). These emerging skills and competencies are changing the way in which we construct and present course material to adult learners. The expectation that the learner will be the driving force of acquiring and applying new knowledge in an educational setting is quickly becoming a requirement in higher education.

Chou and Chen (2008) summarized four main characteristics found in the literature in regards to the self-directed learner. Self-directed learners are independent. They are self-managers and can identify what is needed throughout the learning process, set goals and manage time and effort for learning. They have a desire to learn to acquire knowledge with motivation to do so. Self-directed learners are problem solvers who are able to make use of their resources and overcome difficulties that may occur throughout the learning process (Chou & Chen, 2008). Hsu and Shiue reported that self-directed learning was a strong factor in predicting academic achievement in non-web-based distance learning (2005). While the latter study refers to the traditional, face-to-face classroom, self-direction is even more important in the online learning environment where autonomy is increased.

Online learning environments have shifted from the teacher-centered approach found in traditional settings to one of learner-centered. Rhode (2009) summarizes the literature to conclude that learning takes place through active engagement as opposed to passive transmission of knowledge. Asinteraction is the principle of active interaction with concepts or agents (Rhode, 2009). Interaction includes more than communication in the learning environment. It is engagement in learning and includes intrapersonal, interpersonal, and interaction with technology. Course designers are working to combine the many facets of online interaction with that of curriculum requirements to meet the needs of all learners (Rhode, 2009).

Online Math

Online courses possess unique qualities in comparison to traditional courses. Most content will transfer well in either environment; however, teaching math online is different and often challenging for instructors and students (Akdemir, 2010). The

growing enrollments at community colleges present a student population with diverse needs and a wide range of skills (Ashby, Sadera, & McNary, 2011). Incoming students are often not prepared for math courses. In order to accommodate these students, community colleges offer developmental course, such as math, to prepare them for their undergraduate work, many of which are online to support the increased enrollments (Ashby et al., 2011). Given the poor retention rates of students in remedial courses (Bettinger & Long, 2009), how instructors structure a course and their communication with students can impact student outcomes.

The literature regarding online math includes retention (Bettinger & Long, 2009), modality comparison (Ashby et al., 2011), and student outcomes (Yoshimura, 2010) with little research on best practices (Akdemir, 2010) and communication with students in online math courses. The literature on post-secondary online math is sparse. The majority of the research has focused on the primary and secondary levels. Therefore, the nature of instructor to student communication within an online, post-secondary math course is one particular area absent in the literature. Although research has been published about best online practices, they include overall conclusions and do not target math courses specifically.

The teaching of math online differs in comparison to traditional math. Course development can vary depending on the available course materials. Instructors who develop their courses use a limited number of additional resources in comparison to instructors using established college curriculum (Akdemir, 2010). Additionally in face-to-face courses, instructor examples are used to illustrate math concepts. Online, students may not have access to such profound instruction, having to rely on the book,

animations, or math software (Akdemir, 2010). Therefore, course design can impact student learning and success (Akdemir, 2010).

Student perceptions of taking math online were reported from North Carolina Virtual Public School (NCVPS), where students completed an end of course survey about course effectiveness. When Math was compared to other subjects including English, Career Studies, Social Studies, Science, and Foreign Language, the researchers found that math students reported that they were learning less online and were less likely to recommend online learning to their peers (Oliver, Kellogg, & Patel, 2010). This suggests that perhaps more interaction and communication is needed in subject areas in which modeling are a component to understanding content.

Online math students reported that they favored face-to-face math courses because teachers were available to explain and review the concepts, and communication was more prevalent in this setting (Oliver et al., 2010). The students further reported that they felt their teachers were well prepared to teach online, exemplifying the fact that dissatisfaction in the course was not related to the teacher (Oliver et al., 2010). Content and modality emerge as the dominant reasons for dissatisfaction in a math course. Yet, teachers have little to no control over the modality and frequently pre-loaded course shells. However, teachers can control their presence, communication, and interactions with the students. NCVPS students suggested that math teachers can teach more online (Oliver et al., 2010). Synchronous communications allows the teacher to present the content, answer questions in real-time, and build a sense of community. Given the difficulty of the subject matter, online

math requires more teacher support (Moor & Zazkis, 2000). These findings can influence how instructors communicate with online students.

Computer Mediated Communication

Computer mediated communication (CMC) is also referred to as discussions in online courses. The purpose of discussions in asynchronous environments is to replicate the discussion that took place in face-to-face courses. Discussions were seen as a way to discuss and share information at a distance. It has been said that online discussions transformed learning from instructor to learner-centered (Fahraeus, 2004). This section will discuss the approach students take in discussions, participation requirements, and how time restrictions impact discussions.

Students can take either a 'deep' or 'surface' approach to discussions. A deep approach includes the intention to understand what is being studied while a surface approach incorporates an intention to reproduce or describe what is being studied (Ellis, Goodyear, Prosser, & O'Hara, 2006). The Ellis study found four themes for how students approach online discussions (Ellis et al., 2006). Within discussions students reflect on ideas, challenge ideas, add ideas, and avoid repetition (Ellis et al., 2006). Students who reflect and challenge ideas are taking a deep approach to learning while those who add ideas or avoid repetition are taking a surface level approach (Ellis et al., 2006). Students who engage in the latter behavior may wait to post later in the week or read the posts prior to their submission. Students taking a surface approach may not get much out of the discussion and thus may not be able to extend their learning beyond the course materials. These students may view the discussion as a task rather than critically engaging in the content discussion.

Although this study did not take place with math students, its findings have meaning in math discussions. For example if math problems are posted for discussion, students responding later than others have access to the answer and thought process of their peers. Moreover those responding later in the week have less time to reflect and challenge others' ideas. It impacts not only discussions but overall learning. The findings concluded that deep approaches to online discussions were correlated to a higher level of course performance and students were also more likely to associate their learning to the online discussions (Ellis et al., 2006).

Mandatory participation may not be the best way to encourage continued communication in discussion forums. In a study by Bullen (2007), he found that the students viewed the posts as a cost-benefit situation. The students stated that they replied to get the points for participation but did not necessarily reply with thoughtful responses. Many affirmed that they restated what others said without adding new insight (Bullen, 2007). Secondly, deadlines impacted participation. Limited time to post and submission deadlines often meant that students waited until the due date to post thus leaving little time for reflection, comments, or follow-up from their peers (Bullen, 2007). The content, purpose, and requirements of the discussion need to be addressed in online courses. The content plays a role in what is asked of the student and how the forums are set-up.

Critique of the Methodologies

The research in the field of online education commenced by using quantitative methods. First, the components of transactional distance were under review. Most of the earlier studies utilized surveys, capturing a subjective measurement based upon the student perceptions (Gorsky & Caspi, 2005). Next, the research moved towards looking

at particular outcomes variables as they relate to the components of transactional distance. Satisfaction and perceived learning were two of the variables that were tested. Once again, quantitative measures were the method of choice. In these studies, the researchers were able to make strong correlations between the components of transactional distance and outcome variables such as satisfaction and learning. Although they give us insight into the field, they are limited in reporting the how and why questions that arise. We need to understand what a Likert rating of "3" represents and what factors, or lack thereof, informed the students' decision.

The research was recommending a different method though, one that included interviews and observations. Thus, the research moved in the direction of collecting qualitative data. The rich data collected through interviews answered some of the 'how' and 'why' questions that quantitative measures alone could not answer. Interviews with both students and instructors showed us how communication and interactions occur in the online environment. The themes of this research revolved around a set of best practices that not only assisted in describing the phenomenon but also created guidelines for instructors to use in their courses.

Case studies were found repeatedly in the literature. Convenience sampling at one's home college or within one's own class was a common practice when looking at the aggregate group of studies. This design lowers external validity in that the findings are not generalizable to the larger population, which was reported in the literature. The studies reviewed ranged from 6 to 2,407 participants. Smaller sample sizes were found at the class-level while the larger samples were reserved for multiple course studies. The academic levels of the students also differed, ranging from the undergraduate to

graduate level. A meta-analysis of the literature as well as triangulation of the themes could add to the external validity of these research findings.

The quantitative studies utilized surveys to measure the variables. The construct validity was called into question in several of the seminal studies (Gorsky & Caspi, 2005). The lack of consistent operational variables produced varying definitions and thereby varying results in those studies. Others mentioned content and construct validity by noting that it had been validated in prior research. Few studies included the instrument in the appendix (Picciano, 2002, Swan & Shih, 2005). The inclusion of the survey assists the reader in reviewing the questions in conjunction with the reported findings. It also highlights questions that can be used in future work.

Conclusion

Instructors reduce the transactional distance in an online course through consistent communication, interacting virtually with students, being available to students, and employing immediacy behaviors. Instructors and students communicate through email, chats, discussions, feedback, and online videoconferencing. Instructors and students work together to achieve common learning goals. In addition, three types of interaction, instructor-student, student-student, and student-content, were supported by the literature. Online instructors serve as facilitators guiding students through the course materials and learning process.

The review of the literature found that whether the measures were social presence, interactions, or immediacy behaviors, the studies reported a moderate to significant correlation between the above constructs and student satisfaction. The theoretical frameworks for the reviewed articles were similar too, citing transactional distance as the foundational theory guiding the research. The community of inquiry

(Swan, 2001), cognitive theory (Grandzol & Grandzol, 2010) and activity theory (Morgan, 2011) were additional theoretical frameworks cited in the literature. Math is a unique subject when delivered online. Students can experience a greater distance between the content or instructor. Faculty training varies by college ranging from basic technical skills (Pankowski, 2004) to a mentor in their first class (Muirhead & Betz, 2002). Collectively, the research supports comprehensive, initial faculty training in a number of domains with on-going training to offer resources and support online faculty.

The significance of this review is to assess the past and current literature by reporting common themes as they relate to communication and interactions in online education. It is also an opportunity to identify gaps in the literature indicating the direction of new research. The findings of this review have significance in the professional practice of online educators, course designers, and stakeholders in the field of online education.

Instructors and course designers are the beneficiaries of the proposed research. The way in which the course is designed can set the level of interaction from the beginning. Most courseware management systems come prepared and provided to the instructor, while at other institutions, the course instructor designs the course. Both have the ability to construct a course which permits open communication thus allowing for subsequent interactions and communication. Swan and Shih (2005) note the significance of pro-social behaviors, design of discussions, and faculty training and predictors of social presence. Baker's study (2004) supported the benefits of pro-social communication patterns. He found that as instructors increase immediacy behaviors

and social presence, the students report higher satisfaction with the course and learning experience.

Online educators can benefit from the findings in the literature to inform their practices. The literature reported that increased communication and interactions do influence student satisfaction and perceived learning. Therefore, the online instructor needs to be cognizant of the role they play in this environment. The content and structure of the course also gives way to opening or closing communication among the students. It is also important for the instructor to examine how the course is set up and whether it permits the needed communication and interaction to allow students to achieve learning gains and satisfaction with the course. The literature review supports the claim that the topic of communication and interaction in online environments is significant and worthy of further research.

CHAPTER 3
METHODOLOGY

Chapter 3 describes the methodology and research design used to explore how math instructors communicate with students in an online environment. The chapter will discuss participant selection and criteria, data collection procedures, data analysis methods, subjectivity, ethics, and limitations.

Purpose

The purpose of this study is to investigate the manner in which math instructors communicate with students in online courses and secondly, explore the pedagogical tools that instructors use to increase dialogue in online courses. Three research questions frame this study:

1. How do math instructors communicate with students in an online environment?
2. What tools do math instructors use to promote communication in an online course?
3. How do math instructors structure a course to increase dialogue?

Problem

Earlier studies (Saba & Shearer, 1994; Bunker et al., 1996; Bischoff et al., 1998; Chen & Willits, 1998) tested the components of transactional distance citing its presence in online environments. However, dialogue was operationalized in different ways, most notably defining it as the number of communications that take place in the class. Despite criticism by Gorsky and Caspi (2005), the theory of transactional distance was widely accepted in relation to online education. These criticisms led researchers to clearly define and search for relationships among variables in follow-up studies. Transactional distance grounded many studies that sought to measure the relationship between online course satisfaction and perceived learning (Swan, 2001; Stein et al., 2005; Jackson et al., 2010). Using quantitative methodology, these studies

found a relationship between the two variables. Moreover, Shea, Li, and Pickett (2006) found a positive relationship between perceived teaching presence and students' sense of learning community. Overall, these studies found that increased levels of teacher presence or communication led to increased student satisfaction, increased perception of learning, or the students' sense of learning community. Once these correlations were corroborated in multiple studies, the call to discover 'how' these constructs manifest in an online environment followed.

Conceicao (2006) interviewed online instructors about their online teaching experience. Two themes emerged from this research, the length and depth of engagement during online course delivery differs from face-to-face instruction and the experience is rewarding in new ways (Conceicao, 2006). Her findings concluded that the instructor spent more time designing the course by organizing content, presenting information differently to accommodate all learners, and preparing lecture notes in advance (2006). Regarding communication, faculty cited that it took more effort to stay engaged in a conversation, keep the class focused, and pay attention to the non-verbal cues that are absent such as emotions, tone, and eye contact (Conceicao, 2006).

Schulte (2010) interviewed instructors about their perceived experiences regarding factors in distance education transactions. The course design and faculty preferences for student and instructor transactions were the main themes explored. While the faculty discussed communication through email, discussion groups, and online chat, their responses represented a surface level description of communication citing the use of and limitations of these tools in their context (Schulte, 2010). There

was no mention of how these instructors used these tools to increase dialogue or communication.

Lao and Gonzales (2005) studied the attitudes, perceptions, and experiences of instructors and graduate students in a distance learning environment. In regards to communication and dialogue, the themes of a learning community, technological challenges with the learning management system, and having the correct technology in each course were emerging themes (Lao & Gonzales, 2005). Although important in online education, they did not elucidate how instructors use tools to increase communication within their courses.

Therefore, the current study will address a gap in the literature, specifically how instructors communicate and increase dialogue in online learning environments. The prior research named broad themes recounting instructors' perceived perceptions and experience in online education. However, a specific study delineating exactly how instructors communicate with students and use tools to increase communication would augment the current literature.

Research Methodology

A qualitative, case study was the chosen methodology for this study. According to Creswell (2005), research adds to our knowledge and improves practice and qualitative research studies the view of participants by asking broad, general questions, collecting text data, and analyzing the data for themes. Shank (1994) defines qualitative research as a form of '*systematic empirical inquiry into meaning*'. Systematic refers to the planned nature of qualitative research; it is not haphazard (Shank, 2006). Empirical inquiry is inquiry dependent on the world of experience to verify claims

(Shank, 2006). In contrast to quantitative methodologies, qualitative research allows for patterns and themes to emerge from the data through an investigation of participants' perspectives (Bogdan & Biklen, 2007). Qualitative measures were chosen in order to gather a detailed understanding of a phenomenon (Creswell, 2005). Qualitative interviewing using semi-structured interviews will be the primary method of data collection in order to understand the participants' experiences (Creswell, 2005).

A case study is meant to capture the complexity of a larger phenomenon and not generalize to a larger population (Stake, 1995). It is best applied in situations with special interest in order to understand the activity that occurs within a specific circumstance (Stake, 1995). "Qualitative case studies can be characterized as being particularistic, descriptive, and heuristic" (Merriam, 1998, p. 29). Creswell contends that a case study is based upon a considerable data collection to explore an activity, process, or individual (1998).

Design

This section discusses how the study was designed, including participant selection and background, data collection, and data analysis. It concludes with commentary about research subjectivity, ethics, and limitations of the study.

Participants

In this study, participants were selected using criterion based, convenience sampling. Six instructors were interviewed for this study, as seen in Table 3-1. A collective case study was used in order to describe, compare, and gain an understanding about this topic through several perspectives (Stake, 1995).

All participants matched a set of criteria (Patton, 2002) including:

1. Participants teach online mathematics
2. Participants have at least one year of online teaching experience, irrespective of full-time or part-time status
3. Participants have an earned master's or doctoral degree in any area

Communication differs among subject areas and course content (Ko & Rossen, 2001). Therefore by selecting participants who teach a particular subject, we can control for some of the differences that may be inherent in the various subjects delivered online. In addition, participants with one year or more of experience were recruited for this study. New online instructors may lack online pedagogic skills, therefore may not be able to fully reflect and report upon their practice. As long as participants had at least one-year of experience in teaching mathematics, their employment status, either part-time or full-time, was not considered. Participants were recruited through email solicitation beginning with known online math instructors. A screening process verified that possible participants meet the stipulated criteria. Next, phone interviews were scheduled. Participation in the study was voluntary and no compensation was offered. Interviews were conducted over a two week period in December 2012. Four different institutions were represented in the sample and pseudonyms were used to protect the identity of the participants and the institutions were kept confidential to maintain anonymity.

Andrew

Andrew was a Caucasian male working on a Ph.D. in Math Education. His educational background included both a Bachelor and Master degree in Electrical Engineering in addition to a Master of Math. He teaches both face-to-face and online math courses at a community college. He has been teaching online for 7 years and

estimates facilitating about 30 online math courses during this time. He has taught a variety of math courses ranging from developmental arithmetic to intermediate algebra. He took one online class as a student during his doctoral program.

Betsy

Betsy is a Caucasian female with a background in computer science and math education. She is currently working on her Ed.D in Educational Technology. Betsy has been teaching online for 8 years and estimates teaching 50-75 math sections during this time. She most frequently teaches algebra and foundations of math. She has a history of taking online courses as a student, completing her masters and doctoral degree programs online. She currently teaches online through a large, private university.

Carl

Carl is an African-American male working on a Ph.D. in Math Education. His educational background includes a Bachelor of Computer Engineering and a Master of Math Education. He has taught online for 5 years and estimates teaching about 30 online math courses. He has taught a range of math courses from basic math to trigonometry. He has experience taking courses online as his masters courses were online exclusively. He teaches at a university that includes both on-ground and online programs.

Donna

Donna is a Caucasian female who has taught online math courses for 5 years. During this time she estimates facilitating about 60 courses. She primarily teaches algebra 1a, algebra 1b, and math for teacher education. She has a Bachelor of Computer Science and Math in addition to a Master of Education with math focus. She

completed an online master's program so she has experience as an online student. She currently teaches at a large, private university.

Ellen

Ellen is a Caucasian female with over a decade of experience teaching online math courses. During her 11 years of experience, she estimates teaching between 150-200 sections. The range of math courses she has taught spans algebra to pre-calculus. She estimates taking 30-45 online courses as a student from her bachelor's to master's programs. She has a Bachelor of Elementary Education, a Master of Math Education, and a graduate certificate in Educational Leadership. She teaches at a community college.

Felicia

Felicia is a white female with a Bachelor of Psychology and Wellness, a Master of Business Administration, and a Doctorate in Higher Education Administration. She is a program coordinator for her school and has taught online math courses for the past 5 years. During that time, she estimates teaching at least 70 sections. She most frequently teaches foundations of math and intermediate algebra. As a student, she took one online course. She teaches at a university that has both on-ground and online courses.

Data Collection

Data was collected through one-on-one interviews with interested participants. An email solicitation was sent out to online math instructors at several colleges around the country. Interested participants were screened to verify that they met the pre-qualification criteria. Six instructors did meet the criteria and were scheduled for phone interviews. A copy of the approved informed consent form and guiding interview

questions were sent out to all participants prior to the interview. The interviews were recorded using a conference line. The informed consent was read prior to the interview and all participants verbally consented before the interview started. Each interview averaged about an hour. The interview questions were used as a guide to conduct the interviews and additional probing questions were added as needed to gather more information. The researcher transcribed the interviews which included a total of 105 pages and 3,489 lines of text. Notes were taken during each interview and follow-up questions were noted during the conversations. The interviews concluded by asking each participant if they would like to add any information about teaching math online and also thanked them for their time.

The audio was downloaded, transcribed, and saved on a password-protected computer. Names were changed and institutions were kept confidential to protect the anonymity of each participant. The transcripts were sent to each participant to verify accuracy. This process, called member checking, is a common strategy ensuring internal validity (Merriam, 2009).

Data Analysis

Qualitative data analysis is a process in which the researcher identifies themes in the data through a procedure called coding. Analysis of the data began with open coding whereby large themes were identified and labeled. In this initial stage, the transcripts were read line by line and assigned a code phrase to describe the text. Each new phenomenon was given a code phrase and Excel© was used to organize the code sheets. Glaser (1978) advises researchers to identify categories to describe and account for them in the data while searching for new incidents. As coding progressed, each new piece of data was compared against the code, further refining the data.

Spradley's nine semantic relationships were used to identify the relationship and create memos for each data piece (1979).

A second coder was used to code two of the six interviews. Inter-rater coding is used in order to increase reliability (Creswell, 2005). During this phase, all code sheets were scrutinized looking for common themes and codes, refining the code sheets and making connections among them. Next the categories were compared to one another in a process called axial coding. During this stage, the categories were expanded, combined, or deleted.

The core themes were selected using the research questions as a guide in a process called selective coding. Each code was compared against the three research questions and unified around a central theme. The relationships between the codes were validated in this process. The grouping of codes around a central theme revealed a story which described the phenomenon being studied. This final analysis created meaning of the data and revealed how instructors communicate in online environments and the tools that they use to do so.

Subjectivity

Subjectivity plays a role in qualitative research (Morgan & Drury, 2003). The researcher's experience and knowledge can affect the results, so attempts were made to bracket thoughts. Bracketing is a process in which the researcher notes their thoughts, values, or expectations that could potentially bias the findings (Moustakas, 1994). Inter-rater coding was also used in order to increase the reliability of the findings. The researcher assumes that the participants are reporting accurate accounts of their experience.

Research Ethics

Permission was sought by the University of Florida Institutional Review Board to conduct research. Participants were knowledgeable about the purpose, aim of the study, and the use of results (Creswell, 2005). They had the right to refuse to participate in the study and could have withdrawn at any time (Creswell, 2005). Prior to the interview, each participant was read the informed consent form and verbally consented to the interview. Pseudonyms were assigned to protect the participants' confidentiality and documents were stored on a password-protected computer.

Limitations

There were several limitations within this study including the setting, data collection, and researcher's subjectivity. These categories are discussed in this section.

Setting

The participants were from four institutions across the United States. There are many types of colleges and online programs, this study cannot encapsulate all of the possible perspectives and experiences of all online instructors. The study's participants are familiar with online instruction and may be more attuned to the types of communication in online courses. Therefore, the results of this study cannot be generalized to all online courses and instructors.

Data Collection

Participation in the study was voluntary; therefore, eligible participants may have chosen to not partake in the study for a number of reasons. Those interested in the topic and sharing their story may have been more willing to participate.

All of the interviews were conducted on the phone, which can have limitations. An absence of body language, decreased naturalness of the setting, less thoughtful

responses (Shuy, 2003) in addition to interviewer effects, such as not seeing the participant, (Rogers, 1976) are limitations in phone interviews. Moreover, the participants' accounts were assumed to be accurate depictions of their experience and subject to recall.

Researcher's Subjectivity

The researcher's knowledge and experience in the field of online education is inherently subject to bias when conducting research. Although attempts were made to bracket thoughts and feelings, it can have an effect on the interpretation and analysis of the results. Member checking and an outside coder were used to limit potential subjectivity that could have influenced the results.

Conclusion

The purpose of Chapter 3 was to describe the methodology and design of the study which is focused on ascertaining how instructors communicate in an online environment and what tools they utilize to increase dialogue. Participant selection and criteria, data collection procedures, data analysis methods, subjectivity, ethics, and limitations were addressed here.

Table 3-1. Participant background

Participant	1	2	3	4	5	6
Pseudonym	Andrew	Betsy	Carl	Donna	Ellen	Felicia
Age	31	32	30	50	39	35
Race	Caucasian	Caucasian	African-American	Caucasian	Caucasian	Caucasian
Gender	Male	Female	Male	Female	Female	Female
Highest level of education	Working on Ph.D. in math education	Working on Ed.D. in ed tech	Working on Ph.D. in math education	Master of education with math focus	Master of math education	Ed.D of higher education admin
Years teaching online	7	8	5	5	11	5
Number of courses taught	30	50-75	30	60	150-200	70+
Types of courses taught	Develop-mental to interme-diate algebra	College algebra & founda-tions of math	Basic math to college algebra	Algebra 1a, 1b, & math for teacher education	College and intermediate algebra, & statistics	Foundations of math & intermediate algebra
Taken courses as a student	Yes	Yes	Yes	Yes	Yes	Yes
Type of college currently employed	Bac/Assoc: Baccalau-reate/ Asso-ciate's Colleges, Public	DRU: Doctoral/ Research Universi-ties, Private for-profit	Bac/Assoc: Baccalau-reate/Asso-ciate's Colleges, Private for-profit	DRU: Doctoral/ Research Universi-ties, Private for-profit	Assoc/Pub-R-L: Associate's -Public Rural-serving Large, Public	Bac/Assoc: Baccalaure-ate/Associ-ate's Colleges, Private for-profit

CHAPTER 4
RESULTS

Chapter 4 will discuss the themes that emerged in relation to the three research questions: how math instructors communicate in an online environment, the tools they use to promote communication, and the way they structure a course to increase dialogue. Instructors were also asked to define several terms in relation to teaching online. This section will conclude with a discussion of these terms. The themes related to each research question will be addressed at length by including interview excerpts to support the findings.

Participants were selected using criterion based, convenience sampling. Six instructors met the enrollment criteria. All of the participants had at least 5 years of online math teaching experience with one instructor reporting 11 years of experience. The entire sample possessed at least a master's degree with three participants working on a doctoral degree and one participant with a conferred doctoral degree. Their experience ranged from teaching developmental math courses all the way up to trigonometry. The number of courses taught ranged from a low of 30 to a high of 200, with an average of 77 courses taught.

Following recruitment, phone interviews were scheduled and a free conference line was used to record the interviews. An interview protocol (Appendix C) was used to guide the interviews which lasted between 35-75 minutes. The researcher transcribed and coded 105 pages of interview transcripts in order to identify themes to support the research questions. Core themes were chosen in a process called selective coding, using the research questions as a guide. Subthemes were categorized by establishing a connection between the theme and the subtheme. Figure 4-1 illustrates an overview

of the themes and subthemes found within the data. It provides an overview of how instructors communicate and use tools in online math courses.

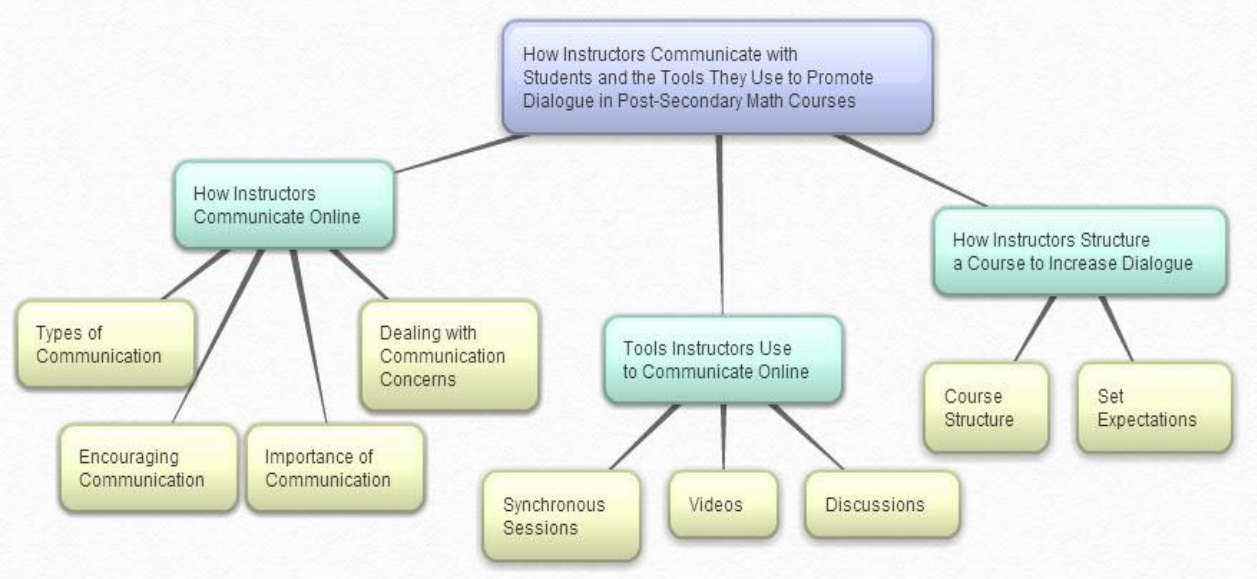

Figure 4-1. Thematic Overview

RQ #1: How Do Math Instructors Communicate in an Online Environment?

Various forms of communication are present in a classroom setting. Similarities and differences between face to face and online instruction exist, however online instructors and students communicate through a learning management system and may never meet in person. The focus on non-verbal communication through an online modality is worthy of further study in order to determine the specifics of this phenomenon such as how they communicate, resolve issues, and enhance the learning experience.

Five themes emerged related to how math instructors communicate with students in an online environment including: types of communication, encouragement of communication, preferred communication, importance of communication, and dealing with other communication concerns. Although the instructors teach at different

institutions, teach different math courses, and have diverse course requirements, the instructors used similar means to communicate with students and shared analogous experiences in relation to communication with students.

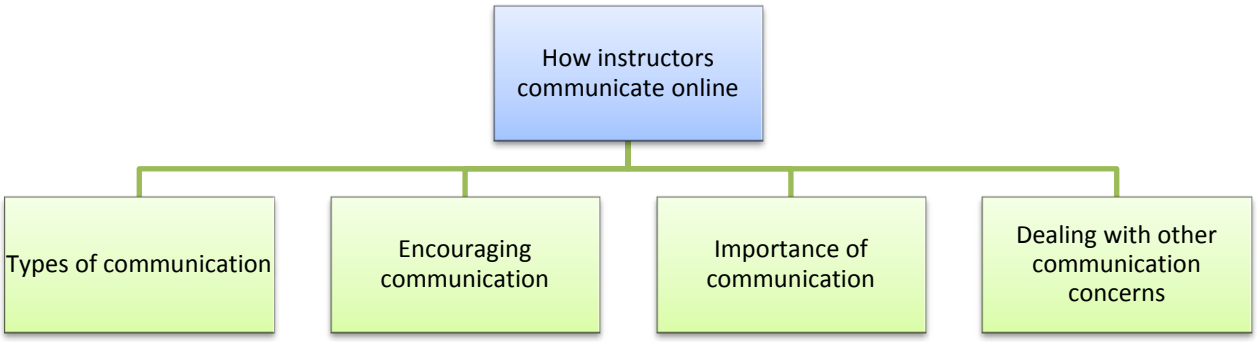

Figure 4-2. Subthemes for How Instructors Communicate Online

Types of Communication

The following list emerged from the interviews as being ways to communicate with online students: email, discussion threads, question threads, announcements, feedback, phone, individual forums, chat or instant messaging, texting, conference calls, Power Points, videos, or using synchronous software such as Adobe Connect or Blackboard for live sessions. Each of these methods of communicating can be categorized as one-way or two-way communication. Announcements, Power Points, videos, and feedback were recognized as ways to communicate information from the instructor to the student. Feedback was commenting on student work and returning the submissions. Although students can reply in response to these communications, most of the instructors found these to be informational, outgoing messages to the students. Two-way communication included email, discussions, phone, chat, conference calls, and synchronous sessions. These ways to communicate often solicited a student

response in which a conversation was back and forth between the instructor and student whether through synchronous or asynchronous means.

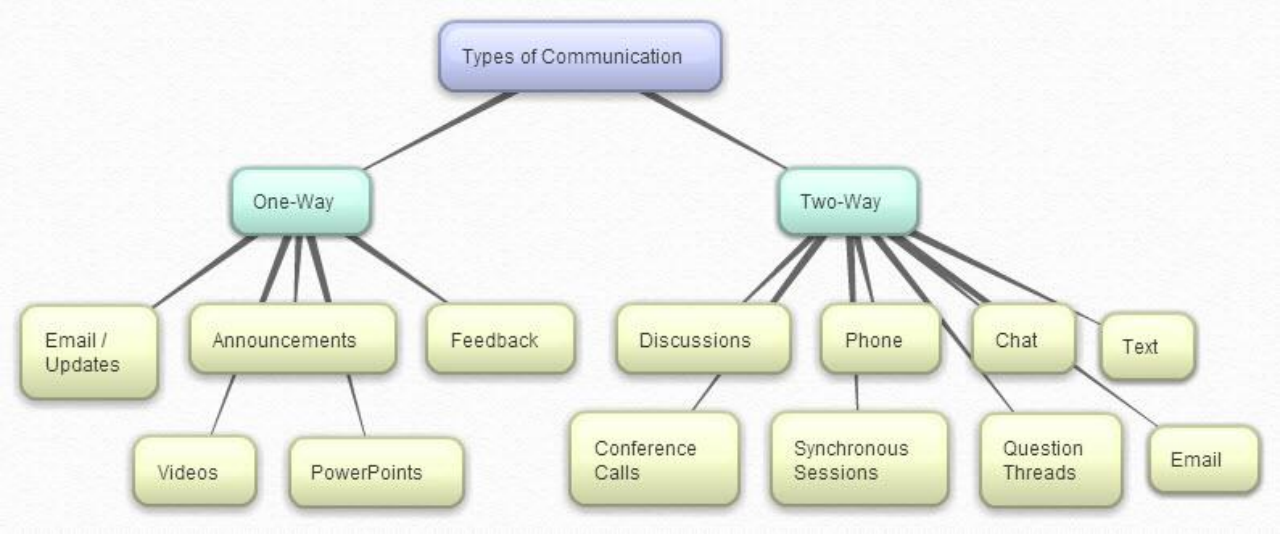

Figure 4-3. Types of Communication

All instructors stated that they post informational or an announcement message each week, six participants affirming that it is required by their specific college. When asked about posting and frequency of weekly announcements, Carl stated:

> Yes every week, every class I've ever taught, you are required to do a weekly announcement to your students also post that weekly announcement in the discussion board. And I found that that helps alleviate concerns as it relates to students, who know on Monday, this is what's required for the particular week. (Carl, 12.12.2012)

Felicia commented on the frequency of posting group messages saying that she limits them in an effort to not overwhelm the students.

> I would say that the group messages, maybe 2 to 3 per week because you don't want to overwhelm students. In regards to individual responses, it was probably upwards of 20. And obviously if you have multiple questions, we have five people asking the same question then you can send out a message to everyone that this has come up a few times just to let everyone know. (Felicia, 12.17.2012)

Email was considered both a form of one-way and two-way communication. When asked about the types of communication used online, Andrew commented:

> So for asynchronous, e-mail is probably the favorite type of communication. I also, I post announcements and now that would be a one-way, you know one directional. But I post announcements that are also e-mail to the students so they can e-mail me back. (Andrew, 12.10.2012)

Carl added that the main types of communication are:

> The main types of communication would be email…the discussion board posts, feedback on the assignments. Those are for me your main types of communication. Some schools require you to speak on the phone with them, so depending upon university that is communication also. (Carl, 12.12.2012)

Ellen stated that she communicates through "email, chat, text, and phone" (Ellen, 12.14.2012). Felicia's methods of communication were similar to the group expressing:

> Email is another area of communication. I would also use the chat function in the math course. I have never used Adobe Connect or anything like that. But I have used phone conversations. I have used conference calls. So e-mail, discussion, chat, conference calls, and then one-on-one on the phone. (Felicia, 12.17.2012)

In summation, class announcements, email (group or individual), discussion forums, phone calls, and chat were the most common means of communication. Although students may not reply to the informational, outgoing messages, some instructors did view this as a type of communication because students were on the receiving end of the conversation. Upcoming course assignments, informational messages, and even feedback were viewed as a form of one-way communication and most instructors did not expect a response to these messages.

Two-way communications fell into one of two categories, either asynchronous or synchronous communication. The majority of asynchronous communication took place within the classroom through the use of discussion boards, chat rooms, or question

threads. Phone calls and chat were cited as rarer occurrences in the online classroom. Instructors used the discussion boards as a way to check for student understanding and teach the class. Felicia said, “The discussion board in my opinion is where I would teach the class” (Felicia, 12.17.2012). The discussion is an area that I viewed as open dialogue.” Carl supported this statement by saying:

> I encourage them to communicate through a) the discussion boards. That tells you a lot about what the students understand the information and who does not understand the information and that tells you about their understanding in regards to the content. (Carl, 12.12.2012)

Donna was asked where she communicates with the class and stated that “…you know as a group, of course it is the discussions, the question threads, email, the instant messaging” (Donna, 12.13.2012).

Felicia preferred to keep all communication within the classroom as a way of keeping record of the communication between her and the students. She said, “So communicating within the classroom ensures that there is a record of all the communication” (Felicia, 12.17.2012).

Although phone calls were a way to communicate with students, this was a less common way to communicate. Regarding phone calls with students, Betsy said:

> The only time I communicate with my students outside of e-mail for forms would be when they call me. And that's usually some sort of emergency. Recently somebody called me. They were having trouble posting their final exam and the deadline ran over so they just called me to, I guess for the reassurance that I was going to still grade it and give them credit for their work. (Betsy, 12.11.2012)

Donna supported the scarcity of phone calls by saying: “Very infrequently do I get phone calls, and I don’t get as many instant messages either” (Donna, 12.13.2012).

Carl offered an explanation as to why phone calls were a less popular way to communicate in an online environment. When asked if he receives phone calls from students, he replied:

> Rarely, rarely. Mostly because everyone knows that in the online environment the time differences. I think it's minute but most of your students, they work at night online and if they are a day person etc., I try to set up appointments where we have a mutually agreed upon time. But I would say 95% of my interactions are electronic via e-mail. (Carl, 12.12.2012)

Andrew pointed to phone calls or a synchronous session as a means to clear up misunderstandings that a student may have. When students are not able to explain what they need through email, he preferred to speak to them on the phone or through other synchronous means to understand their questions.

> With students they can't always form, can't always get what they're trying to say through e-mail. So generally being able to speak with them, whether it's on the phone or by using again video or audio components like Big Blue Button or some other kind of virtual session school. But that sort of that back and forth when we're questioning them about something and they're responding or trying to determine to really understand. And they're trying to somehow put into words where their confusion may lie. (Andrew, 12.10.2012)

In summation, the instructors cited both asynchronous and synchronous communication that occurs with their students. Due to the time differences and schedules of both the students and the instructor, two-way communication within the course through email, discussions or forum threads were the most common ways to communicate. Students needing clarification regarding a topic or those who have an emergency tend to call the instructor for a more immediate response. Other synchronous communication included chat or instant messaging, text, or live sessions. Although only one instructor held synchronous sessions, it was not required. None of the colleges required the instructors to hold live sessions. If they did, it was a personal

preference. Four out of the six participants were required to hold one office hour per week, by being available to students during that time. While the two community college instructors were able to hold the hour in their physical office or online, the online instructors were available through a chat forum or by email during the required hour. Nevertheless, most of the communication between the instructor and student takes place asynchronously within the course platform.

Encouraging Communication

Online courses lack the physical and verbal interaction that take place in a face to face setting. An absence of online communication back and forth severely limits the transference of information and course instruction. In traditional educational settings, the instructor leads the class through lecture or planned activities. A similar approach is needed in the online modality in order to maintain high teaching and learning standards. Therefore, the instructor should plan and initiate contact with the students to establish an open and welcoming learning environment. This can be accomplished by encouraging communication.

Instructors cite several ways in which they encourage communication with the individual students in addition to encouraging communication amongst the students. Subthemes that emerged as a result of encouraging communication with students are tone, meaningful discussion responses, open forms of communication, and prompt replies. Instructors try to encourage communication among the students, however it can be challenging. Instructors do not feel comfortable sharing student information and the location or time differences of the students make it difficult for students to meet in a synchronous setting. Instructors encourage student interaction through the discussion and chat forums. Separate chat rooms may be set up if groups of students want to

communicate asynchronously. Instructors are often not aware if students do communicate with one another outside of the online course, although comments to one another in the discussion forums can point towards an informal relationship. Otherwise, instructors state that they do not think students are engaging with one another outside of the class due to the independent nature of the online environment and the differences in schedule and time zones.

Instructors state that they encourage communication by paying attention to their tone of message, addressing students by name, and maintaining a friendly environment. They concluded that doing these things encourage students to interact with them and ask questions. Andrew spoke about his experience addressing students as individuals as opposed to a group:

> I try to be friendly. This isn't miraculous or anything but really trying to you know instead of just starting an e-mail saying ‘class’ or ‘guys’ kind of make it seem a little more friendly so they feel like they can e-mail me or that they it's just not that they're bothering me by sending an e-mail. When we are doing a virtual session, referring to the students by name. (Andrew, 12.10.2012)

Betsy cited that she kept a positive tone in her communication to students. She tried to remain encouraging despite the type of email she was sending. She commented on this topic by saying:

> The one thing I do the most of, to encourage communication, would be to stay positive. I reread what I write. I want to make sure that I send a welcoming message in any form. Whether it's a negative conversation about say plagiarism, I always try to be encouraging. So just by keeping my side of things not necessarily light but positive that would be the main thing I do to encourage students. (Betsy, 12.11.2012)

Felicia felt that the way to engage students was to address them by name, referring to the direct nature of math faculty, she said:

> I think that engaging students, if you're going to engage them in an e-mail or discussion thread for anywhere, you address them by name. You always inquire if there's anything else I can help you with. I think a lot of times faculty will just provide the answer, especially math folks. Math folks can be very short and to the point because that is how the brain works. And sometimes I think you need a little bit more finesse. (Felicia, 12.17.2012)

The discussion forums were another area where instructors encouraged communication with students. Not only do instructors address students by name in these forums, but they also expand upon their post often asking follow-up questions. Carl commented on his participation in the discussion boards by saying:

> Not to say 'great post' but expanding upon their post and asking them questions. That way they have to go back into the discussion board, read what you wrote, and respond to it. That provides a richer environment in the course. (Carl, 12.12.2012)

Donna expects her students to respond to her in the discussion boards when she poses questions. Through experience, she modified how she responds to students in the discussion forums by addressing the students by name rather than a general post to all. She shares her experience in the following statement:

> I expect them to respond. In fact I just changed within the last year or so. I used to make all my posts to the student in general, 'greetings class', 'hi everyone' etc. etc. and then I would say like 'John makes a good point that blah, blah, blah' and then I would still have the question at the end. But I changed it to make all my posts to the individual student rather than saying then 'John makes a good point', it's just 'Hi John, you make a good point'. Now the post at the end is still addressed to the class in general that I might say 'Class what you think about whatever?' but I would say that in almost all of my posts…At least it gets a response from the person I responded to. They don't like to not respond when you respond to them by name. I have kind of discovered that. (Donna, 12.13.2012)

One of the instructors chose to keep the lines of communication open by not limiting the ways in which students can contact them. Felicia commented on this topic by stating that, "I think if you limit communication avenues at times you may come off as

being less approachable" (Felicia, 12.17.2012). She later added that in the beginning of the class, she would include her expectations of the students and ask their expectations of her. She also provided different methods for them to communicate with her and other students in the class.

Another instructor reiterated the best ways to contact her for prompt replies. Donna described her process for letting the students know the best way to contact her by saying:

> I push the individual forums. Just in the beginning of class, I post something along the lines of the best way to get ahold of your instructor or what's the best way to get my questions answered quickly something like that. And then I say the best way to reach me is the individual forums. It is checked most frequently. A lot of them really like to start sending out e-mails. I push for the individual forum and I do check the individual forum more frequently than e-mail. (Donna, 12.13.2012)

A prompt reply to students is another way to encourage communication with them. Felicia discussed her communication experience with students by saying that by responding to students in a prompt manner is the best way to increase dialogue. She related their experience to her own saying that when she has a question, she wants an immediate response and therefore tries do the same for her students. She said:

> I think the best way to increase dialogue or to promote better communication is just prompt responses to whatever it is. If it is the discussion board post you want to, especially if it's a question, you want to respond as soon as possible. If it's an e-mail you want respond as soon as possible. The issue with communication in the online world tends to be the lack of urgency. You know we have a 24 hour response time whereas a lot of students want a more immediate reply. And I understand that because I am built that way too. If I have a question, I want response. So a lot of times encouraging communication to be faster in response to questions. That seems to make things better. (Felicia, 12.17.2012)

Most instructors try to encourage communication among the students in the class. The means in which the students can engage with one another differs depending

on the institution and types of students in the class. Students attending a local college may be in the vicinity of one another and thus can meet in person while a larger online university can enroll students around the world. Most instructors state that they do try to encourage students to interact or communicate with one another whether it is within the class platform or outside of the course. Instructors can encourage this communication by telling students within the class or posting threads that allow students to exchange information with one another. Instructors often don't know if students do take advantage of this opportunity and meet or talk outside of class. Most of the instructors think that they do not do so based on their schedules and availability. The subthemes that emerged from this larger theme include encouraging students to communicate with one another through various means and the sharing of student information.

Andrew commented on the independent nature of his students and the nature of being in an online environment. When asked if he encourages students to communicate with one another, he said:

> I tried to. That's probably the most difficult thing. In online setting people are very independent and I think it's just the nature of being online. They are at home by themselves. They don't have anybody right next to them. So I think if they're going to reach out to anybody it's going to be me first. And I tried to encourage student to student interaction in the virtual sessions. (Andrew, 12.10.2012)

Carl was in favor of students communicating with one another and added:

> Yes highly encourage. I am one of those, I love cooperative groups and they are different in the online environment because they are more friendly or apt to exchange phone numbers or personal e-mails outside of school. So they can work together, and with the online environment surprisingly some students are in the local vicinity to each other so they can meet up and form groups outside of online they can meet up and work together. (Carl, 12.12.2012)

When Felicia was asked how she encourages students to communicate with one another, she replied:

> You communicate via e-mail to let them know what options they have available to them and if they want to do study groups, the best way to go about finding who is near who in the class is through the discussion board. So there would be a lot of discussion back and forth students were interested in finding someone who was close to them. (Felicia, 12.17.2012)

Although the majority of the instructors were in favor of student communication, many perceive that they are restricted by FERPA laws (Martinovic & Ralevich, 2007) and feel that they are not able to share personal information with other students. Andrew waited until he was approached by a student before he attempted to set up a group. However, he was not sure what became of the group formation. He recounts his experience in this excerpt:

> Currently I don't really have a way to do that because I can't necessarily share student e-mail addresses without their permission. I'm not sure if I can or can't because it's a school e-mail address but I don't feel right about doing that personally. So if I do, I think the only thing I've done is I've had one student who said he was interested in setting up a weekend meeting at Starbucks or something and so I with his permission posted his e-mail address and said I thought it would be really, really good and really, really helpful but I'm not sure what actually came of that if they went that far other than that for virtual sessions because the students don't have any contact with each other. (Andrew, 12.10.2012)

Felicia also discussed the restrictions in sharing student information. She is in support of email and chat groups for the students and stated that she would set-up chat rooms for them if needed. When asked how she would bring this topic up to students, she said:

> You communicate via e-mail to let them know what options they have available to them and if they want to do study groups, the best way to go about finding who is near who in the class is through the discussion board. So there would be a lot of discussion back and forth students were interested in finding someone who was close to them… And then just if

> someone brought it up then there would be more discussion on that topic. If no one brought it up, I wasn't going to make students feel uncomfortable. (Felicia, 12.17.2012)

Donna encouraged student engagement within the discussion forums. After every discussion question, she had a statement encouraging students to answer one another's problems to get them to communicate with one another via the discussion.

> After the discussion question was posted there used to be a little part afterwards saying 'consider participating by responding to your peers'. So every discussion question I had tips afterwards for how they could participate with their peers. 'Consider participating by assisting those who are struggling with the sample problem you posted.' 'Consider participating by providing an alternate viewpoint to what your peers said' and stuff like that. (Donna, 12.13.2012)

The Importance of Communication

All instructors were in consensus that communication was an important component in an online math class. They viewed the instructor role as one to set the course expectations, to be engaged in the course, and to be present as one would be in a traditional course. Therefore, these were the subthemes of the importance of communication.

Andrew thought that it is the instructor's role to be active in the classroom. The lack of engagement upon the instructor would make the instructor "irrelevant" as he put it. If instructors do nothing but grade, then he felt they were synonymous to a teaching assistant. He expanded on this topic by saying:

> Honestly a lot of people, they could just develop a course and then just have a TA run the course and just do the grading and then it's really a student led class because students are just reading the materials. I think we need to do more than that and that is where the communication in all its forms comes into play. (Andrew, 12.10.2012)

Carl commented on the teacher's presence comparing it to a traditional class where the instructor or student can be seen as 'there'. Online though, presence is

determined through communication whether it is through posts or assignment submissions. When asked about the importance of communication, he replied:

> Unlike an on-site, you have to communicate in an online course because literally "Is the person there?" And I say 'there' as being in class so that's why the communication aspect is important for the online environment. That's when you check to see if they are participating, even assignment submissions. That's when you quickly can find this kid is not communicating. He is not even submitting assignments. So that's the best way. (Carl, 12.12.2012)

Betsy felt that communication was a way to convey her expectations of the students. She said, "Communication, absolutely, because otherwise they won't know what my expectations are or what they even need to do for the course. I don't think that it's really worked as a course without some sort of communication" (Betsy, 12.11.2012).

Felicia cited several reasons why communication is important in an online math class. First, she felt that the frequency, promptness, and tone of communication were extremely important. She added, "Communication is key but not only communication, but appropriate and pleasant communication" (Felicia, 12.17.2012). She thought that through communication, the instructor could show who they really are and their teaching style. In regards to a pre-prepared course, she said:

> To provide a level of communication that shows who you are, it reflects your teaching style. It reflects…your online teaching style, because there is a difference. It reflects who you are as a person and it reflects in my opinion how we respond to students, is how you want people to respond to you. (Felicia, 12.17.2012)

In summary, the instructors felt it was important to communicate in an online math class and show who they are as an instructor. Through communication, they are able to convey their expectations of the course and their students. Communication shows that they are engaged and active in the course, rather than being seen as a grader or assistant. Ways to show their presence is through the discussion forums,

help posts, or email communications with students. A lack of communication can result in having a student-centered course where the students interact only with the content and not with a subject expert. These instructor roles align with instructor presence whereby the instructor is asserting their role through timely communication, setting expectations, answering questions, and guiding the class thereby showing their active status as the course instructor. Thus, the instructors viewed communication as a key component in an online math course.

Dealing with Other Communication Concerns

In addition to responding to students in online courses to communicate expectations, participate in discussion forums, and answer questions, instructors also deal with inappropriate student communication and non-responsive students. Although inappropriate communication was described as rare, several instructors commented on their experience in dealing with these situations in addition to strategies for students who are not active in the class. These two subthemes of other communication concerns will be discussed in this section.

Andrew discussed a situation in which he had a hostile student posting in the discussion forums. He chose to send a private message to the student to diffuse the situation and understand the situation. He recants the story below:

> Okay so it doesn't happen very often. I did have it when I was doing discussion boards. I did have somebody who got pretty hostile in the discussion board about the course in general, just basically said 'this isn't a real course' and something. You know, I ignore some of it because people are just airing frustrations about things… I sent him an e-mail. I'm not going to post below it and jump all over him, so I sent him an e-mail saying "I respect your opinion. You don't have to believe that it is a real course". I said "I happen to believe it is but I prefer this to be a friendly environment so any negativity like that I would prefer that you minimize it,

> you know not post things like that". We kind of went back and forth and we came to an understanding. (Andrew, 12.10.2012)

Other instructors choose to deal with similar situations in a private manner. They will save the post for documentation and delete from the forum if possible. Carl explains how he deals with an inappropriate post:

> So first and foremost I mainly copy/paste into a Word document and save it for reference. I delete the post and then I directly respond to the student. This is a one-time occurrence. I explain to them why their post is inappropriate because some students don't think their post is inappropriate so the main thing is to eliminate the post saving it for reference just in case and then that directly e-mail the student to discuss the post that they made. (Carl, 12.12.2012)

Felicia's experience with inappropriate posts supports the other instructors' actions. She prefers to handle the situation in an individual manner. If a student posts something inappropriate to another student, she does the following:

> If you have a situation where one student is saying something inappropriate to another student, then obviously has to be handled individually. A lot of times that will be through e-mail, and it is individual. There is nothing that other students need to know, and a lot of times I will delete those discussions. (Felicia, 12.17.2012)

Betsy will ask a student to remove an inappropriate post but also act as a mediator to fix the disagreement and move the students forward. Instructor intervention can usually resolve the situation and move the students forward. If the comment is directed towards the instructor, she discusses how she handles this situation:

> If they said something hateful or inappropriate, I do acknowledge it saying that it's not really appropriate that you addressed your instructor this way but I guess that's the mom in me coming out. I just want to make sure that they're aware that they did something wrong. (Betsy, 12.11.2012)

Ellen also addresses the student individually by setting up a time to talk about the situation to understand their position. She stated, "So if it's negative and it is in an e-

mail, I think my answer is we will set up a time to talk about it so I can understand where you are coming from and we can move forward" (Ellen, 12.14.2012).

The instructors also commented on non-responsive students. They defined these students as ones who do not participate in the class or do not submit assignments. They deal with this issue by sending out a personal email to the student and submitting a ticket to their advisor. Their first choice is to reach out to them through email. Carl commented on his process for a non-responsive student:

> The first thing you want to reach out to them via e-mail. There's a difference between a general discussion board where everyone sees it and the personal private e-mail. The next, depending upon the institution sometimes, they allow you to call them via phone or you contact them through an advisor or they may have an alert system to contact the student. (Carl, 12.12.2012)

Felicia went a step further by creating an individualized plan for these students and emailing it to them. However, she was not always successful in getting a reply or getting the student working again. She stated:

> I would do these individualized reports, start to look up, import grades, their work, and then look in the in the gradebook to say 'here is what you have left'. 'Let's work out a plan to get this done by whatever the date is you pick a date.' And it was not always successful. (Felicia, 12.17.2012)

Betsy follows up on non-responsive students by submitting a ticket to their academic advisor. "I would say if I'm not getting any interaction from the student, I can submit the student issue form and they will contact their advisor and try to figure out what's going on with that student and why they're not interacting" (Betsy, 12.11.2012).

In conclusion although inappropriate communication towards other students or the instructor is rare, most of the instructors have dealt with this situation. They respond by either deleting or saving the post and contacting the student individually to discuss the situation. In most cases, the issue is resolved and the behavior does not continue.

They are reminded of their tone and the expectations for posting in a public forum or email. Many of the instructors cited these cases as a miscommunication that was resolved once explained to the student through email or over the phone.

Instructors also deal with non-responsive students in the online math classroom. The instructors stated that they used email and advisor alerts to make contact with the student. These attempts don't always result in success though. Some students acknowledge the attempt, but do not makes changes while others don't reply at all. The instructors said that the online environment limits what types of communications they can have with non-responsive students because they don't meet face-to-face. If email attempts and advisor alerts do not work, they feel that they tried to reengage the student and did their due diligence as an instructor to help them be successful in the course.

Instructors use several methods to communicate with students in an online math course through both synchronous and asynchronous means. Most instructors stated that asynchronous communication was more common due to the different time zones and student schedules. Moreover, colleges did not require synchronous communication with the exception of holding an office hour at three of the colleges represented in the sample. The preference for asynchronous communication led instructors to communicate through email, announcements, and discussion posts with most communication took place within the learning management system. The instructors were flexible and used a variety of communication means in an effort to accommodate their students' needs. Being available at different times and through different means was mentioned numerous times during the interviews as a way to create a learning environment conducive for learning.

In conclusion, the types of communication fell into two categories, one-way and two-way communication. One-way communication included outgoing messages that did not receive a response from the students. Two-way communication included emails, discussion boards, and phone calls. The instructors encouraged the students to communicate with them and with their peers. They did so by keeping a positive tone in their messages, making meaningful discussion responses, keeping communication open, and replying promptly. To encourage communication among the students, some instructors set up groups or chats within the class so that they can communicate with one another. They also encouraged them to reply to one another within the discussion forums.

All of the instructors stated that communication was an important component in an online math class. They viewed their role as one who sets expectations, stays engaged in the course, and maintains instructor presence which all could be accomplished through communication. Instructors set expectations regarding what they expect from their students in terms of communication, assignments, and discussion feedback. These can be quantitative, stating the number of required posts or qualitative by providing a rubric for discussion posts. Course engagement included replying to students, answering questions, providing materials, and participating in discussions. Engagement took place for the duration of the course, not just the first or last week of class. Instructors continually monitored forums and student progress, assisting students appropriately.

Instructors also deal with non-responsive students and miscommunications. Using alerts and contacting the student are two ways they reach out to non-working

students. When it comes to miscommunications, they stated that discussing the situation with the student and understanding their point of view is one way to resolve the problem. Most situations are resolved after discussing the situation with the student. Two instructors resolved situations to an extent saying that the student may not be happy with the outcome but nothing further could be done; an example being grades on discussion assignments. The student was given the reason for the grade and ways to improve, although they did not agree with the assessment nor comprehend what they needed to do to improve.

RQ #2: What Tools Do Math Instructors Use to Promote Communication in an Online Course?

The nature of the online environment affords instructors the ability to use several tools to promote communication. Since they do not meet face to face, instructors use tools such as synchronous sessions, videos, and discussions to communicate, interact, and disseminate information to their students which were common tools utilized by the instructors. Even if they did not use a specific tool listed here, all were aware of the tool and had some experience using it in their courses.

In the preceding section, instructors discussed several tools that they used to communicate such as email, announcement posts, instant messaging, phone, and texting. This section will expand on the types of tools instructors use to communicate with math students in an online environment. When asked which tools they use, synchronous sessions, videos, and discussions were the recurring themes in this category. The subsequent section will describe how the instructors use these tools and their thoughts about using them in an online math classroom.

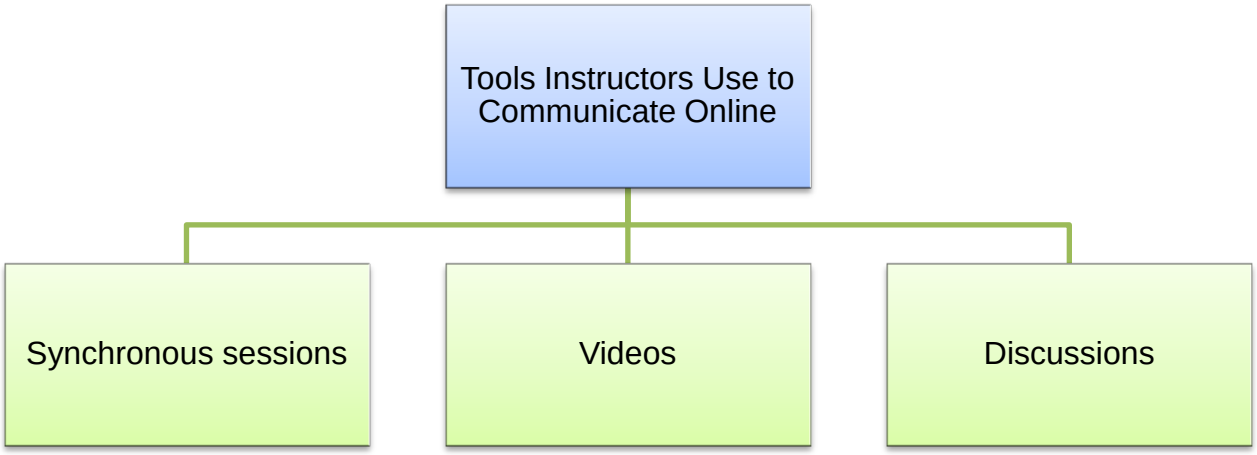

Figure 4-4. Subthemes for Tools Instructors Use to Communicate Online

Synchronous Sessions

Andrew discussed his experience with using synchronous sessions using Blackboard. It was a new addition in his classroom as his college was piloting the software and training select instructors to use it in their courses. When asked about using these sessions he replied, "If I probably had to rank these communication tools, it [synchronous sessions] would be among the highest one" (Andrew, 12.10.2012). Reflecting on his practice, he talked about the missing component in his online course in relation to his on-ground math courses. The personal engagement and lecture in the traditional course was what he thought was missing online. That led him to want to experiment with some way to connect with the students, share his content expertise, and help students.

Felicia spoke about engaging students' multiple senses through the use of synchronous sessions. She stated:

> Whereas if you can use Adobe Connect, you can engage your senses. You can engage the visual. You can engage the audio. And students can write what they are reading or what they are listening to. You can engage more of the senses which encourage more interaction, more engagement, and more learning. (Felicia, 12.17.2012)

Most of the instructors agreed that some use of synchronous sessions would be beneficial for the students. However, most of them had concerns about them. First, some of the colleges did not offer the software needed to hold synchronous sessions. So if an instructor wanted to incorporate this tool into their class, they had to use outside software. Moreover, copyright restrictions were a concern of using non-mandated software.

Second, time and schedule restrictions were a concern in the group. The consensus was that students are attending online courses partly for the flexibility in scheduling. Holding a mandatory session would negate the reason for any time, any place learning. In addition, two of the represented colleges enrolled students living in different time zones including international students. Time zones were less of an issue for the two community college instructors since their students lived within the vicinity of the college. However, they all felt that mandating a meeting time defeated the purpose of online courses asserting that students attended these classes because timed meetings were not required.

Finding a time that works best for everyone was a noted challenge. Third, some instructors discussed the format for these sessions. They experimented with open and structured sessions. Fourth, the option to record the session was seen as a worthy compromise for live attendance in the group. They felt that this was the best option to reach as many students as possible, disseminating the information. However, accountability for who watched the recording and tracking it was a concern brought up by several of the instructors. Lastly, the option of having an office hour was mentioned though its effectiveness was questioned. Two of the instructors who were required to

hold office hours stated that students are going to contact them as needed rather than during a pre-determined hour set by the instructor. Very little to no student contact happened during the office hour since most students elected to email or post questions as needed.

Donna commented on the lack of software that can be used for synchronous sessions at her college. The college did not offer or require sessions to be held for the students. The amount of work required to hold sessions on top of the current responsibilities made her hesitant to want to use them. She said:

> I think that a synchronous component would be great. I just don't see how it would be feasible with the type of format we have at [college name]…Yeah and we don't have the means to do anyway. I would have to research something on my own, try to figure out you know, how to do it and then the school is funny about using too much outside software anyway. (Donna, 12.12.2012)

The scheduling of the synchronous sessions was a recurring issue among the instructors. The flexibility of the online environment does not hold students accountable at a certain time or place. Therefore mandating attendance at sessions goes against this principle. Ellen commented about mandatory synchronous sessions:

> The reason why is because the students take it online for reason…Because they don't want to be at the same time, same place as everybody else. That basically says you have to be somewhere at the same time, same place kind of defeats the purpose and holds them prisoners of time. (Ellen, 12.14.2012)

Donna was in agreement with having a synchronous component but also questioned the feasibility and fairness of offering it to all students. She commented:

> Yes and sure I think it would be great but it would be so hard to. I mean how do you do that when people live all over the country, people are in different times? I mean suppose you could say you are opening up a synchronous session here. You can either make it or you can't, but that doesn't seem right either. (Donna, 12.13.2012)

Felicia thought it would be a good addition to the math classes, but didn't for see a college-wide requirement being mandated in the near future. She stated:

> I think it would be a worthy experiment. I don't know if an implementation across the board would be necessary. I think it would be something to experiment with and students responded to it then yes rolling it out. But if students are attending online courses for the asynchronous piece of it that we don't want to force synchronous pieces on them because it just, it's a put off. So I think experimenting with those things would be good but not necessarily for implementation. (Felicia, 12.17.2012)

The topic of recording the live session and posting it in the class was a topic that came up in the interviews. All of the instructors agreed that this would be a viable option. However if they are attaching points to the sessions, they were unsure how to monitor students who chose to watch the recording. A link housed within the learning system could tell them if a student clicked on the link but not whether the student had watched the recording. Therefore, two of the instructors stated that some type of assessment would need to be created to assess whether or not the student watched the recording. One instructor commented that they could 'plant seeds' as a way to track and assess viewing of the recording. It was considered to be extra work on behalf of the instructor though since each session would differ from week to week and from one class to the next.

Andrew talked about his experience with recording a live session. In the past, there wasn't an option to record the session. But he plans to record the session with the new software being introduced at his college. He said:

> There wasn't a way to do that. There will be a way to do that. But I want to because I would like to post it so that students could review the whole thing and have the benefit of that. It would be really good too because that would they would at least be able to view you know synchronous communication even if they couldn't necessarily be a part of that. (Andrew, 12.10.2012)

Carl was in agreement with providing recordings of the sessions. He said, “They can access at any time so if they miss a live lecture they can go in and see the notes for the video” (Carl, 12.12.2012). Felicia supported the recording of sessions saying:

> It is hard to make a time work for every single person. So the ability to record the sessions makes it valuable. And that's why I think that type of tool; it's going to be the direction of the future. (Felicia, 12.17.2012)

Andrew went into detail about his experience using synchronous sessions with his online math classes. He tried both structured and unstructured sessions. His experimentation has helped him refine his sessions and the content included within them. He talks about a time when he didn’t structure the session:

> It was not structured and it should've been. I think that is why it probably wasn't as useful as it could have been because I did kind of leave it open and it was like crickets. At first students wouldn't ask any questions so then I'd be like ‘okay well let me ask about this’ so I can come up with stuff pretty quickly. But I didn't necessarily all the time have ‘okay first 10 minutes we are do this and then the next 10 minutes we are going to do this.’ I think in the future I am going to make it more structured because the students aren’t necessarily coming in with a whole bank of questions. Because a lot of them haven't looked at it enough to really get the questions. (Andrew, 12.10.2012)

Instructors who were assigning points to the sessions talked about the feasibility of tracking attendance for all students. The use of a quiz or assessment to test their knowledge from the session was one option. Andrew discussed how he would handle this situation:

> I may say ‘okay well if you can't make the session’, say on Thursday, ‘then I will record the session’ and then plant some eggs or some seeds or something in there. Just kind of look for something that I could then ask them questions about, just to make sure that they actually did, you know, did do that. And they would have to take it between Friday and Sunday. (Andrew, 12.10.2012)

Ellen also talked about tracking student attendance in the recorded sessions. She discussed including an assessment for attendance tracking:

> Next time I will put it as an assessment so I know whether or not they entered. It doesn't tell me whether they watched it, just whether they clicked on it. The only thing that I have is when students say “Thank you for this. I have another question” but I would have no idea what percent of students actually go back and watch it. I don't think you can capture that. (Ellen, 12.14.2012)

The use of an office hour was another option brought up by some of the instructors; however most did not find it an effective use of their time. Donna discussed her experience with holding online office hours:

> As it turned out, I don't think it made a whole lot of difference being there a certain time because students are going to contact you when they want to contact you because they are not always available during the whatever hours I would set for office hours anyway. (Donna, 12.13.2012)

Ellen commented about her availability to students saying:

> If the student asked for something specific, I would just call them whenever they asked…It goes back to ‘I don't need her when she's available I need her when I need her.’ (Ellen, 12.14.2012)

In summary, most instructors were in favor of using synchronous sessions in their math courses if they had access to the needed software. Feasibility and accountability were concerns brought up by the instructors. One solution was to record the sessions and make it available for all students. The instructors were in favor of this option. Assessing students who watch the recording was another issue brought up. Instructors felt they would need to create an assessment as a way of tracking students who watched the recording since there was no other way to track it. Office hours were discussed by some of the instructors, but their experience showed that this was not an effective use of their time. The online environment is one of flexibility and varied schedules. Students contact their instructor according to their schedule regardless of a posted office hour.

Videos

The discussion about recorded synchronous sessions led instructors to comment on their use of videos in the instruction. They stated that they use pre-made videos from a number of math websites or created their own. This section will discuss how instructors incorporate videos into their math courses.

Carl talked about using links to videos in his class and how the college is beginning to embed links to videos within the class:

> I provide links to videos to Khan Academy. It is huge so I provide students with those videos. And what's happening now in the online courses, they are starting to embed videos within the course. So from instructor standpoint it's helpful as it's already there for you for the students. (Carl, 12.12.2012)

Ellen talked about her use of videos and also using a phone app to create her own videos:

> I grabbed them from YouTube. I grabbed them from Khan Academy. And I use an app on my phone to do it myself. It's not a video. It's me. It's just a whiteboard and I can record it and show whatever I want to show and then e-mail it, post it. (Ellen, 12.14.2012)

Andrew commented on using a Smart Pen to write in a notebook and record the writing and his voice which can later be disseminated to his students. Donna said she used Jing to create her own videos for the students. Felicia talked about also using the internet to find videos for those who are not able to create their own or who do not have the software to do so. She said:

> So if you are not able to make your own video, which sometimes it's really hard people don't have the resources to do that. If you're unable to do that there is a plethora of stuff available either through the Khan Academy for whole bunch of different math problems, Purple Math. Just different websites that, I regularly search and it's one of those things where you can't just search a concept and find a video and just say 'here you go' you have got to watch the videos and make sure it jives with the curriculum. (Felicia, 12.17.2012)

Overall, the instructors were cognizant of online math videos and how to use or make them. They served as a viable option to help students with questions and further their understanding of a topic. Some of the instructors saw videos as an alternative to the synchronous sessions citing that they served a similar purpose for course instruction.

Discussions

All of the instructors had experience using discussion boards in online math courses. The structure of the course and college requirements dictated how the instructors used and assessed work in the discussion boards. With the exception of the two community college instructors, all other instructors were required to use discussion boards in their math classes. Several colleges also set student and instructor requirements for participation in the discussions. In general, the instructors did not favor making posting requirements in the discussion forums and those that had the option to remove the requirements, did so. This section will discuss the instructors' thoughts about discussions and participation requirements.

The two community college instructors had the flexibility to structure their course in terms of a student participation requirement. Andrew talked about how he can incorporate a student participation requirement using 5-10% of the total grade and chose to eliminate discussions, using synchronous sessions in lieu of them. He found the discussions to be 'busy work' for both him and the students. He stated:

> I was using discussion boards, but honestly it wasn't the best tool for communication in a math class. It ended up just being like a pain and busywork for my students and me. And responses I got weren't really communicating very much so I kind it would rank that probably at the bottom. So this term, it's a fall term, I dumped the discussion board but I have the virtual sessions. (Andrew, 12.10.2012)

Ellen also chose to eliminate the discussion requirements for her students. She still posts a weekly thread but does not place a numerical value on participation. It is there for them to ask questions of her and one another. When asked about placing requirements on participation she stated:

> I don't do that. I could not stand it as a student and I think it's a horrible thing to do. Because it doesn't mean that you're getting the breadth of the discussion in the activity it just means it's a requirement and it's a check off the list. So it's up to the student to decide whether or not they choose to use that opportunity to learn the content by having discussions with others. So you know I encourage and I state that in the syllabus, but I do not require. (Ellen, 12.14.2012)

Felicia works at a college where weekly discussions are required, but there are minimal requirements set on posting. Her view on discussion boards was to have the instructor active in the forum to engage students in the discussion. In her experience when she was more active in the discussion board, students would reply almost daily regardless of the requirements because they were engaged in the discussion. When asked about discussion requirements, she replied:

> Nope. I think requirements are stupid. So even if we require students to participate they have an initial response and response to the other classmates, they are going to do so begrudgingly because they have to. If you start a conversation and the instructor is engaging students in the discussion board and promoting higher learning, a higher level thought, that would encourage more participation. You're going to have more participation. I have the requirement of participation at least one a week and post attendance. But I had students participating every single day, all day because I was in the discussion board. (Felicia, 12.17.2012)

Carl viewed the discussion boards as a way to monitor student learning. He said:

> If I see something in the discussion board that stands out to me, let's say you know they're totally lost with the mathematical concepts; I'll reach out to them via e-mail saying "Hey do you have any questions about this?" I'll send them actually additional notes "Hey these may help you. Let me know if you need help." (Carl, 12.12.2012)

Donna works at a college which requires students to make 8-10 posts per week and also required the same of the instructors. Donna taught a past course which had no discussions and did not like it. She found that the students did worse on their assignments and were not able to ask questions through the use of discussion threads. Donna takes an active role in the forums saying that she posts, “25 to 30 [posts per week] and sometimes more though. Sometimes it's 40 or more because it depends on if the students are, if they're not getting it, then I have to jump it more often” (Donna, 12.13.2012). When asked if she would change the discussion percentage for the final grade, she would raise it slightly if she could. She stated that if they were worth more points, students would be more inclined to actively participate.

Betsy does not like having discussions in a math class, but they are required by her college. She tries to encourage the students to communicate with one another, explaining the concepts in their own terms to help one another and also guides them through prompts in the discussions. When asked about her methods for increasing dialogue in the forums by using prompts, she stated:

> I find that if I don't prompt them and give them guidance…it's not about asking them deeper questions; it's about really giving them a direction to come back to me. That is the only way where I find I can get them to respond and move the conversation forward. I can make questions or comments like, “Oh that was a nice post” or “This is what I think”. But if I don't really guide them, I don't feel like my students will move the conversation forward. So those are kind of my methods for doing that. (Betsy, 12.11.2012)

The use of discussion boards in an online math course is mixed. Those who have the academic freedom to assign or require points for the discussion forums opted to not do so or exclude them all together. The other instructors are required to use them and count them as a part of the students’ final grade. The participation

requirements for the students range from 1-10 posts per week and faculty requirements range from 2-10 posts per week, although one instructor stated she posted beyond the minimum requirements. The boards were seen as a way to check for student understanding and engage them in the class. Many instructors thought that requiring students to post was not a way to engage them because it is viewed as a task rather than a learning experience. For the majority of the instructors, they had to follow the college requirements which included having weekly discussions, participating in them, and assigning points to them.

In conclusion, the instructors stated that they used synchronous sessions, videos, and discussions as the main tools for communication. The use of synchronous sessions was limited due to availability of resources and the requirements set by the college. Most of the institutions did not require instructors to hold live sessions. The few instructors who had experience with these lessons reported positive experiences. In lieu of hosting live lessons, most of the participants shared videos with their students. Often these videos came from recommended math websites but a few instructors had experience making their own videos. Discussion boards were common in the majority of the courses and often required by the institution. Both the instructor and student were required to participate in the discussions with varying requirements among the colleges. The use of discussion boards in an online math classroom was mixed. The focus and use of these discussions were important factors in determining the feasibility and effectiveness in the courses.

RQ #3: How Do Math Instructors Structure a Course to Increase Dialogue?

Course structure is an interesting component in an online class. While most face to face instructors are used to designing how to deliver the content, this is decided for

the online instructors by their schools. Therefore, online instructors are commonly referred to as facilitators since the course structure is pre-determined. As evidenced in the interviews, four of the six instructors have a course structure set by the school with little to no changes that can be made. The two community college instructors have more flexibility in designing the course but still follow the content structure set by the college numbering system.

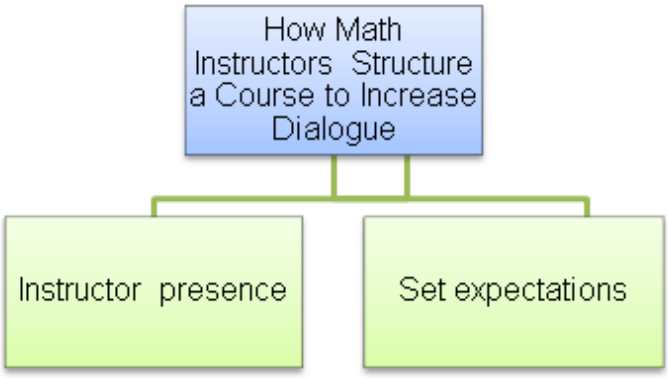

Figure 4-5. Subthemes for How Math Instructors Structure a Course to Increase Dialogue

All of the instructors use a learning management system that is set up by the college. The curriculum is created by the college, including most of the assignment and discussion requirements. Only two of the instructors have some flexibility in the course structure, but the content cannot be altered. The two instructors that can modify the course can assign categorical points within a certain percentage, for example participation can be between 5-10%. The other four instructors work at institutions in which the course is completely pre-made and little to nothing can be altered. They work as facilitators of the content and course. Even though the course is pre-packaged, there are a few things that they can do to increase dialogue with their students. The themes in this category include instructor presence and setting expectations.

Carl works at a college which pre-packages his math courses. When asked how he increases dialogue, he replied:

> Unfortunately I would think most institutions will not allow you to alter the course in any manner, so you can increase the dialogue through additional posts or additional e-mails to your students. (Carl, 12.12.2012)

Felicia also commented on the structure of the course stating that almost nothing can be changed. However, she felt that instructors can still show who they are by injecting their teaching style and personality into the class. She stated:

> [It is] prepackaged. There is not much you can alter. There are small things that the people can do to make the class their own, and that is the academic freedom. There is not a lot of room for change but there is room to show who you are as an instructor and to make accommodations for your teaching style. (Felicia, 12.17.2012)

At Betsy's college, she is required to post two discussion threads per week but has flexibility in writing the questions.

> My courses are standardized. They are created by the institution. I am able to change the questions that I ask for the discussions. But that's about as much control that I have. (Betsy, 12.11.2012)

Andrew incorporates notes and videos in his course to encourage dialogue. He posts open-ended questions to encourage the students to discuss the math. He said:

> I guess I try to in the notes and even in the videos I post, I try to post some kind of open-ended questions a little to increase dialogue but then again it's tricky because it may feel like they have to the answer the question at some point. Even with this course and the classroom at some point you have to round everything back up. (Andrew, 12.10.2012)

Ellen has more flexibility with her course and is able to design the structure. When asked if she structures her course to increase dialogue, she replied:

> Yes I guess before I design, I think about how I'm going to encourage it but I have not yet found a way that has made any difference that I've seen. Maybe in my years now doing this I've decided this is the tried and true way that works and there will always be a handful students reach out and then there are the students that go with what's there. (Ellen, 12.14.2012)

The instructors noted that they set their expectations at the beginning of class to help increase the dialogue with their students. Within these expectations, they will note their preferred ways for contact including various times and ways they can be reached. Some set two-way expectations, those for the students and ask what the student expects from their instructor. One instructor sends a message about keeping negative feelings out of the math forums and to keep the conversations about math positive.

Andrew stated that he sets his communication standards at the beginning of the course by listing it in his syllabus. He wanted students to have realistic expectations about contacting him and getting replies. He said:

> I try to set the norms at the beginning; you know in the syllabus. I tell them email is probably the best way to get in touch with me. Understand I might not be able to respond to you until the next day. Maybe I have read it but I just can't. I have to draw a line somewhere otherwise I'm really going to be a slave to my computer and nobody wants to be that. And common sense generally prevails. (Andrew, 12.10.2012)

Felicia talked about posting a welcome message where she included her expectations for the students and asked what they expected from her. Within that message, she also posted the various ways she could be reached.

> [I] provide a welcome message which includes, something that I included was my expectation of the students and then I also ask what their expectations were of me. And then I also provided different methods in which they could communicate, both with myself and other students if they wanted to. (Felicia, 12.17.2012)

She also brought up a message about squashing bad attitudes about math. She saw that some students would use the forums to talk badly about math, encouraging others to do so too. Therefore, she set the expectation that this was not going to be permitted in her course. She said:

> Once the students knew what the expectation was, that you could have a negative feeling or negative vibe but don't spread their hatred of math. Don't spread the bad feelings, they get it. (Felicia, 12.17.2012)

Ellen felt that the adult learners in her course should be responsible for their work. She commented that she would help them if needed, but it was up to them to be accountable for the class. She stated:

> I prefer that they are involved and that they do those things [participate in forums] but I don't hold them accountable to it. I encourage adult learners, I kind of feel like they're going to put in what you need to put in to be successful and that the accountability is on you. I will give you whatever resources you need but you are the one accountable in the end. (Ellen, 12.14.2012)

In conclusion, most of the instructors facilitated courses designed by the college and had little to no flexibility in altering the course structure. Some things they did were add question or chat threads, alter discussion questions, make more posts, provide their contact information, and set expectations. The assignments, points, and discussion structure were standard across most of the institutions. When they could alter the course structure, they removed discussion forums, removed participation requirements for the discussions, posted supplemental course materials, and added synchronous sessions. Instructors were able to assert their teaching style through additional posts, emails, and within the various forums.

How Instructors Define Terms

Instructors were asked how they defined three terms in relation to online math courses, specifically, communication, interaction, and dialogue. All instructors described engaging in all three types of communication within their online courses,

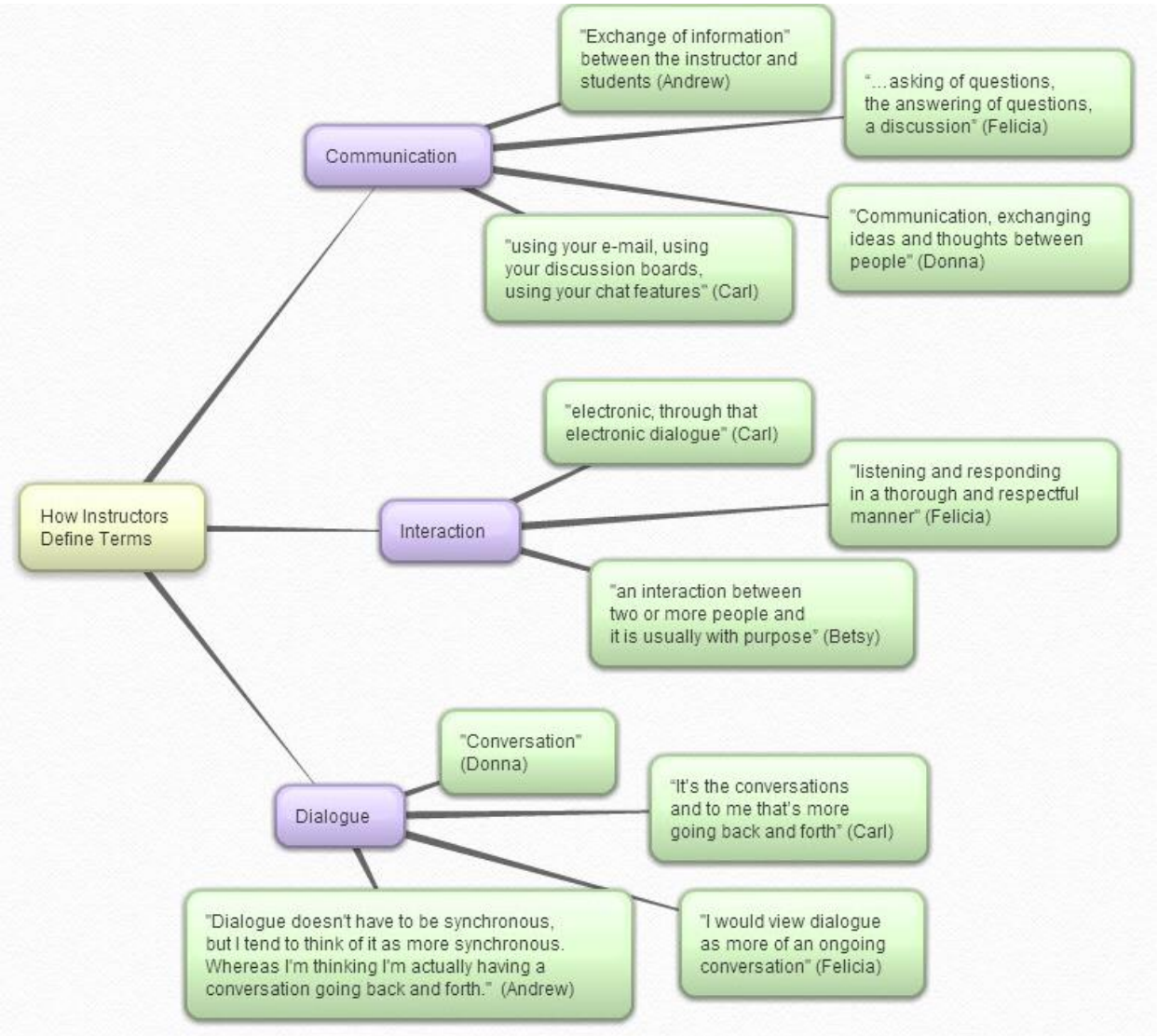

Figure 4-6. How Instructors Define Terms

many struggled to develop a single definition for each one. Many felt that the terms overlapped one another or attempted to use a derivative of the word in the definition. Some key phrases and common definitions were repeated within the group which will be discussed in this section.

Communication was described as an “exchange of information” or “using the types of tools that can be used to communicate online.” Andrew stated:

> I would define communication as the exchange of information and that could be instructor to student, student to instructor, or even student to student. (Andrew, 12.10.2012)

Donna defined communication in a similar manner stating: "Communication, exchanging ideas and thoughts between people" (Donna, 12.13.2012). Felicia spoke about communication citing it as the "…asking of questions, the answering of questions, a discussion" (Felicia, 12.17.2012).

Carl attributed communication with the use of emails, chat, and discussion boards. He said:

> As it relates to the online environment communication first of all starts with the e-mails. So just interacting with the students via e-mail. If your online platform offers chat functions, those are your main communication tools with your students and the biggest one throughout the course is the discussion boards. So that's how I would define it in an online environment using your e-mail, using your discussion boards, using your chat features. (Carl, 12.12.2012)

Interaction was defined by study participants using the electronic features within the course as well as the engagement of two parties. Carl stated that interaction is "…in an online environment is mainly electronic, through that electronic dialogue" (Carl, 12.12.2012). Betsy defined interaction as "…an interaction between two or more people and it is usually with purpose" (Betsy, 12.11.2012). The manner in which instructors and students respond to one another was a characteristic mentioned by Felicia.

> Interaction has to do with, I ask you a question and you respond. You ask me a question, and I respond accordingly. You are listening and you are responding because you are listening to whatever the question is. So listening and responding in a thorough and respectful manner. (Felicia, 12.17.2012)

The last term the participants were asked to define was dialogue. There was more of a group consensus when it came to this term. Most of the instructors defined

dialogue as “synchronous”, “a conversation”, and “back and forth”. Felicia defined dialogue as:

> I guess I would view dialogue as more of an ongoing conversation. So if you are communicating over a matter of I don't know post or thread or e-mail over a matter of hours, a good dialogue would be the development of a conversation and then the persistence of that conversation, whether it [is] in written word or verbal word. (Felicia, 12.17.2012)

Andrew thought of dialogue in a synchronous manner, in line with a conversation saying:

> Dialogue doesn't have to be synchronous, but I tend to think of it as more synchronous. Whereas I'm thinking I'm actually having a conversation going back and forth. An e-mail doesn't tend to be as effective with that especially when it comes to students. (Andrew, 12.10.2012)

Donna referred to dialogue as “conversation” and Carl said: “It’s the conversations and to me that’s more going back and forth” (Carl, 12.12.2012).

Online instructors engage in these three types of information exchanges, communication, interaction, and dialogue; however there is not one clear definition as expressed by the participants. Some instructors thought about it in terms of the traditional classroom and how those behaviors carry over into the online environment. Several instructors stated that the terms overlapped and could be intertwined with one another. Some clear phrases did emerge as possible definitions which further elucidated how online instructors describe these terms.

Preferred Communication

The instructors were asked which types of communication they preferred and the types preferred by their students. Their varied answers to their preferences speak to their flexibility as an online instructor and their willingness to be available to students through various means. The most common form of instructor communication was email

although face-to-face, synchronous sessions, discussions, individual forums, and text were also listed as preferred means of communication. When asked about the ways they thought the students prefer to communicate, email and discussion boards were the top selections. This section will discuss the preferred means of communication for both the instructors and their students.

Andrew stated he preferred to communicate face-to-face and also prefers to speak during virtual sessions. His response differed from the group. He comments on this topic by saying:

> I find it easier to communicate if the students are right in front of me, and I think they would feel the same way about it…like on the virtual sessions I prefer to speak. I prefer to have the video on me. A lot of students are not like that. They prefer to type. (Andrew, 12.10.2012)

Asynchronous communication via email or discussion boards was a commonly cited communication preference of instructors. Carl stated, "As the instructor, I prefer the e-mail first and foremost and then the discussion boards secondary" (Carl, 12.12.2012). Betsy also preferred asynchronous communication and explained the reason why:

> … Asynchronous communication. I get back to them within 24 hours every time, but to be able to answer at my own time. So many times I got a phone call, and not knowing who it was, and out with my family doing something. And I'm getting a math question and want help with their homework. I prefer the asynchronous so I can kind of put my math professor hat on and do what I need to do while I'm near my resources. So definitely e-mail in the private forums. (Betsy, 12.11.2012)

Donna also preferred communicating within the individual forums saying, "Well, I like the individual forums. I am fine with typing and writing" (Donna, 12.13.2012). On the other hand, Ellen preferred communications to go to her mobile device so she could reply promptly. She stated:

> I prefer it to come to my mobile device so if they e-mail me inside the learning management system it sits inside the learning management system. So I feel like my response to that will be 24 to 48 hours depending on the last time I've been able to check in. So I'm perfectly fine to chat or e-mail that comes to my mobile. (Ellen, 12.14.2012)

Lastly, Felicia was open to any type of communication that the students' preferred. She felt that instructors should communicate based upon students' preferences, not the instructor's. She commented on this topic by saying:

> Yes and what I prefer is irrelevant. If you are teaching an online class you need to gauge what your students want and how your students want to be communicated with is how we need to communicate with them. And I think the same applies to an online class. If students are more engaging in the discussion board, then you need to be in the discussion board. If students are more engaging in e-mail, then you need to on e-mail. If they want more chat. Wherever your students are that is where you need to be. (Felicia, 12.17.2012)

When asked what their students prefer, most of the instructors said that the students prefer to communicate through email to the instructor or the discussion board. Andrew commented that online students are hesitant to admit weakness to their peers and will go to him first. Carl also said that students are more apt to ask the instructor first by saying:

> They typically contact me first because everyone is coming from the business world. They want to hear from the boss so they contact the instructor first to find the clarity. And if they don't feel like they're getting a quick response than they post there [discussion forum], but typically the instructor first. (Carl, 12.12.2012)

Ellen found a difference between age groups in her courses. She states, "…it would be email for the adult learner, the older learners, and the text or chat for the younger group" (Ellen, 12.14.2012).

In conclusion, instructors have a wide range of preferences which can be attributed to their flexibility in accommodating the needs of many students. Being that

their courses are conducted asynchronously, it is not surprising that this is the most popular communication preference. They are also trying to be cognizant of students' schedules, understanding that their students live in various place and time zones. Email seems to be the quickest way for both of them to communicate and exchange information. Based upon the instructor opinions of student communication preferences, email is also a preferred method. Being flexible when it comes to communication methods, will allow the instructor to meet the needs of all their students and communicate in the manner in which they want to be communicated with in an online environment.

Conclusion

Chapter 4 discussed the themes and subthemes that emerged in relation to the three research questions:

1. How do math instructors communicate with students in an online environment?
2. What tools do math instructors use to promote communication in an online course?
3. How do math instructors structure a course to increase dialogue?

Instructors use several methods to communicate with students in an online math course including both synchronous and asynchronous means. Most instructors cited using asynchronous means, communicating within the learning management system. The instructors were flexible, accommodating students' preferences in terms of time and method. These communications included both one-way and two-way communications. Regardless of the method or means, all of the instructors stated that communication was an important component in an online math course. Some of this communication included setting class expectations, engaging with students, and maintaining instructor presence through timely responses.

The main tools used by math instructors included synchronous sessions, videos, and discussions. The use of synchronous sessions was limited by college requirements and availability of resources. Those who did have access reported positive experiences. Online videos were seen as an alternative to live sessions and could be easily acquired and shared with students. The group reported using pre-made, online videos in addition to creating their own. Discussions were also a staple in most online math courses. Most of the instructors were required to post and participate in weekly discussions with both the student and instructor requirements differing among the colleges.

The structure of the course was a limitation for most of the participants who were not able to control how the course was set-up. These instructors asserted their identity through instructor presence and by setting expectations. They were present in the course, responding quickly to students and set expectations by posting additional messages. In order to increase dialogue, instructors posted messages, sent emails, and asked questions.

CHAPTER 5
DISCUSSION AND IMPLICATIONS

The purpose of this study was to investigate the manner in which math instructors communicate with students in online math courses and explore the tools the instructors use to increase dialogue in online courses. The study posed three research questions to learn more about this topic. Qualitative interviewing was employed in order to gather rich, descriptive data. Chapter 5 will discuss the findings including the themes and subthemes surrounding the focus of the study in addition to implications, additional limitations, and recommendations for further study.

Discussion of the Findings

Six participants from four higher education institutions provided detailed, in-depth data about how they communicate with their students, the tools they use, and how they structure a course to increase dialogue in online math courses. The sample was highly educated, comprised of one doctor of education and three participants working on their doctoral degree. They also had extensive experience of working in an online setting with the group averaging 6.8 years teaching online math courses. The group as a whole estimated facilitating between 390-465 math courses. All of the participants completed at least one online course as a student with four out of six completing entire degree programs online. The experience of the participants both as an instructor and student yields data that is grounded in experience and sound math pedagogy.

The three main topics were organized around the research questions and included: how math instructors communicate with students in an online environment, the tools they use to promote communication, and how they structure a course to increase dialogue. Four themes emerged elucidating how instructors communicate

online including the types of communication, encouraging communication, the importance of communication, and dealing with communication concerns. Several tools were cited as ways instructors communicate online with the main themes being synchronous sessions, videos, and discussions. Finally, the type of course structure and setting expectations were two themes of how instructors structure a course to increase dialogue.

Communication

Although the sample consisted of participants from four different institutions, there was a consensus of how they communicate with their online math students. Both one-way and two-way communication means were mentioned during the interviews. This is consistent with Moore's definition of a distant environment where there is a separation of teaching and learning assisted through the use of media (1973). Announcements, feedback, Power Points, and videos were noted as one-way means to communicate. Even though students can reply to them in response to these materials, most instructors categorized them as informational messages being passed from the instructor to student. Two-way communication was defined as a back-and-forth interaction between the instructor and student and included email, discussions, phone calls, text, chat, and synchronous sessions. All of the instructors engaged in all or some of these activities in their courses. There are three types of interaction in the online environment: instructor to student, student to student, and student to content (Moore, 1989). The types of communication found within the group supports this assertion. The use of interactive tools, such as Blackboard, for synchronous sessions impacts the transactional distance by promoting a multi-interactive, collaborative learning

environment (Stein, Wanstreet, & Calvin, 2009). When communication increases between the instructor and student, the transactional distance decreases (Moore, 1997).

The instructors cited flexibility in their communication techniques, accommodating students' needs, and using one or all of these ways to communicate with math students. Flexibility was a best practice noted in the research. It is implied that the 24-hour flexibility of online schooling is extended to include this characteristic in online instructors (DiPietro, Ferdig, Black, & Preston, 2008). Moreover, it is also consistent with research stating that the student experience has a positive impact on student satisfaction. Students are more likely to be satisfied with their course when the feeling of remoteness is removed (Steinman, 2007). Further findings supported this assertion by stating that instructor interactions are critical in an online learning environment (Rhode, 2009). Some instructors were open to multiple forms of communication saying that they were open to all forms, whichever was best for the student. Overall, phone calls were named as the least likely way to communicate mainly due to the different schedules and time zones of the students and instructor. Asynchronous communication through email, discussion, or individual forums was the most common way to correspond with students. The three subsystems from Moore's (1973) original theory, learner, teacher, and method of communication, are still present in online learning today.

Encouraging communication was a second theme discovered in regards to communication. Immediacy behaviors is a way to explain how communication takes place online and is a foundational component for developing online community (Arbaugh, 2010). Instructors stated that they attempt to encourage communication

between themselves and the students in addition to encouraging the students to communicate with one another. This is consistent with findings of online teachers whereby they foster a sense of community to make connections with their students and open the avenues for continued help and support (DiPietro et al., 2008). Tone, meaningful discussion, open communication, and prompt replies were ways to encourage communication with students. Several instructors stated that they addressed the students by name in discussion and emails, taking a personal approach, which supports a reduction in transactional distance (Moore, 1973). Past experiences of addressing the class of a group were deemed as a bit impersonal and thus stating the student's name was a way to encourage communication through reciprocal dialogue. As one instructor noted, students are more likely to reply to you when the post is addressed to them. Instructors monitor their posts and emails to make sure the message is positive and received in a friendly manner. Verbal immediacy behaviors, including addressing a student by name, citing personal examples, and providing feedback, can enhance leaner and overall course satisfaction (Arbaugh, 2001).

This personal engagement carried over into the discussion forums where students were addressed by name and specific comments were made in instructor posts. Instructors commented on particular parts of a student's post and replied in meaningful ways. Clarifying understanding or posing questions was also a method used in discussion replies. Instructors can encourage these behaviors in students by modeling and being engaged in the discussions to promote dialogue through this medium (Conaway et al., 2005).

The instructors cited open forms of communication as one way to encourage communication with math students. Posts with contact information, preferred methods of communication, and question threads within the class were ways to let students know that the instructor was available. These techniques support evidence that instructors provide students with multiple ways to interact with the content to accommodate their learning styles (DiPietro et al., 2008). Several instructors stated that prompt replies to student posts and questions were ways to encourage communication. Although most colleges require a reply within 24-48 hours of a student's post, most of the instructors replied much quicker saying that students expect a quick response to their questions. One instructor described it through her own eyes saying that she would want a fast reply and thus monitors the forums and emails in order to reply quickly to her students. These responses characterized instructor presence in an online environment. Participating in the course, grading assignments, and spending time in chat rooms are ways to create an online presence (Brooks, 2003). Swan and Shih's study found that instructor presence was the sole predictor of course satisfaction when other factors were controlled (2005).

Encouraging communication among the students is a strategy used by several of the instructors. A few saw the peer interaction as important and encouraged students to exchange email, contact information, to post in chat forums. The notion that peers could help and support one another was a major reason for encouraging student to student interaction. Establishing a community of learners is a best practice cited in the literature. Online instructors value and encourage student to student interaction to create a social climate among the class (DiPietro et al., 208). Many instructors set up

forums for students to post or created them as needed. Facilitating discourse is the second component of teaching presence according to Anderson, Rourke, Garrison, and Archer (2001). Within this component are the means by which students are engaged, interacting, and building upon the information provided through the course materials (Arbaugh, 2010). Although the instructors did not share student information, many encouraged the students to contact one another, exchanging information or even meeting in person to form study groups. Most of the instructors were unaware if these meetings or offline communication took place, but some witnessed personal dialogue amongst the students which led them to believe that the students had communicated beyond the course.

The participants named many ways that they communicate online and their preferred means of contact. Given their flexibility to accommodate students, their preferences varied. They also commented on the students' preferred means of contact. Most of the instructors preferred to communicate asynchronously through email, individual forums, and discussions. Their schedules and time zones were a factor in their preferred means of contact. One instructor stated that she liked to think about her replies and wanted to take the time to write them out rather than answer when out of the office. Another instructor asserted that he preferred to communicate face-to-face and through synchronous sessions. He found it easier to communicate with the student in front of him in order to understand their needs and clarify meaning. Overall though, the instructors were flexible with means of communication and accommodated the students as needed. Asynchronous means were a fitting way to communicate since there were little to no time restrictions on the course. The diverse student population and location

supported email, individual forums, and discussions as a viable way to communicate with online instructors.

The instructors affirmed that math students preferred to communicate through asynchronous means too, saying that email, question threads, and discussion were the most common ways that students communicated with their instructor. Phone calls were rare and usually used for emergencies or last minute clarification. Even during synchronous sessions, students preferred to not speak and opted to type instead. Those that commented on these sessions cited poor attendance with the same students present each week. Emailing and posting questions were deemed to be a quick way to get a reply and effective given the different schedules and time zones. Self-directed learners are independent, problem solvers, and use their resources to overcome difficulties through the learning process (Chou & Chen, 2008). Students' using various means of communication when needed supports the assertion that they are emulating the image of a self-directed learner in online learning environments. Moreover, self-directed learning was a strong indicator of academic achievement (Hsu & Shiue, 2005).

All of the instructors indicated that communication in an online math course was very important. The lack of face-to-face interaction placed a stronger emphasis on the instructor's role in an online course. Most viewed the instructors' role as setting course expectations, being engaged, and showing instructor presence. Differing from a traditional course where these things can be accomplished in person, the online instructor needed to do so from a distance. If an instructor is able to reduce the perceived distance through the use of materials and engagement, then the transactional distance is reduced. Students reported satisfaction with online learning experiences

when they were enrolled in more interactive courses (Boling et al., 2012). These elements were illustrated through regular posts and emails, participation in the discussion forums, feedback, and availability to answer questions. Many instructors viewed the absence of these activities synonymous with a student-led course set-up or a course that could be run by a teaching assistant. The expertise as an instructor demanded that these elements were present in the online course in order to give students an equal or better learning experience in comparison to its traditional course counterpart. Online math requires more teacher support given the nature of the subject which was evident in the importance instructors placed on online communication in math courses (Moor & Zazkis, 2000).

In addition to regular communication, instructors are also faced with dealing with inappropriate communication and non-responsive math students. Both of these issues are handled in a similar manner among the participants. The consensus among the instructors was to diffuse the situation, delete the post, or speak with the student for further clarification. Inappropriate posts either between students or addressed to the instructor were a rare occurrence. When it did happen, the common response was to contact the student either through email or on the phone to speak to them about it. If the post was in a public forum, the procedure was to copy the post for reference and then delete it. Clarifying understanding or explaining the situation to the student usually resulted in the issue be deescalated and not a recurring problem. Students were reminded about online tone and proper etiquette in an online forum. When the communication was addressed to the instructor it was usually a result of student frustration, lack of understanding, or difficulty with the content. In these cases,

instructors took a similar approach by addressing the student's concern and providing the needed assistance. This validates the findings from prior research when teachers reported the importance of addressing inappropriate behavior and dealt with it by sustaining a non-threatening environment (DiPietro et al., 2008).

All of the instructors dealt with non-responsive students. These students were described as not participating in class or not submitting work. The issue was addressed by contacting the student through email and/or alerting the academic advisor. One instructor stated that she created and sent individual work plans for students to get back on track. The student response was mixed ranging from a reply with completed action items, reply without action, and no reply. Aside from email and advisor alerts, the instructors commented that there was little else that could be done. Some placed responsibility on the student claiming that they were adults and needed to be accountable for their work. Outside of these contact methods, nothing else was offered as a steadfast solution for engaging non-responsive students. This is synonymous with self-directed learning as define by Knowles, "a process in which individuals take the initiative to diagnose learning needs, formulate learning goals, identify resources for learning, select and implement learning strategies, and evaluate learning outcomes" (1975, p. 18). Students who are not able to manage their courses, take responsibility, or reach out for assistance may not be self-directed and thus can struggle in an online environment.

Communication Tools

In addition to email, course announcements via posts, phone calls, and texting, the instructors used synchronous sessions, videos, and discussions as tools to communicate in an online math course. All of the instructors were familiar with the

software needed to hold synchronous sessions, although their experience with it varied. The software supported by the college or lack thereof were determining factors as to whether this tool was used as a means of communication in the math classes. At least half of the instructors stated that their college did not offer or require virtual sessions, although they did see benefit in having this as an option in the course. They also asserted that they would be hesitant to use outside software for reasons such as permissibility, cost, and feasibility. However, the use of two-way, synchronous tools has the option of reducing transactional distance through faster communication and clarification. The perceived distance between the instructor and student is reduced when communication is shared and interactive (Steinman, 2007). The desire to explore new technology and incorporate it into online courses is a best practice supported in the literature (DiPietro et al., 2008). Participants in the former study sought out and were interested in integrating technology into their instructional content (DiPietro et al., 2008).

Of those instructors who did use synchronous sessions, the software was being piloted at their college and thus was a recent option for online courses. There were both positive and negative thoughts regarding the use of synchronous sessions. On the positive side, it was deemed a great way to increase instructor to student and student to student interaction. It was a good substitute for the in-class interactions that are absent in the online classroom. Moreover, students could get direct help with math concepts and ask questions in real time. The use of structured versus unstructured sessions was up for debate, but easily amended through experience and student needs.

On the negative side, requiring attendance during synchronous sessions was seen as a violation of the ‘any time, any place’ philosophy that the online world affords.

Many instructors felt that students chose to attend classes online due to schedule and time limitations, thus requiring them to attend went against this philosophy. The idea of recording sessions was a viable option offered by the instructors. They found recordings a reasonable compromise to make the sessions available for all. If participation points were linked to the sessions, to increase attendance and student buy-in, they struggled with a practicable way to assess the students who watched the recorded session. Designing additional assessments to track participation was seen as an added instructor task in an already busy class.

Office hours were also mentioned though many deemed them as unsuccessful and an ineffective use of time. The 24/7 nature of the online environment doesn't limit when students can contact their instructor, thus they will make contact as needed and not only within a specified timeframe each week.

Therefore, most instructors concluded that synchronous sessions would be beneficial for the students, but how and when were questions left unanswered. Non-required sessions were seen as poorly attended and thus perhaps not a good use of instructor time. The lack of technology offered by the college was a limiting factor too.

Videos

Recognizing that some form of visual instruction does benefit math students, instructors use online math videos as a viable alternative to synchronous sessions. Since students may not have access to lecture online, they may have to rely on other sources such as animations or math software (Akdemir, 2010). The participants stated using both existing and self-made videos to explain math concepts or calculator use. Math sites such as Khan Academy and Purple Math were mentioned as recommended sites to get pre-made videos. Instructors used videos in a number of ways by including

them in class materials, using them in discussions, or sending them to students as needed. Several instructors stated that they created their own videos by using Jing or a whiteboard phone app. The latter allowed instructors to customize the instruction and examples for individual students. They also felt they could offer a more detailed understanding of the line by line steps by explaining what happens as they work out a specific problem. Colleges are recognizing the use of online math videos and some are starting to incorporate them within the course materials. According to Akdemir, instructors who develop their own courses use a limited number of additional resources when compared to instructors using established college courses (2010). Course customization, filling in the gaps, and meeting the needs of students can explain why instructors add materials or videos to pre-existing courses. Moreover, the use of videos can reduce the transactional distance felt by students since they have access to that material at any time, when needed.

Discussions

Discussions are a standard component in most online math courses. Prior research looked at discussion forum posts for examples of immediacy behaviors including affective, cohesive, and interactive responses and concluded that immediacy behaviors were present in the discussions (Conaway et al., 2005). The thoughts about inclusive discussions in an online math class and the participation requirements varied among the group of instructors. One of the instructors removed the discussions, requiring synchronous sessions instead and another instructor posts a weekly discussion thread but does not make it required. About half of the instructors did not favor required participation requirements for the students and/or faculty. It was seen as busy work, a checklist, and lacking depth of knowledge. While other instructors saw

discussion boards as a means to clarify conceptual understanding, assist students, and allow students to interact with one another. The requirements for student participation ranged from optional posts up to 10 required posts a week. Faculty participation varied too, although most colleges set requirements for them. Faculty posts ranged from 2-10 a week, although one instructor reported an estimated 35-40 posts per week depending on student needs. The number of weekly discussion threads was between 1 and 2. The instructors can model and engage students in the discussions (Conaway et al., 2005) which can alter the purpose and direction of the discussion. Modeling formal online communication through discussion boards and emails is considered a critical component in teaching students how to effectively communicate online (DiPietro et al., 2008). Although discussion threads are inherent in online courses, the structure, purpose, and assessment in a math class may need to be reassessed.

Two of the instructors had the flexibility to design the course components and thus removed discussion requirements. Of the others, the college mandated weekly discussion threads and they could not make changes. At one of the institutions, the instructors were allowed to modify the actual discussion questions as long as it stayed in line with the weekly curriculum. When these instructors were asked about modifications they would make to discussions, the response was to remove the required number of posts or raise the percentage that discussions weight in the overall grade. The small weight led one instructor to think that students chose to not participate and just complete the other assignments. Requirements often meant that students will do it because they had to for a grade, but posts may be superficial and not promote depth of knowledge. Students can ascribe to deep, surface, or achievement learning

approaches (Garrison & Cleveland-Innes, 2005). They concluded that higher interactions from the instructor resulted in a deeper knowledge approach on behalf of the students versus no shift or a drop in learning involvement with no instructor involvement (Garrison & Cleveland-Innes, 2005). We may need to look at the instructor's interaction in the discussions as a way of assessing student learning and achievement as a result of meaningful discussions.

The instructor perspectives on discussions were enlightening and point towards continued conversation on the use of discussion forums in a math course as a best practice. The college requirement versus academic freedom dictates when and how discussions are used in online math courses. From a design perspective, the discussions are intended to represent the dialogue that would take place in a face-to-face setting.

Course Structure

The instructors use various learning management systems which are set-up by the college. The academic freedom to design the course activities compared to a fully pre-packaged course was the range seen in the sample. Four out of six instructors worked at an institution which pre-packaged the course for them. Half of them could make no changes while the other two could add forums, threads, and weekly discussions. The nature of the course was not a limiting factor though when identifying how instructors structure a course to increase dialogue. Instructors asserted their individual teaching style in the course regardless of the structure. They did so through instructor presence and setting expectations.

Instructors noted posting announcements, posting frequently in forums, and sending emails as ways to show their presence in the course and increase dialogue.

These were seen as things instructors could do regardless of the course structure. Keeping a positive tone and replying promptly to students aided in increasing the instructor-student dialogue. Adding videos, materials, or asking open-ended questions were additional techniques employed by the instructors. According to Arbaugh, the instructor plays the role of discussion facilitator and content expert in order to effectively deliver instruction online (2010). Enhancing course content and using strategies to accommodate all learners were best practices found in a study of online instructors (DiPietro et al., 2008).

Setting expectations at the beginning of the course was one way to set the standards irrespective of the course structure. Some of the instructors stated that they send out welcome emails setting the course expectations, providing contact information, and also asking the students for the expectations of the instructor. These practices aid in opening up the dialogue from the start of the class, setting a welcoming environment in which students feel comfortable and safe to communicate with their instructor. The addition of question or chat threads, if available, provides a place for students to ask questions or seek clarification from the instructor. Garrison notes that the structure or design of the course plays a key role in the interactions and dialogue in higher-order learning (2007).

In conclusion, the in-depth interviews provided a wealth of insightful practices that math instructors employ in their online courses. The diversity of colleges and instructor experiences captured many pedagogical methods and tools that are being used in online math courses and revealed how they are being used to increase communication. The implications of these findings will be discussed in the next section.

Implications

The instructors in this sample were knowledgeable of and used a wide range of tools to communicate with their math students. They displayed flexibility in not only the method of communication they used but also in accommodating the students to meet their needs. They made a point to encourage communication through emails, announcements, and forum posts. The instructors did so as a means to connect with their students rather than a requirement set by the colleges. The various tools used support the reduced transactional distance in the online environment. A flexible structure is synonymous with high dialogue and learner control (Sahin, 2008). Looking at how experienced math instructors use tools to communicate with their students will reinforce current best practices, the tools that can be added to learning management systems, and training that colleges offer to new instructors. Training should not only include the various ways instructors can communicate with students, but also best practices for using these tools and samples of how effective communication can look in an online class. Ongoing training or support can also be provided to assist instructors with situations that arise while teaching in addition to sharing practices with one another.

Communication

The type of information being conveyed dictated which tools the instructors would use. For example, course reminders and broad information was transmitted through announcement posts in a main forum. These were viewed as outgoing messages that did not require a response. If there was an assignment due, an upcoming test, or note about material, a broad announcement was seen as the best way to deliver this information. Email can be used in two ways, for outgoing group messages and for

individual communications. The instructors noted using email in both instances. Announcements or weekly updates were sent to the group by email. Students with questions or concerns also communicated via email with the instructor directly. Email was seen as a common practice and used by all of the instructors.

The type of email system is worthy of attention. The participants perceived that email housed on a server outside of the classroom was more accessible versus email housed within the learning management system (LMS). Email through Outlook could be accessed by smart phones or even forwarded to another address to alert the instructor that an email is waiting for them whereas email within the LMS required the instructor to log in to the class to read it. Although it may not be viewed as a substantial component, the response time can differ based upon the system used. Emails sent through the course LMS may have a longer wait time if the instructor has logged out for the day. On the other hand, emails sent to an outside server have the potential of getting a quicker reply. Although a 24 hour reply window is seen as a standard response time, most students want and expect a quicker reply. Tu and McIsaac (2002) found that timely responses have a positive influence in online classrooms. If the reply was not within the expected range or the student did not receive a response, the sender perceived less social presence (Tu & McIsaac, 2002). Looking at the types of available communication tools for instructors and their accessibility is something to consider in online courses. During initial and ongoing training, online math instructors should be educated on the various forms of communication tools and exercise flexibility in communicating through a number of means to reach all students.

The use of a weekly office hour was not seen as beneficial by some of the participants. Because of the many communication options available to students, being available for a set hour each week did little to accommodate all students across different time zones. The students made contact based upon their schedule and in their chosen format. Therefore, limiting or requiring online instructors to hold virtual office hours was not seen as a good use of time as perceived by the sample. This supports research by Li and Pitts (2009) who found that students did not take advantage of virtual office hours when offered, opting to get their questions answered via email with a small number of students reporting that the times were inconvenient. However even though the office hours were not frequently used by the students, they still were positive about having access to them and considered it a valuable addition to the class (Li & Pitts, 2009). This warrants further research to ascertain the impact office hours has on student assistance and overall experience. Universities should look at the impact of requiring office hours with the effect it has on student satisfaction and achievement. Giving instructors options to fulfill this requirement may be a viable approach in order to reach a larger number of students over a wider range of courses. It should be implemented with purpose opposed to merely complying with a requirement.

Reaching out to non-responsive students was another best practice applied in the online environment. Instructors encouraged work and replies by using email or individual messages to students. Some colleges had a system for recording non-responsive or students in danger of failing. These systems included early warning reports sent to the college or advisor alerting them of the situation, although not all colleges have a system in place to do so. Instructors either used the early warning

reports or attempted to contact the students directly. Beyond these two attempts, they were at a loss for how to re-engage non-responsive students saying that they could only do so much. According to Moore (1997), it is the learner who sets goals, determines their experience, and evaluates the outcomes, not the instructor. In addition looking at Knowles theory of adult learning, it is the individual who moves from dependency on others to self-direction (1970). Therefore, the student does assume responsibility for completing their work and asking for assistance. Colleges can scaffold this process by assessing the steps instructors should take in these scenarios, the systems in place for recording non-responsive students, and the actions for handling dis-engaged students.

Structure

The course structure did not present a large issue for the instructors. They worked within the structure and infused their personal teaching style in the course. Instructors did so by customizing announcement messages, sending emails, creating question forums, and actively participating in discussion forums. Many of the instructors noted that they supplemented the pre-made materials by adding in their own notes or adding video resources. Growing enrollments in college are met with students who have diverse needs and a wide range of skills (Ashby et al., 2011). The subject of math usually required more resources beyond what was provided in the course and incoming students are often not prepared. The instructors augmented the existing materials to help students struggling with the content. It is important for colleges and course designers to recognize the uniqueness that math courses hold in an online environment and allow instructors to add materials as necessary. The collective experience of the math instructors illustrated that they used outside materials in order to aid in the students' learning experience. Although the basic materials may be adequate in regular

classroom settings, learning math independently online calls for new ways to deliver the information. The instructors found ways to deliver a lecture experience through the use of online videos and resources. Interestingly, instructors who develop their own courses use a limited number of additional resources in comparison to instructors using established course curriculum (Akdemir, 2010). The difficulty of the subject matter requires online math to have more instructor support (Moor & Zazkis, 2000). Reading from the book may not be the best way to deliver and teach the content. Interactive math programs with set or individualized assignments were viewed as a benefit in math courses and recommended by instructors. Therefore, colleges can assess the types of materials they use in math classes, the extent of interactions with those materials, how instructors can supplement the curriculum, and math programs that guide the students through the content using a formulated process. Instructor training should include the extent and limitations that instructors have to use outside resources within their course. Topics such as fair use and copyright can be included since for-profit universities were included in the sample.

Instructor Presence

Trainings for online instructors should also include a component related to instructor presence. According to the data, a positive tone and prompt replies were two ways to display instructor presence. The findings from prior studies support this claim by stating that instructors establish and maintain a presence in the online classroom by logging in regularly, responding quickly to students, being active in discussion forums, and motivating the students to complete the course (DiPietro et al., 2008). Synonymous with the traditional classroom, the online instructor needs to assert their presence by replying to students, posting announcements, and participating in forums to

demonstrate their activity in the course. The lack of verbal cues and physical presence makes the non-verbal components even more important. Instructors can create an online presence by grading assignments in a timely manner, spending time in chat rooms, and participating in the course (Brooks, 2003). Regardless of the platform, online math instructors should be encouraged to make the class their own by using similar strategies that would be used in traditional math courses. Training that demonstrates how to interact and reply to students can support the teacher-instructor relationship and thus enhance the student experience in a math course. Instructors need to observe how instructor presence looks online and have time modeling effective presence strategies. This can be accomplished in trainings that set up a mock classroom, exemplifying characteristics of instructor presence.

Synchronous Sessions

It was noted that online math instructors use outside tools and resources to supplement the course material to assist the students with the content. This is consistent with the best practices found in a study of virtual teachers. They have a desire to find and incorporate new technology in the existing classroom to enhance the content (DiPietro et al., 2008). Aside from using videos and notes, the use of synchronous sessions was a best practice described by the sample. If software was not available, open resources are a viable option to assist students in learning math (Charles & Rice, 2012) although the group did not explore this option. The use of Blackboard Collaborate or Adobe Connect was not a common practice in secondary, online math courses. Less than half of the instructors noted ever using synchronous software. Only one instructor at a community college was undergoing training to incorporate live sessions in the math course, involved in a pilot project. Otherwise, the

instructors questioned the viability of incorporating such a component or noted the lack of resources at their college. Most of the instructors noted that they did not have access to technology outside of their course shell. One instructor was apprehensive about using technology not approved by the college. Available technology was limited to email and chat rooms. Therefore, incorporating synchronous sessions in a math course was met with mixed feelings. Although they were viewed as potentially being beneficial, the software needed, cost for the institution, training, timing, and student participation were noted concerns. Those who experimented with holding synchronous sessions cited low participation and unprepared students. Nevertheless, the NCVPS found that students suggested more live sessions to deliver the math content (Oliver et al., 2010). There is not a single solution that can or will apply to all math courses at all colleges. Therefore, the use of live sessions can be made both at the college and instructor level to best meet the needs of their students. Training can include not only the use of software but how to set up sessions to increase effectiveness and student success. Mandatory sessions, viewing recordings, or points for attendance can be considerations to increase student participation.

Videos

All of the instructors stated they used online videos either posted in the class or sent them out to students for additional math help. Khan Academy was mentioned as one site that was used frequently. Sending a video allowed the student to view it on their own time, take notes, use rewind options, and may even include practice problems. This was seen as an alternative to required synchronous sessions. Although some instructors had experience in creating their own videos, sites such as Khan Academy offer a wide range of math videos removing the need to create new ones.

Some schools are taking the use of videos into account and including them within the course materials. Providing students with ample opportunities to interact with content through the use of videos is viewed as a best practice in online courses (Vogel & Oliver, 2006). Moving forward, the use and access to online videos is a consideration in math course design. If videos are not included, instructors should have the freedom to incorporate them into the course. Telling students to use the web for search for videos on their own would not be considered a best practice. As the content expert, the instructor should guide students to the right resources and videos that will best help them. Some math sites offer answers for math problems rather than teaching the concepts. Therefore, the instructor should lead the students to the correct resources and offer help on how to use them. Creating forums for instructors to share their resources is one way to combine multiple resources and offer students a broad range of help resources.

Discussions

The use and requirements surrounding math discussions is a dichotomous issue. While some instructors used discussion forums to run the class, check for understanding, and interact with students, others felt that required posts removed the depth of knowledge that is required for math. The use and requirements surrounding discussion forums varied among the colleges. Those with the highest restrictions on posting requirements and lack of instructor modifications were met with more apprehension. This finding was supported in the literature where students noted taking a surface approach to discussions by replying for the points rather than for knowledge growth and extension (Bullen, 2007). The nature of math discussions differs in a math course and thus should be taken into account when designing and assigning

requirements. The math instructors felt that the process should be organic and that required posts detract from the purpose of the discussions. Instructors who had the flexibility to modify or create discussion questions and requirements reported fewer issues with them. This finding points towards the uniqueness of math discussions and the flexibility that should be afforded for online courses. Applying a one size fits all approach may not necessarily be the best approach for math class discussions. Allowing the instructor to design them in a way that meets the needs of their students is a factor that can be addressed at the college level, instructor level, and in course design. Instructors can also be active in the discussions to model posts and help students develop a deeper learning approach. Inauthentic assessments of student discussion posts can promote surface approaches in replies (Ellis et al., 2006). In addition, institutional requirements placed on both the student and instructor can be reexamined to ascertain the benefit, use, and frequency of discussions in math courses. Alternatively, synchronous sessions were seen as a viable replacement, providing a participation requirement that was largely the reason for implementing discussions in online platforms. Further research on how to create purposeful discussions, training for online instructors, and best practices can elucidate how we can incorporate discussion forums in math courses. More information specific to math courses is needed to assess the impact of changing the use of discussion forums in math classes.

In conclusion, this study revealed best practices in communication, the use of tools, and discussion recommendations for a group of secondary, online math instructors. Given the limited body of knowledge in this area, it is a step in the right direction for improving the communication in math courses, creating trainings for new

and experienced instructors, as well as highlighting potential modifications for course design. Math instructors both experienced and new to the online environment would benefit from trainings that emphasize communication, best practices, and the various tools used in online settings. As pedagogy continues to evolve, on-going instructor training would support the exchange of ideas. Online instructors are often unaware of what their colleagues are doing given the separation of time and location. Creating forums where they can interact and share ideas won't only enhance the instructors' knowledge but also improve the overall pedagogy of online math courses.

Preparing Online Instructors

Online teaching differs from traditional classroom instruction. Faculty need new skills in order to successfully teach online (Moon, Michelich, & McKinnon, 2005). Wolf (2006) adds that online faculty are successful when they can participate in formal training. Moreover, instructors need to modify their attitudes about teaching in the online environment and understand what is needed to guarantee quality instruction (Yang & Cornelious, 2005). Incoming online instructors are often dependent upon the institution to present and deliver the skills necessary to be a successful online instructor. Institutions need a strategic plan for training faculty to become successful online instructors (Wolf, 2006). However, this isn't always the case since training varies from one college to another. At times, there is not enough faculty training and support for online instructors (Levy & Beaulieu, 2003).

The literature is lacking studies discussing training for online faculty. Probable explanations include the emergence and growth of online faculty in the past decade or the specific needs and nature of each online college. Most research in this area consists of case studies at one's home college, due in part to researcher access (Moon

et al., 2003). Additionally new instructors, regardless of subject area, complete the same training so there is not a specific training for math faculty that has been documented in the literature (Wolf, 2006).

While little research exists about training faculty, Bawane and Spector (2009) cite five competencies that should be included in pedagogical training. These are designing instructional strategies, developing appropriate learning resources, implementing instructional strategies, facilitating participation among students, and sustaining students' motivation. Training, however, cannot be limited to just online pedagogy. All aspects of online instruction must be included for faculty training (Shelton & Saltsman, 2005). Bawane and Spector refer to eight roles of an online instructor including professional, pedagogical, social, evaluator, administrator, technologist, advisor/counselor, and researcher (2009). The range of training components varies greatly though among the colleges. Some may focus on the technical aspects of facilitation (Pankowski, 2004) while others go as far as to provide a mentor during the first class (Muirhead & Betz, 2002).

The consensus is clear nonetheless that online faculty training programs do need to include competencies beyond the technical basics. Best practices and ongoing training (Pagliari, Batts, & McFadden, 2009) should be incorporated not only to train the faculty but to ensure delivery of high-quality instruction to the students for sustained program growth. Given the growth in community college enrollments, these schools should constantly evaluate new online faculty training and ongoing professional development to provide an infrastructure complete with instructor resources and support to deliver high-quality, online instruction (Pagliari et al., 2009).

Higher education is continuing to grow their adjunct population especially in high need areas such as mathematics. The use of adjuncts in online courses has several implications such as disincentives, lack of pedagogy, and the deprofessionalization of college adjuncts. Adjuncts are compensated by class and contracted on a course by course basis. Growth and full-time opportunities are limited while pay remains stagnant and not dictated by performance. The lack of benefits and absence of yearly pay raises makes adjuncts attractive for online education since they are cheaper to employ and paid less per course than their full-time counterparts, although having comparable education. This should be a concern when assessing the quality of online education. Just as we recruit, train, and attempt to retain competent full-time instructors, the same standard should be applied in the adjunct population. Given the lack of growth and pay, math adjuncts have little motivation to grow as an instructor and obtain education related to their field or online education.

We also have to consider the pedagogical backgrounds of online adjunct instructors. Many instructors do have the required degrees or 18 graduate hours in their field however do not have online teaching experience. Delivering and facilitating an online math class does require knowledge and training, both of which can be limited in online faculty trainings. We should consider the experience level of incoming adjuncts and assess what skills they need in order to successfully facilitate their course. As the findings in this study showed, the instructor is not just a content expert but must master asynchronous communications as well as adding supplemental resources.

Finally, the deprofessionalization of adjunct math instructors should be addressed. While full-time faculty are encouraged to research and publish, thus adding

to the professional body of knowledge, adjuncts are either not required or encouraged to do so. The lack of professional growth can impact the quality of faculty being recruited and retained. Moreover, the pre-made structure of the courses inhibits instructors from expanding and improving the courses from one semester to the next. They are in a perpetual cycle of delivering the same materials in the same manner course after course. The unique instructor qualities that would emerge in a face-to-face course are diminished with a pre-prepared course.

In conclusion, there are several implications regarding the training, growth, and retention of online math instructors. Incentives for instructors to grow within the school, research, and modify course structure are a few ways to empower them. Adjuncts should be offered opportunities for growth in addition to comparable pay to the full-time instructors. Preliminary and on-going training should also be encouraged to allow adjuncts to grow as online instructors but also within their content area. With the number of adjuncts being hired in higher education, these considerations should be taken into account in order to provide the highest level of outcomes for both faculty and students.

Additional Limitations

There were several additional limitations discovered during the study. Although the instructors from the sample were employed at four different colleges, the generalizability of these finding to all online math courses is limited. The study represents the findings from this particular sample and thus may not apply to all instructors or settings. Next, the instructors were experienced online instructors and thus have unique experiences and perspectives related to teaching math online. They adapted and modified their pedagogical practices based upon their institutional

requirements and professional experience. Assessment feedback and student characteristics were not mentioned in the interviews. There was substantial focus on computer mediated communication, discussion posts, and requirements of both students and faculty. Finally given the length in years of online teaching for each participant, there is an inherent recall bias. It was assumed that all accounts represented accurate data and recall of past experiences.

Recommendations for Future Research

As with any study, questions still remain at the end and point towards directions for further research. Only the instructor experience was captured in this study and thus the student perspective would also be valuable. The instructor presence, communication practices, synchronous sessions, and taking math online are all topics that are worthy of continued study. Although the instructors use many sound best practices as viewed from the instructor perspective, they ultimately set-up the course and thus students are beholden to this configuration. More research is needed to corroborate the findings from this study, increasing the generalizability in addition to capturing the student perspective through in-depth interviews.

APPENDIX A
UF IRB APPROVAL

UF Institutional Review Board
UNIVERSITY of FLORIDA

PO Box 112250
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352-392-0433 (Phone)
352-392-9234 (Fax)
irb2@ufl.edu

DATE: December 3, 2012

TO: Heidi R. Fernandez
2400 Oak Bend Place
Newburgh, IN 47630

FROM: Ira S. Fischler, PhD, Chair
University of Florida
Institutional Review Board 02

SUBJECT: **Approval of Protocol #2012-U-1235**

TITLE: A Qualitative Investigation of How Instructors Communicate with Students and the Tools they use to Promote Communication in Online Courses

SPONSOR: None

I am pleased to advise you that the University of Florida Institutional Review Board has recommended approval of this protocol. Based on its review, the UFIRB determined that this research presents no more than minimal risk to participants, and based on 45 CFR 46.117(c), An IRB may waive the requirement for the investigator to obtain a signed consent form for some or all subjects if it finds either: *(1) That the only record linking the subject and the research would be the consent document and the principal risk would be potential harm resulting from a breach of confidentiality. Each subject will be asked whether the subject wants documentation linking the subject with the research, and the subject's wishes will govern; or (2) That the research presents no more than minimal risk of harm to subjects and involves no procedures for which written consent is normally required outside of the research context.*

The IRB authorizes you to administer the informed consent process as specified in the protocol. If you wish to make any changes to this protocol, ***including the need to increase the number of participants authorized***, you must disclose your plans before you implement them so that the Board can assess their impact on your protocol. In addition, you must report to the Board any unexpected complications that affect your participants.

This approval is valid through **November 20, 2013.** If you have not completed the study by this date, please telephone our office (392-0433), and we will discuss the renewal process with you. **Additionally, should you complete the study before the expiration date, please submit the study closure report to our office.** The form can be located at http://irb.ufl.edu/irb02/Continuing_Review.html. It is important that you keep your Department Chair informed about the status of this research protocol.

ISF:dl

APPENDIX B
INFORMED CONSENT FORM

Appendix C

Verbal Informed Consent

Protocol Title: A Qualitative Investigation of How Instructors Communicate with Students and the Tools they use to Promote Communication in Online Courses

Researcher: Heidi Fernandez

UFIRB #2012-U-1235

The following information will be read to participants prior to conducting the interview and recorded with the interview.

Purpose of the research study:

The purpose of this study is to investigate the manner in which instructors communicate with students in an online course. It will also explore the tools that instructors use to increase communication in online courses.

What you will be asked to do in the study:

You will be asked to participate in an interview. Your teaching background, methods for communicating with students, and the tools you use to communicate with students will be the topics covered in the interview. You may be asked follow-up questions after the interview for further clarification. You may also be asked to read the transcript to verify the accuracy of the content.

Time required:

The interview will last approximately 60-90 minutes

Risks and Benefits:

There are no perceived risks associated with this study. Participation in this study will not affect your standing or evaluation in the school in any manner. Benefits may be seen through improved communication and reflective practice.

Compensation:

There is no compensation for participation in this study.

Confidentiality:

Your identity will be kept confidential to the extent provided by law. Your name will not be used in any report. Any data you share about students or courses you teach will be

kept confidential. All data collected during this study will be password protected and only the researcher will have access to it.

Voluntary participation:

Your participation in this research is voluntary. There is no penalty for not participating. You can choose to stop participating at any time or ask for any of your contributions to be excluded.

Right to withdraw from the study:

You have the right to withdraw from the study at any time without consequence.

If you have questions about the study, please contact:

Heidi R. Fernandez, 2400 Oak Bend Place, Newburgh, IN 47630: phone (954) 384-6047

Dr. Erik Black, Dissertation Chair, 701 SW 16th Ave, Bldg. A, Division of General Pediatrics, University of Florida, Gainesville, FL 32608: phone (352) 275-7868

If you have questions about your rights as a research participant in the study, you can contact:

IRB02 Office, Box 112250, University of Florida, Gainesville, FL 32611-2250; phone 392-0433.

Agreement:

Please verbally confirm that you voluntarily agree to participate in the procedure, and I have your permission to proceed with the interview.

APPENDIX C
INTERVIEW PROTOCOL

Background Questions:

1. What is your gender, age, race, and educational background?
2. How long have you been teaching?
3. How long have you taught online?
4. Approximately how many online courses have you taught?
5. Which online courses have you taught?
6. Have you taken any online courses as a student?
    a. Which ones?

Main Questions:

1. How do you define communication? Interaction? Dialogue?
2. What types of communication do you have with students in online courses?
3. How do you encourage students to communicate with you?
    a. How do you encourage students to communicate with one another?
4. What are some of the tools that you use to communicate?
    a. How do you use these tools to increase dialogue?
    b. How frequently do you use them?
5. What are some tools that you are not using that you would like to incorporate?
6. Do you do anything to increase the communication between you and your students?
    a. If so, what?

b. How do you encourage communication?

c. Tell me about it.

7. How do you deal with inappropriate communication?
8. Do you find communication is an important component in online courses?
    a. Why?
9. Do you alter the structure of the course to increase dialogue?
    a. If so, how?
    b. Can you provide an example?
10. Do you find a difference in the types of communication you prefer and those that are preferred by students?
11. Describe a positive experience communicating in an online environment.
12. Describe a negative experience communicating in an online environment.

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BIOGRAPHICAL SKETCH

Heidi Fernandez graduated from the University of Florida in 2003 with a Bachelor of Arts in sociology and a minor in education. Upon graduation she taught 2nd grade at an elementary school in Florida. After teaching in the classroom, she found a love for teaching math and returned to school as an online student pursing her Master of Math Education at Walden University. Upon completing this degree, she transitioned to middle school teaching 8th grade math. While teaching middle school math, she earned her National Board Certification in early adolescent math.

Discovering a passion for math and online learning, she decided to combine the two and has over 5 years of experience teaching math online at high school and college. It was at this point that she decided to pursue her dream of earning a doctorate and enrolled at the University of Florida to study educational technology. Her passion for online education coupled with a love of math has driven her to pursue research in online math education and the best practices used to communicate with math students in an online environment.