HOW COGNITIVE REQUIREMENT OF PROMPT AND TIME IN COURSE ARE CORRELATED WITH INTERSUBJECTIVITY WITHIN THREADED DISCUSSIONS

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Abstract

Threaded discussions represent conversational turn-taking in asynchronous, online learning environments. Given the crucial role that discussions play in the construction of knowledge within an online course, the quality of the interaction that occurs within threaded discussions is important to achieving the learning objectives of the designed instruction. Despite this importance, research has consistently demonstrated that the threaded discussions could offer more substantial benefit to learning in constructivist environments. Three variables, two of which were considered elements of course design, were examined relative to threaded discussions: intersubjectivity, cognitive requirement of prompt (CROP), and time in course (TIC). Intersubjectivity is the representation of knowledge construction achieved through a synergistic progression from individual contributions to sequences of interdependent contributions. This variable was measured using the Interaction Analysis Model, a tool of content analysis developed in 1997 through a grounded theory approach. CROP was defined as the highest category in the cognitive process dimension of Bloom‘s revised taxonomy that was required within the response to a discussion prompt. TIC was the amount of course time that had elapsed before a particular message was posted to the discussion board, calculated as the percentage of course completion at the time the response was made. Peer responses (n=167) were examined from a wholly online communications course offered through an accredited community college. Both elements of course design, CROP and TIC, were found to have significant, positive correlations with intersubjectivity as a measure of quality in online classroom discourse. As online course delivery continues to grow, the challenge for instructional designers is the identification and implementation of those

course elements which facilitate intersubjectivity in online courses. This study demonstrated that the cognitive requirement of prompt and time in course are two elements that are related to the quality of discourse within threaded discussions. The initial prompt is one of the first pieces of scaffolding necessary for the knowledge construction requisite in a constructivist learning environment. Instructional designers should continue to recognize that the strength of the construction of knowledge, as evidenced in the threaded discussion, depends upon the strength of the scaffolding that supports that construction.

Dedication

It is with heartfelt nostalgia that I dedicate this dissertation to the memory of my mother, Phyllis Jean Mathews Miller, whose young death taught me that ―someday‖ is today.

Acknowledgments

The achievement of a doctoral degree occurs only with the support of many individuals. Much gratitude is extended to Dr. Rod Sims, my dissertation mentor and committee chair, and to the members of my committee, Dr. Nan Thornton and Dr. Ken Silber. I wanted a committee that would challenge my thinking, and these members fulfilled this obligation with earnest.

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My appreciation is extended also to my sister, Amy Deseree Goodrich, whose companionship, highlighters, and M&Ms made each colloquium both a learning experience and a family reunion. Of course, I am thankful for the family to whom I could always come home–my husband, Jeff, and my children, Ally, Willie, Matthew, and Elizabeth. They perpetually and patiently permitted me ―just a few more minutes" to finish ―just one more paragraph."

Finally, I am thankful for my father, James Edwin Miller, whose own intellectual genius and deep spirituality remind me that the most worthy knowledge is gained not through academic degrees, but through the sharing of love and laughter in everyday life.

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CHAPTER 1. INTRODUCTION

Since the second half of the last century, there has been a call for a paradigm shift in education from standardization to customization (Reigeluth,1999) and from the instructor-centered model focused on the dissemination of knowledge to the learner-centered model focused on the construction of knowledge (Reigeluth & Carr-Chellman, 2009). Concurrent with this call has been the growth of degree programs offered in wholly online formats (Allen & Seaman, 2010). In online course rooms that seek to facilitate knowledge construction, the discussion board is the most common space in which this collaborative knowledge construction is demonstrated (Calvani, Fini, Molino, & Ranieri, 2010). Furthermore, Gibson (2009) asserted that discussion-based teaching ―reverses the focus of the industrial-age paradigm by emphasizing learning as the priority, not teaching" (p. 102). Given the prominent role that these discussion areas play, Mäkitalo-Siegl (2009) called the discussion boards the ―life blood and center of energy" (p. 55) for the online course.

These areas usually take the form of threaded discussions, which represent a ―hierarchically organized collection of notes in which all notes but one (the note that started the thread) are written as ―replies' to earlier notes" (Hewitt, 2005, p. 568). This structure represents conversational turn-taking in asynchronous discussions. Given the role of the threaded discussion in the construction of knowledge that occurs within an online course (Calvani et al., 2010), the interaction that occurs within threaded discussions is important to achieving the learning objectives of instruction situated within a constructivist environment. Successful knowledge construction requires ―active and

broad participation" (Sing & Khine, 2006, p. 254) occurring at a higher level than surface interaction, as noted by Dennen and Wieland (2007). Knowledge construction at this more advanced level of interaction occurs through the opportunities for cognitive engagement required for the higher-order learning processes indicated by Bloom's taxonomy (Bloom & Krathwohl, 1956). Interaction alone neither produces nor demonstrates knowledge construction consistent with a constructivist perspective (Hall, 2010b). Thus, while interaction is inherent in constructivist learning, it is feasible to take interaction to a higher level known as intersubjectivity (Dennen & Wieland, 2007; Martin, Sokol, & Elfers, 2008).

Intersubjectivity represents the higher quality of synthesis represented in interactions needed to achieve the knowledge construction required in a constructivist environment and can be defined as the representation of knowledge construction achieved through a synergistic progression from individual contributions to sequences of interdependent contributions. Intersubjectivity relates to the coordination of individual contributions during the activity, thereby creating "continuity in activity progression" through "building on each other's contributions" (Matusov, 1996, p. 41). Similarly, Bober and Dennen (2001) defined intersubjectivity as the development of shared understanding that relates one situation to another, relying on artifacts created by the ongoing conversation to develop new contributions to the discourse.

However, as shown by the following studies, course room discourse among learners has consistently lacked this higher level of quality. Rather than the "sequences of dependencies" (Suthers, 2006, p. 4) required for intersubjectivity, researchers categorize student contributions as distinct presentations (Henri, 1992), information

exchange (Salmon, 2000), exploration (Garrison, Anderson, & Archer, 2001), shared stories (Romeo, 2001), serial monologues (Pawan, Paulus, Yalcin, & Chang, 2003), consecutive online notes (Hewitt, 2005), or superficial postings (Bures, Abrami, & Schmid, 2010; Ke, 2010). The learners themselves share this disappointment in the quality of online discussions, according to Chang (2003), who found that two thirds of students considered the discussions to be of insufficient value in supporting their learning.

Many factors influence intersubjectivity within the threaded discussions of online courses. As online course delivery continues to grow (Allen & Seaman, 2010), the challenge for instructional designers is the identification and implementation of those course elements which facilitate intersubjectivity in online courses situated within a constructivist framework. Two particular course elements that may influence intersubjectivity are cognitive requirement of prompt (CROP) and time in course (TIC). CROP is the level of thinking that should be evident in a response, indicated by the highest level of Bloom‘s revised taxonomy required to answer the discussion prompt. TIC is the amount of course time that has elapsed before a particular message was posted to the discussion board, as indicated by percent of course completed at the time the response is made. Some questions emerge about these elements of course design. What kinds of prompts lead to greater levels of intersubjectivity within the responses? Does intersubjectivity change at different points in time within a course? The study addressed these questions by measuring the connection between intersubjectivity and two aspects of the online course: the cognitive requirement of the prompt (CROP) and time in course (TIC).

This chapter provides a background for the study, a concise statement of the problem which this study seeks to address, the purpose and rationale of the study, the research questions, the nature and significance of the study, and the assumptions and limitations of the research.

Background of the Study

The question of how to increase and enhance the quality of interaction has been an important research goal (Hannafin, 1999). In a survey of research articles in the 20th century, Berge and Mrozowski (2001) concluded that one of the three topics addressed most often was how to increase interactivity. Parker (2004) accurately stated that ~~"th~~e greatest challenge for trying to define quality in any product or service is that quality remains a relative experience, realized in large part through an individual's level of expectation" (p. 387). While the exact definition of quality may be subjective, the quality of online threaded discussions has failed over the last two decades to meet the level of expectation of many individual researchers within the field.

The quality of online discourse emerged as a research question in the late 20th century. Henri (1992) noted that ~~"e~~ducators are not making use of the content of [computer-mediated communication] exchanges to further the learning process" (p. 114). Two years later, Wan and Johnson (1994) and Ackermann (1994) noted that learners often post only a single reply, rather than engaging in a more robust discussion of the course topic. Likewise, Hara, Bonk, and Angeli (2000) found that students posted about one message per week and the resulting discussions reflected one-way, rather than two-way, interaction. Consistent with the occurring shift from quantitative to qualitative

standards of online discourse, Duffy, Dueber, and Hawley (1998) argued for a shift in assessment from the structure of thinking to the quality of thinking. For example, the presentation of evidence is a structural component of an argument. If a post was judged strictly on the presence of evidence, the learner's post would be considered to have met the standard. However, if the quality of thinking was considered to be a more important component of assessment than the mere presence of any evidence, as Duffy et al. argued, the post would be judged in terms of the quality of that evidence, such as the credibility of the source and its relevance to the topic under discussion. Guzdial and Turns (2000) continued the call for quality discourse, recognizing that online discussions are often not sustained over time, lack broad participation, and veer away from course topics.

Research relating to the quality of online discourse continued into the first five years of this century. Järvelä and Häkkinen (2002) noted that the results of many studies, including their own, indicated low-level discussions that are ~~"s~~uperficial and egocentric" (p. 15). In a study of their *Framework of Evaluating Participation: Quality of Interaction*, Khine, Yeap, and Lok (2003) found that the majority of participants did not exhibit critical thinking and that nearly half of the messages posted by participants were independent statements that were not in reference or connected to prior messages (see Henri, 1992). Similarly, Pawan et al. (2003) described the majority of the online course discussions as focused on ~~"t~~he presentation of positions rather than in inquiry" (Instructional Factors and Pedagogical Interventions, para. 1). The learners themselves shared this disappointment in the quality of online discussions according to Chang (2003), who found that 65% of students considered the online course discussions to be of insufficient value in supporting their learning. Hewitt (2005) called the need for ~~"m~~ore

educationally worthwhile online discussions" a "persistent and widespread problem" (p. 569).

This problem has persisted within the last five years. Wickersham and Dooley (2006) called much of online discussion the "illusion of participation" (p. 186) and called for additional research on quality in online discourse. Similarly, Spatariu, Quinn, and Hartley (2007) considered studies improving the quality of online discourse as a "major research gap" (p. 44). Kanuka, Rourke, and Laflamme (2007) found that the discourse in their study was "not reflective … rarely went further than what was required … [and] resulted in desiccated discussions" (p. 267) that "resembled a document delivery system" (p. 268). Bradley (2008) also noted that the "quality of online discussion can be improved" and that "very little research has been conducted in this area" (p. 889). In their research on the relationship between motivation and quality discourse, Zhang, Koehler, and Spatariu (2009) noted the "lower levels of student reasoning in online discussions" (p. 195). In their investigation of a semantic forum for collaborative learning, Li, Dong, and Huang (2009) also noted the lack of "high-quality discourse" (p. 71) in the traditional online forum. Wise (2009), in considering reference points in the development of shared context, also recognized the problem of "low-quality interactions in online conversations" (p. 317). Even in an online course on critical thinking, Thompson (2009) noted that students often wrote "short, underdeveloped summaries" (p. 7). Jorcak and Bart (2009) continued to substantiate the need for intersubjectivity among discussion posts in order to construct group knowledge that is indicative of higher order thinking (Bloom & Krathwohl, 1956).

Despite extensive research over the last decade, quality in online discourse remains inconsistent and ephemeral. If intersubjectivity is the representation of knowledge construction achieved through a synergistic progression from individual contributions to sequences of interdependent contributions, then the opportunity certainly exists to identify those elements which influence intersubjectivity within these course room discussions (Boulter, 2010; Wang, Woo, & Zhao, 2009; Wruck, 2010). As online course delivery continues to grow (Allen & Seaman, 2010), the challenge for instructional designers is the identification and implementation of those course elements which facilitate intersubjectivity in online courses. Two such elements may be the cognitive requirements of prompts (CROP) used to elicit learner responses (Andresen, 2009; Donnelly, 2010; Gilbert & Dabbagh, 2005) and the time spent within the course term, or time in course (TIC; see Boulter, 2010; Christopher, Thomas, & Tallent-Runnels, 2004).

One element that may influence the quality of course room discourse, and the subsequent achievement of intersubjectivity, is the cognitive requirement of the initial prompt (CROP) (Andresen, 2009; Donnelly, 2010; Gilbert & Dabbagh, 2005). Questioning, a particular kind of prompt, is an ~~"in~~structional device in directing student thinking through productive discussion" (Wang, 2005, p. 304). From this definition arises the possibility of different ways to design prompts, as instructional devices or strategies, which influence student thinking. Indeed, nearly two decades ago, Rosenshine and Meister (1992) demonstrated that different types of question prompts elicit different responses and may lead to different learning effects. More recently, Wruck (2010) suggested that instructional designers could modify discussion questions in order to

influence learner responses. The recognition that CROP exerts an influence on learning calls for a way to group prompts so that they can be examined for their influence on subsequent discussion.

Many ways exist to categorize the multiple prompts designed within instructional materials for the purpose of generating and guiding course discussions. One way is to apply Bloom‘s taxonomy (Bloom & Krathwohl, 1956) of educational objectives, as done in a study by Christopher et al. (2004). Thus, an examination of the influence of CROP, as categorized using Bloom‘s taxonomy, on course room discussions is situated within the published literature.

The research literature has also considered time as another factor influencing discourse in online course rooms. Time has been explored in several ways, including comparing traditional and accelerated courses (Anastasi, 2007; Daniel, 2000; Kretovics, Crowe, & Hyun, 2005; Kucsera & Timmaro, 2010; Poellnitz, 2008; Seaman, 2004), day of posting and thread growth (Hewitt, 2005; Jeong & Frazier, 2008), time delay between postings (Cheung, Hew, & Ng, 2008; Garrison, Anderson, & Archer, 2000; Huntley & Thatcher, 2008; Pendergast, 2006; Tu, 2002), and changes from the beginning to the end of the course (Boulter, 2010; Christopher et al., 2004). Published studies suggest that the development of threaded discussions is related more to the time at which a message was posted than to the content of the message. However, the number of peer responses does not indicate the quality of those responses (Wruck, 2010). The coordination of perspectives evidenced within the content of the message is what determines whether or not intersubjectivity has been achieved (Dennen & Wieland, 2007; Wertsch, 1985).

Another way that time might influence course room discourse is at different points within the course. While research has considered changes in threaded discussions between the beginning and end of courses (Boulter, 2010; Christopher et al., 2004), many other points of time exist throughout the progression of a course. Does intersubjectivity look different at these multiple points in the course? The abundance of courses with varying lengths makes it difficult to examine intersubjectivity along these multiple points and across courses. In order to make accurate comparisons across courses of different lengths, time in course (TIC), which is measured as a calculated percentage of course completion, could be used.

Statement of the Problem

With the content of discussion posts ranging from substantive to irrelevant, the problem to be investigated by this study is the lack of consistent quality in learner-to-learner discussion board interactions.

One way to measure the quality of discussion posts is the level of collaborative knowledge construction, or intersubjectivity, achieved within the post (Dennen & Wieland, 2007; Penny & Murphy, 2009). Although the continued growth of online courses (Allen & Seaman, 2010) calls for a thorough understanding of the instructional design elements that influence intersubjectivity, the opportunity to examine many of these influential factors still exists (Boulter, 2010; Wang, Woo, & Zhao, 2009; Wruck, 2010).

Purpose of the Study

The purpose of the study was to investigate the relationships between intersubjectivity, as a measure of the quality of interaction in course room discourse, and (a) cognitive requirement of prompt (CROP) and (b) time in course (TIC) within the threaded discussions of online course rooms.

Rationale

A significant element for understanding the purpose of the study is establishing the connections between the design of the prompt and the dialogue that ensues. These connections have been established through the literature. According to Lim (2004), the communication that occurs in any learning environment is the most important aspect of the educational process that happens in that environment. Lim's assertion is consistent with social constructivism (Vygotsky, 1978), which acknowledges that interaction through dialogue is crucial to cognitive development. Since the majority of the dialogue in the online learning environment occurs through the discussion boards (Jeong, 2003; Schwartman, 2006; Thompson, 2009), learners who engage these discussion boards should be able to achieve a high level of cognitive processing (Thomas, 2002). The term intersubjectivity has been used to describe the result of learner-to-learner coordination within their individual, cognitive perspectives (Dennen & Wieland, 2007). An effective means of determining the level of cognitive process is Bloom's taxonomy (Jorgensen, 2009). Effectively planning the use of discussion boards is important in achieving this high level of cognitive engagement (Tu & Corry, 2003), and one element of planning for

cognitive engagement is the design of the initial discussion prompts (Asherian, 2007; DeLoach & Greenlaw, 2007). Therefore, additional research on these connections was warranted.

Research Questions

The purpose of the study was to investigate the relationships between intersubjectivity, as a measure of the quality of interaction in course room discourse, and (a) cognitive requirement of prompt (CROP) and (b) time in course (TIC) within the threaded discussions of online course rooms. There were two research questions.

1. What is the association between intersubjectivity and cognitive requirement of prompt (CROP) within the threaded discussions of online course rooms?
2. What is the association between intersubjectivity and time in course (TIC) within the threaded discussions of online course rooms?

Answers to these research questions addressed the stated problem of inconsistent quality in course room discourse by offering information about what relationship exists between the two elements of instructional design (cognitive requirement of prompt and time in course) and the identified measure of quality in course room discourse (intersubjectivity).

Nature of the Study

The research used a quantitative methodology to consider intersubjectivity, cognitive requirement of prompt (CROP), and time in course (TIC) within the discussion board of an online course. The explanatory correlational design employed content analysis, specifically the Interaction Analysis Model (IAM) of Gunawardena, Lowe, and Anderson (1997), to measure the intersubjectivity of student responses posted to the discussion

boards. As illustrated in Figure 2, the IAM has been used consistently, and increasingly, since its development. CROP was determined by the level of Bloom's revised taxonomy (Anderson & Krathworthl, 2001) required in a response to the prompt. TIC was calculated as the percentage of time that had elapsed between the beginning of the course term and the date on which a message was posted. The study included all peer responses within the threaded discussions of a wholly online course offered at an accredited community college. There were two raters to ensure reliability of coding. Inter-rater reliability was established through training and the two raters coding one set of data, measuring the reliability of coding, then discussing and resolving differences. There was no affiliation between the coders and the course in which the data were collected.

Significance of the Study

The process of knowledge sharing is different than its outcome (Reich, 2010). As online course delivery continues to grow (Allen & Seaman, 2010), instructional designers will have increasing opportunities to design learning activities that promote quality course room discourse. Rather than relying on heuristics (Silber, 2007; Woo & Reeves, 2007), instructional designers would benefit from the development of research-based principles on which to design the prompts directing the initial course room discussions. The purpose of the study was to investigate the relationships between intersubjectivity, as a measure of the quality of interaction in course room discourse, and (a) cognitive requirement of prompt (CROP) and (b) time in course (TIC) within the threaded discussions of online course rooms. This study added research to the knowledge base of instructional design by offering information about the relationship between the two

elements of instructional design (CROP and TIC) and the identified indicator of quality in course room discourse (intersubjectivity).

Assumptions and Limitations

There were several assumptions and limitations of the study, including its theoretical framework and generalizability. These limitations are more thoroughly discussed in Chapter 5.

This study has four assumptions. The study is framed by social constructionism, a learning theory the lineage of which can be traced from Kant (1781/2007) through Piaget (1952), Vygotsky (1978), and Papert (1991). Thus, one assumption of this study is the validity of the theoretical framework upon which it rests. The manifestation of and ability to detect evidence of knowledge construction within course room discussions are further assumptions. Another assumption of the study is that the design of the instruction influences the extent of knowledge construction that occurs within these discussions.

This study has three limitations. Two limitations are related to generalizability. The extent to which the results can be generalized to programs beyond the level of the institution (associate‘s degree) is one limitation. For example, learners could respond differently to the initial discussion prompts in bachelor, master‘s, or doctoral programs. The ability to generalize beyond the knowledge domain or the course topic (communication) examined is a further limitation. For example, learners could respond differently to the initial discussion prompts in courses on other topics, such as education or human services. Another limitation is the explanatory correlational design, which measures the degree of association but offers no predictive or causal descriptions.

Definition of Terms

Several terms are used in precise ways within this study. Therefore, those terms are defined here.

Cognitive requirement of prompt (CROP). The level of thinking that is required in a response; measured as the highest level of Bloom's revised taxonomy required within the response to a discussion prompt. This definition is supported by Wang's (2009) assertion that the "level of student thinking is directly proportional to the level of questions asked" (p. 310) and that higher-order thinking is represented in the top three levels of Bloom's taxonomy. Similarly, Christopher et al. (2004) also categorized discussion prompts according to Bloom's taxonomy.

Higher-order thinking. Actions represented within the top three levels of Bloom's revised taxonomy (Anderson & Krathworthl, 2001): analyze, evaluate, or create. This definition is supported by multiple studies, including Boulter (2010) and Wruck (2010).

Intersubjectivity. The representation of knowledge construction achieved through a synergistic progression from individual contributions to sequences of interdependent contributions. This definition was constructed from the initial definitions of intersubjectivity presented in philosophy (Husserl, 1931), sociology (McMahon, 1999), and psychology (Fişek, 2010; Natterson, 1993).

Prompt. A statement, question, or other description of the topic to which learners should respond in their initial discussion post (Brown & Green, 2009).

Threaded discussion. A "hierarchically organized collection of notes in which all notes but one (the note that started the thread) are written as 'replies' to earlier notes"

(Hewitt, 2005, p. 568) and represent "well-defined, easily identifiable artifacts [in which] the reply protocol roughly aligns with the notion of conversational turntaking" (p. 568).

Time in course (TIC). The amount of time that elapsed before a particular message was posted to the discussion board and was measured using percentage of course completion. This percentage is calculated using a procedure similar to that outlined in 34CFR668.22(f)(1)(i) for determining "period of enrollment" for the treatment of Title IV grant or loan funds. Thus, the total number of calendar days completed prior to the date on which the message was posted to the discussion board is divided by the total number of calendar days of the length of the academic term. The result is rounded to the nearest whole number.

Organization of the Remainder of the Study

The remainder of the study is discussed in the following chapters. The theoretical framework for the study and significant literature related to each element of the correlation are examined in Chapter 2. The methodology of the study is explained in Chapter 3, including the research design and strategy, measures of the variables and the validity and reliability of the selected instrument, data collection, and anticipated analysis. The data collection techniques and data analysis findings are described in Chapter 4. The study's conclusions, significance, and limitations, as well as suggestions for future research, are discussed in Chapter 5.

Summary

With the content of discussion posts ranging from substantive to irrelevant, the problem investigated by this study was the lack of consistent quality in discussion board

interactions. Although the continued growth of online courses (Allen & Seaman, 2010) calls for a thorough understanding of the instructional design elements that influence intersubjectivity, the opportunity to examine many of these influential factors still exists (Boulter, 2010; Wang, Woo, & Zhao, 2009; Wruck, 2010). The purpose of this study was to investigate the relationships between intersubjectivity, as a measure of the quality of interaction in course room discourse, and (a) cognitive requirement of prompt (CROP) and (b) time in course (TIC) within the threaded discussions of online course rooms. This study added research to the knowledge base of instructional design by offering information about the relationship between the two elements of instructional design (CROP and TIC) and the identified indicator of quality in course room discourse (intersubjectivity). The assumptions and limitations of the study are related to its theoretical framework and generalizability. The theoretical framework for the study and each element of the correlation (intersubjectivity, CROP, and TIC) are reviewed in the next chapter.

CHAPTER 2. LITERATURE REVIEW

The purpose of the study was to investigate the relationships between intersubjectivity, as a measure of the quality of interaction in course room discourse, and (a) cognitive requirement of prompt (CROP) and (b) time in course (TIC) within the threaded discussions of online course rooms. This section reviews the theoretical framework of the study, which is social constructionism and its roots in constructivism, and the three variables (intersubjectivity, cognitive requirement of prompt, and time in course) between which relationships were investigated.

Social Constructionism

The importance of the discussion post in online learning is rooted in social constructionism, a learning theory the lineage of which can be traced from Kant (1781/2007), Piaget (1952), Vygotsky (1978), and Papert (1991). An understanding of the origins of constructivism, and the subsequent departure of social constructionism, provides the theoretical framework for this study. Each distinction between the theories contributes something unique to the framework of this study.

Constructivism

Constructivism emerged from Immanuel Kant's (1781/2007) philosophical position that the only known reality is that which can be represented by human thought. The term "postepistemological" (Noddings, as cited in von Glaserfeld, 1995) has been used to refer to the way in which constructivism has evolved beyond its philosophical roots. As it expanded into the realm of education, constructivism came to be understood as both a theory of knowledge and a theory of learning. This dual recognition is important

to this study because the discussion board within an online course is where learning is prompted and knowledge is demonstrated.

In short, the theory of constructivism asserts that knowledge is actively constructed rather than passively received. This theory represented a monumental shift away from the idea that knowledge can be disseminated and acquired and toward the recognition of the value of experience in learning. Constructivism can be divided into cognitive constructivism, based extensively on the work of Jean Piaget, and social constructivism, based on the derivative work of Lev Vygotsky. In order to fully understand how social constructionism framed the study, it is necessary to explore cognitive and social constructivism from which social constructionism emerged.

Cognitive constructivism. As a psychologist, Piaget built his theory from the philosophical foundations of Kant (1781/2007). Just as Kant asserted that knowledge cannot be represented outside of human thought, Piaget (1952) asserted that the relationship between an individual‘s conceptual structures and the individual‘s experiential world was not one of representation of an independent reality, but of adaptation based on previously constructed perceptions (Von Glaserfeld, 1996). The term *cognitive equilibration* was developed by Piaget to account for his idea of a constant balancing process between assimilation and accommodation. Assimilation refers to organizing experiences within a learner‘s current understanding, while accommodation refers to the modification of current understanding as the learner experiences contradictions (Fosnot, 1996) or anomalies (Driscoll, 2005). This process of equilibration was used by Piaget to describe how an individual moved from one developmental stage to the next, until the end stage of formal operations was reached.

Social constructivism. Lev Vygotsky agreed with Piaget's developmental theories to a certain extent. However, Vygotsky (1978) rejected the idea of specific, invariant stages of development and argued that development depended on more than the individual equilibration process of Piaget (Driscoll, 2005). Thus, although a derivative of cognitive constructivism, social constructivism diverges in several ways.

One difference is the way cognitive constructivism focuses on the cognitive structuring process of the individual (Fosnot, 1996), while social constructivism emphasizes the sociocultural effects of the environment on the cognitive structuring process. A second difference is Vygotsky's (1978) emphasis on social interaction, as seen in his stress on dialogue, beyond Piaget's focus on contradiction and equilibration. This difference is important to this study, which examines the interaction that occurs through the discussion threads. It is through the discussion board that contradictions to individual constructions are presented, thereby triggering the process of accommodation. Another difference is Vygotsky's differentiation between concepts as either spontaneous or scientific. For Vygotsky, spontaneous concepts were those that occurred naturally through interactions with the environment, like learning language (Fosnot); these are the kinds of concepts that Vygotsky claimed were relevant to Piaget's (1952) idea of equilibration. Scientific concepts, however, were more logically defined abstractions that required formal, structured activities to learn. The range of interactions in an online discussion board includes both spontaneous and scientific concepts in the Vygotskian interpretation.

Von Glaserfeld (1995) offered a bridge between cognitive and social constructivism by noting Piaget's (1973) acknowledgement that the causes of

disequilibrium most often were found through interactions with others. Thus, social interactions, as emphasized by Vygotsky (1978), offer important opportunities for Piaget's (1952) process of adaptation, through accommodation or assimilation, to occur. In an online course, this process is prompted by and demonstrated through dialogue within the discussion threads. Whereas cognitive constructivism sees conceptual reorganization as the primary process of learning, social constructivism sees social enculturation as the primary process of learning. While followers of one type of constructivism consider theirs to be the primary process, they are also obliged to acknowledge the contributions to learning offered by the other type of constructivism. That is, as Cobb (1996) stated, ~~"~~it is as if one perspective constitutes the background against which the other comes to the fore" (p. 45). Thus, in terms of this study, advocates of either cognitive or social constructivism would have to acknowledge the role of the discussion board in the construction of knowledge.

In summary, constructivism is a learning theory derived from the work of Kant (1781/2007). Piaget's (1952) theory of assimilation builds on Kant's epistemology by suggesting that the equilibrium sought biologically is also sought cognitively. Development is equated with learning, and each stage of development, hence learning, occurs as equilibrium is achieved repeatedly. Vygotsky (1978) extended Piaget's work by emphasizing the socio-cultural effects, notably dialogue, on the processes of assimilation and accommodation from which equilibrium is achieved. The framework of the study was built on these ideas because the study recognized the importance of dialogue in the construction of knowledge. There was one more element to the framework for this study, however, that pushed past social constructivism into social

constructionism. Just as cognitive constructivism and social constructivism are derivatives of the larger concept of constructivism, so also is social constructionism derived from social constructivism. This relationship is illustrated in Figure 1.

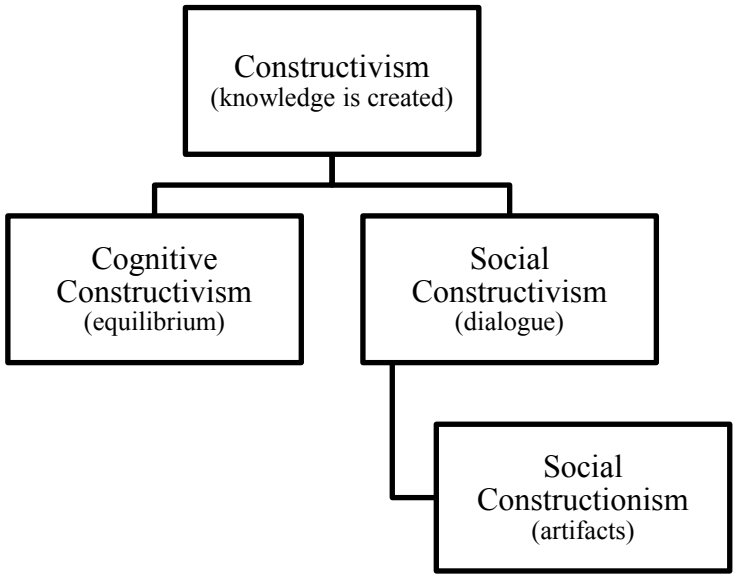

Figure 1. Relationship of theories and their contributions to the framework of study.

Constructivism contributes the broad theory that knowledge is created. As derivatives of constructivism, cognitive constructivism contributes the concept of equilibrium and social constructivism contributes the importance of dialogue. From social constructivism comes social constructionism and its contribution through the importance of artifacts.

Social Constructionism

Seymour Papert is credited with the foundation of constructionism. Papert spent five years (1959-1964) working with Piaget at the Center for Genetic Epistemology (Papert, 1980). Derived from Piaget's (1952, 1973) original constructivism, social

constructionism was developed as ―a new elaboration of the old idea of learning by doing" (Harel & Papert, 1991, p. 41). Impressed by Piaget's thinking of children as active knowledge builders, Papert wondered from what materials was this knowledge being built. Although the suggestion sounds humorous that constructionism descended from a soap-sculpture model (Papert, 1991), the model itself and the style in which other students approached their work were inspirational in the development of constructionism.

Constructionism rests on the idea that what first develops within an individual is the preference for a certain proximity to objects. From this preference for a particular degree of closeness to objects follows the individual's propensity to use abstract or concrete styles of thinking (Turkle & Papert, 1991). Thus, in constructionism, this proximity to objects is seen as another way to appropriate formal systems that allows for valid alternatives to abstract thinking. While Piaget's (1952) theory of development moved from the concrete to the formal, Papert (1980) asserted that formal reasoning is a style, not a stage. From a constructionist perspective, intellectual style refers to ways of thinking that keep people either close to or distant from objects. As such, constructionism suggests that a preference toward the concrete and relational intellectual style associated with a close relationship to objects is as equally valid as the abstract and analytical style associated with a distant relationship from objects.

While both constructivism and constructionism view learning as an act of constructing knowledge (Ackermann, 2001), constructionism goes on to suggest that learning occurs when the learner is constructing a ―public entity" (Harel & Papert, 1991, p. 1). The ―public entity" is the object, or artifact (Kafai & Resnick, 1996), which distinguishes social constructionism from social constructivism. Examples of such

objects in Papert's work included gears and turtles (Harel & Papert). The key is that the entity, artifact, or object is public, meaning it is both external and sharable. In this study, the created object or artifact was the threaded discussion, an object which is both external to the individual and shared with the public, conceived of as the other members of the course room. Indeed, Hewitt (2005) called the threaded discussions "well-defined, easily identifiable artifacts" (p. 568). Similarly, in their study of reference points, Wise, Padmanabhan, and Duffy (2009) suggested that objects do include initial discussions and subsequent exchanges in online discourse. The emphasis on objects is a key point of distinction between constructivism and constructionism.

Not only are ideas made, instead of transmitted, and not only are these ideas more likely to emerge during the construction of an artifact, these ideas are more likely to emerge because the process and the outcome of construction are personally meaningful to the learner. In addition, reflection, considered essential in adult learning (Mackeracher, 2004), is easier when there is an artifact on which to reflect. This newly created artifact then serves as material for future reflection and, subsequently, knowledge refinement and construction.

This led to Papert's recognition of affect and culture. Papert (1980) varied from Piaget (1952, 1973) in the role he attributed to the culture as a source of the materials – the entities, artifacts, and objects – needed for the building of intellectual structures. The acquisition of language serves as a good example of how cultural materials stimulate learning. When materials, like verbal speech, are present in the culture, complex and formal learning, such as is required for language, is spontaneous because there are plenty of opportunities for the learner to experience the language concepts in simple and

concrete ways. When these materials are not provided by the culture, such as trying to learn a foreign language without being immersed in a location where that language is spoken, deliberate, formalized instruction is required (Papert). In terms of this study, when a threaded discussion achieves intersubjectivity, meaning multiple perspectives have been presented and negotiated within the dialogue, the learner has more opportunities for spontaneous learning because he or she is immersed in a course room culture that is filled with the necessary materials for the construction of knowledge within that particular subject area.

Social constructionism supports the existence of multiple ways of knowing. Papert (1980) countered established dichotomies between ways of knowing, such as facts versus skills, "knowing that" versus "knowing how," or propositional knowledge versus procedural knowledge. Papert (1991) did acknowledge his "vendetta against the idea of any single explanation for mental phenomena" (p. 18). Similarly, Jonassen (1999) noted that "to impose a single belief or perspective is decidedly nonconstructivist" (p. 217). Accepting the validity of multiple ways of knowing and thinking, as suggested by constructionism's emphasis on proximity to objects, allows for an epistemological pluralism (Turkle & Papert, 1991) that is important to consider when approaching the design of instruction.

In summary, the study is framed by social constructionism and its emphasis on artifacts. The emphasis on objects that is presented by social constructionism is a key distinction from its superordinate theories of social constructivism and constructivism writ large. The discussion thread of an online course room, which was the focus of this study, was the object (social constructionism) that provided the materials for the process

of adaptation (cognitive constructivism) through social interaction and dialogue (social constructivism). With an understanding of the theoretical framework for the study, and specifically how this framework supports the threaded discussion as the focus of the study, attention can be turned toward each of the variables in the study.

Intersubjectivity

The outcome variable in the study was intersubjectivity. While interaction is inherent in all the forms of constructivist learning, intersubjectivity takes interaction to a higher level (Dennen & Wieland, 2007; Martin et al., 2008). This section distinguishes intersubjectivity from interaction and suggests why additional research was needed to understand how elements of instructional design can influence intersubjectivity.

Defining Intersubjectivity

Intersubjectivity is the representation of knowledge construction achieved through a synergistic progression from individual contributions to sequences of interdependent contributions. This definition was built from multiple descriptions provided in the literature of a variety of disciplines.

As a construct with its roots in multiple disciplines, intersubjectivity is described in multiple ways with discipline-specific connotations. Three disciplines from which intersubjectivity arose are philosophy, psychology, and sociology. From the phenomenological branch of philosophy (Husserl, 1931), intersubjectivity represents an interactional achievement between independent subjectivities, meaning people or personal experiences. As this concept expanded from philosophy to psychology, intersubjectivity became a theory of relationship between the psychoanalyst and the client

(Fişek, 2010; Natterson, 1993). As it shifted into sociology, intersubjectivity was recognized less as a static intersection of the personal experiences of individuals and more as the ―dynamic interplay between two participating subjective systems" (McMahon, 1999, p. 313).

The emphasis on participation is important to the construct of intersubjectivity used in this study. Successful knowledge construction requires ―active and broad participation" (Sing & Khine, 2006, p. 254) that occurs at a higher level than surface interaction, as noted by Dennen and Wieland (2007). According to Matusov (1996), who noted the difference between individual action and this higher level of ―participatory contribution" (p. 27), intersubjectivity represents how individual contributions are coordinated with each other during the activity, thereby creating ―continuity in activity progression" through ―building on each other's contributions" (p. 41). Matusov's description of intersubjectivity is consistent with the description of Baker, Hansen, Joiner, and Traum (1998) as the ―coordination of contributions in joint activity…not just overlapping of conceptualizations" (p.4). Similarly, Garrison, Anderson, and Archer (2001) noted that interaction must be ―coordinated and synergistic" (p. 21). From these descriptions can be ascertained that intersubjectivity involves participation that is coordinated and that progresses toward the goal of the activity.

These descriptions of intersubjectivity are reflected by other researchers, as well. These additional reflections bring the discussion closer to the construct of intersubjectivity used in this study. For Bober and Dennen (2001), intersubjectivity is the development of shared understanding that relates one situation to another, relying on artifacts created by the ongoing conversation to develop new contributions to the

discourse. The point that intersubjectivity involves relationship and reliance on artifacts is consistent with Suthers (2006), who called intersubjectivity the "sequences of dependencies based on the theoretical phenomena of interest, such as argumentation or collaborative knowledge construction" (p. 3). The idea of building something new, of the construction of knowledge, is reflected by Ligorio, Cesareni, and Schwartz (2008) in their conception of intersubjectivity as new understanding resulting from the combination of different perspectives. Similarly, Martin, Sokol, and Elfers (2008) asserted that "it is through participating within, taking, and coordinating perspectives, first in interactions and then in intersubjective engagements, with others that we become ... communal agents capable of operating within a diversity of perspectival systems" (p. 314). Just as Ligorio et al. separate the process of combining perspectives from the result of understanding, and as Martin et al. separate interactive and intersubjective engagements, Reich (2010) distinguishes ―processes of knowledge-sharing from their empirical result (which may range from full intersubjectivity to utter misunderstanding)" (p. 41). Likewise, Wells (1999), stated that "discourse is a means, not an end in itself, and verbal information is valued … for its use as a means towards the achievement of some larger purposes" (p. 231). These reflections build on the notion of intersubjectivity as participation that is coordinated and progresses toward the goal of the activity. These reflections add the idea that participation involves learner interdependency, rather than learner independence, and that the goal is knowledge construction. Thus, the definition of intersubjectivity is the representation of knowledge construction achieved through a synergistic progression from individual contributions to sequences of interdependent contributions.

Distinguishing Intersubjectivity

In addition to defining intersubjectivity, understanding this study requires distinguishing intersubjectivity from interaction. As Jerolmack (2009) pointed out, interaction does not require the shared understandings or intentions implicit in intersubjectivity. Furthermore, some interactions create barriers to knowledge construction (Matzat, 2010).

Interaction can be defined in many ways. One definition, offered by Wagner (1994), is "the reciprocal events that require at least two objects and two actions" (p.8). This definition, however, is too broad, as it lacks recognition of people (versus objects) and technology. Recognizing the vast expansion of computer-mediated interaction, Muirhead and Juwah (2004) described interaction as "a dialogue or discourse or event between two or more participants and objects which occurs synchronously and/or asynchronously mediated by response or feedback and interfaced by technology" (p.13). While this definition acknowledges people and technology, the definition is cumbersome and lacks explicit relevance to knowledge construction.

For this discussion focused on discourse as an indicator of collaborative knowledge construction in course-based, online learning, a useful definition is that of Gunawardena, Lowe, and Anderson (1997): "interaction is the process through which negotiation of meaning and the co-creation of knowledge occurs" (p. 407). Although the definitions provided by Wagner (1994) and Muirhead and Juwah (2004) describe interaction, these definitions do not describe the outcome of the actions beyond their occurrence. Another reason why the Gunawardena et al. definition is valid for a discussion about course-based discourse is the increasing use of the Interaction Analysis

Model from which the definition is drawn (Hall, 2010a). The idea of interaction as a process is a key point in distinguishing interaction from intersubjectivity.

Two Metaphors

Two metaphors may be useful in distinguishing the concepts of interaction and intersubjectivity (Hall, 2010b). The first metaphor is that of a puzzle. Interaction represents contributions that exist independently, like solitary puzzle pieces, or contributions that occasionally make connections with other contributions, like a few pieces that have been connected on the edges of the puzzle. Intersubjectivity, however, is the completed puzzle in which each piece, or contribution, connects and contributes to the greater whole.

The second is one of a traveling car, a metaphor that is consistent with the idea of an educational journey. In this case, interaction is the car and intersubjectivity is the destination. That is, the car is the method, or process, that is used to get to the destination, or end-product. If the car is interaction, and the destination is intersubjectivity, then the road is the discussion board, which serves as the medium for both the process – interaction - and the product – intersubjectivity. As a process medium, the discussion board is the work space in which perspectives are exchanged and negotiated through interaction. As an outcome medium, the discussion board provides the evidence that intersubjectivity has been achieved (Hall, 2010b).

Hypothetical Example

An example is useful in understanding the difference between interaction and intersubjectivity. In the following excerpt from a hypothetical threaded discussion in a

course on human services (Hall, 2010b), two students are discussing a case study from their text:

> Lucas: I think some people make the service delivery process too complicated. I don‘t know if it‘s the administrators or the practitioners themselves, but action is often slow and opportunities are missed.
>
> Takiyah: The decision-making process for a human services practitioner is very difficult. There are so many different players and contexts. It‘s hard to know what to do and in what order to do it. I am not sure there is enough guidance on who to help first.
>
> Lucas: The human services practitioner must put the child‘s needs above everyone else‘s needs. The adults in the situation can take care of themselves, or are at least more responsible for their actions than a child can be.
>
> This dialogue certainly fits within the definitions of interaction provided above.

The participants have demonstrated interaction, but not intersubjectivity. While the participants have exchanged views, they have neither negotiated nor constructed anything new from their contributions. By interacting at a higher level, intersubjectivity can be reached. Consider the difference when the following when the following excerpt is added to the discussion above:

> Takiyah: While the child‘s needs are certainly very important, I am not sure that their needs are always the most important or the first priority. Consider Bronfenbrenner‘s ecological systems theory. If we look at the situation from this theory, then everybody‘s needs affect everybody else. If the parents‘ needs aren‘t met, then that affects their ability to provide the child‘s needs.
>
> Lucas: That‘s a good point, Takiyah. I can see how there are needs of the individuals and of the family as a whole. If we look at the case study through this theory, then delivery process should look not at just one individual at first, but the whole family. We should look at the whole community, really, since there are many systems which affect this particular family.
>
> Again, this excerpt certainly represents an interaction. As in the excerpt above, the participants are exchanging views. This second exchange, however, demonstrates

negotiation of meanings (needs of individuals and needs of the family) and construction of new knowledge (practitioners should look at the entire system, beyond the family or a single individual). A return to the descriptions of intersubjectivity will illuminate this point.

Several descriptions of intersubjectivity have been drawn from the literature. Matusov (1996) noted that intersubjectivity requires "continuity in activity progression" through "building on each other's contributions" (p. 41). Such continuity and building is evident in the second discussion in several ways. Takiyah acknowledges the previous contribution of Lucas that the child's needs are important then suggests an alternative perspective. Lucas then begins his message by acknowledging Takiyah's point about ecological theory and then continues his message by extending this theory to the remainder of the case study under discussion.

The description of intersubjectivity offered by Baker et al. (1998) is also reflected in this second exchange. While the first exchange demonstrates an "overlapping of conceptualizations" (p. 4) of the service delivery process, the second exchange demonstrates the "coordination of contributions in joint activity" (p. 4). Each learner coordinates his or her contributions to the discussion by beginning from the position at which the previous learner concluded. Furthermore, both learners coordinated their responses using a theory explored in the course material as an anchor for their assertions.

According to Bober and Dennen (2001), intersubjectivity is the development of shared understanding that relates one situation to another and relies on artifacts created by the ongoing conversation to develop new contributions to the discourse. In the second exchange, Takiyah and Lucas do develop a shared understanding of the complexity of the

service delivery process and the possible application of ecological theory to this process. In addition, each learner relies upon the previous message as an artifact which is referenced in the continuing conversation. This demonstrates the ―sequences of dependencies" later described by Suthers (2006, p. 4).

The second exchange between Takiyah and Lucas also reflects Ligorio et al.'s (2008) conception of intersubjectivity as new understanding resulting from the combination of different perspectives. Both learners demonstrate a new understanding of the service delivery process as seen through material presented within the course. Their discussion involved the coordination of perspectives asserted by Takiyah, Lucas, and ecological theory. Like Ligorio et al., Martin et al. (2008) asserted that such coordination transforms the learners into "communal agents capable of operating within a diversity of perspectival systems" (p. 314).

With an understanding of intersubjectivity and its difference from interaction, attention can be turned to the influence that instructional design has on intersubjectivity, specifically the influence of design on the threaded discussion.

Influence of Design

Many elements of design can influence any instructional material, with many more design elements to consider when the instruction is delivered asynchronously online, such as the course this study examined. Two elements of design that are particularly important for online courses are the instructional design and the interface design. Although Ligorio et al. (2008) noted that tools are part of ―the architecture sustaining intersubjectivity" (p. 352), Sims (1997) previously summarized the popular viewpoint that ―quality in an instructional resource is a function of the design effort, not

the technology" (p.158). While this assertion is reminiscent of the great debate on media and methods by Clark (1983, 1994, 2001), Kozma (1994a, 1994b, 2000), and others, the point is particularly valid for the purposes of this study, which focused on how course design, not course technology, influenced the quality of interaction such that intersubjectivity is demonstrated. Indeed, Woo and Reeves (2007) noted that "design guidelines for interaction in online learning are more akin to heuristics than to research-based principles" (p. 16) and Niemczyk (2010) continued to call for additional "ways for supporting student construction of meaning in ill-structured learning environments" (Future Research, para. 1). In the next section, one of these instructional design elements – cognitive requirement of prompt (CROP) – is reviewed.

Cognitive Requirement of Prompt (CROP)

The first research question of the study asked about the association between intersubjectivity and cognitive requirement of prompt (CROP) within the discussion threads of online course rooms. The published literature has focused mostly on the moderation of online discussions, rather than the design of the prompts that initiate those discussions, as an instructional element that can promote higher-order thinking. Since Renaud and Murray (2007) concluded that there is an overlap between critical thinking and the higher order thinking exemplified in Bloom's taxonomy, research using either term is accepted as relating to intersubjectivity.

While Elder and Paul (1998) noted that thinking is driven by questions, not answers, Oliver (2008) pointed out that "the success of the activity can then be judged according to responses in the form of answers" (p. 2). It was asserted in this study that

intersubjectivity within discussion responses represents that success. This section explores existing research on the use of questions to promote intersubjectivity and examines the need for additional research on the connection.

Moderating Questions

As noted previously, the published literature related to questioning has focused more on questions posed by either instructors or peers within the dialogue than on the original questions or prompts that are written as part of the course design. The role of questions has been explored within the contexts of Socratic questioning and scaffolding within discussion moderation.

Socratic questioning. The use of Socratic questioning in discussion moderation is one way that cognitive requirement of prompt (CROP) has been explored in the literature. The Socratic method of questioning is called such because of the way in which Socrates encouraged the critical thinking and reflection of his student, Gaulcon, who eventually succeeded in constructing a new understanding of the topic (justice). The process of Socratic questioning involves assisting learners in developing their thinking and making that thinking explicit. Socratic questioning includes six categories (Paul, 1993): questions of clarification; questions that probe assumptions; questions that probe reasons and evidence; questions about viewpoints or perspectives; questions that probe implications and consequences; and questions about the question.

There is certainly a resemblance in the six categories of Socratic questioning and the six levels of Bloom‘s revised taxonomy (Anderson & Krathworthl, 2001) for the cognitive domain, which are remember, understand, apply, analyze, evaluate, and create. Thus, even though the studies related to the use of Socratic questioning focus on the

moderation of discussions rather than the design of discussion questions, the results of these studies have implications about the application of Bloom‘s taxonomy to CROP.

Although Boulter (2010) did not find a significant relationship between instructor-facilitated Socratic questioning and either frequency of participation or critical thinking skills, previous studies have found such a relationship. In a review of studies specifically focused on online teaching strategies, Yang, Newby, and Bill (2005) reported that the use of this questioning technique increased students‘ level of critical inquiry. These results were confirmed in a later study (Yang, 2008), which confirmed that use of Socratic questioning in online discussions has shown improvement in learner‘s critical thinking skills. These results influenced the current study by suggesting that initial discussion questions assessed using Bloom‘s revised taxonomy (Anderson & Krathworthl, 2001) could generate higher levels of critical thinking, or intersubjectivity, similar to the levels found in discussions posts responding to Socratic questioning. Socratic questioning can be considered as a specific scaffolding tool for the development and use of critical thinking skills in online discussions.

Scaffolding. The term *scaffolding* was introduced by Ausubel and Fitzgerald (1962) in their discussion of advance organizers. Using the metaphor of an anchoring post, Ausubel and Fitzgerald asserted that ―ideational scaffolding" (p. 244) that is clear and well organized serves as an anchor within a learner‘s cognitive structures that allows for meaningful learning and retention of new concepts. Rogoff and Wertsch (1984) related the concept of scaffolding with Vygotsky‘s (1978) conception of the zone of proximal development. Similarly, Sharma and Hannafin (2007) asserted that scaffolding ―operationalizes Vygotsky‘s relationship between instruction and psychological

development" (p. 28). As noted previously, the current study is rooted in social constructionism, another derivative of Vygotsky's social development theory. Thus, the concept of scaffolding offers some insight into the present study of the relationship between cognitive requirement of prompt (CROP) and intersubjectivity.

Consistent with the concepts of Ausubel and Fitzgerald's (1962) ideational scaffolding and Vygotsky's (1978) zone of proximal development, scaffolding includes the prompts used to initiate discussion in online course rooms. Teacher questioning in any form has been well-established as a form of scaffolding in the traditional, physical classroom (McLoughlin, 2002). As Rosenshine and Meister (1992) demonstrated nearly two decades ago, different types of prompts elicit different responses and may lead to different learning effects. Thus, different types of prompts should be designed to focus on different processes. More recent research shows similar findings that higher-level discussion prompts stimulate higher cognitive processes. Cho and Jonassen (2002) found that online argumentation scaffolds support students' problem-solving activities, and Tu and Corry (2003) concluded that 80-85% of learning is retained when acquired through higher-level discussion prompts. Jorgensen (2009) called for additional research ~~–to~~ identify how to improve the cognitive level achieved in learner initial discussions" (p. 118). In terms of this inquiry, the matter becomes the relationship between prompts classified according to the different levels of Bloom's revised taxonomy (Anderson et al., 2001) expected in the response and the level of intersubjectivity developed in those responses.

Most of the scaffolding provided within online discussions is dynamic, as the scaffolding is provided within the context of an ongoing dialogue. Initial prompts written

as part of the course design, however, are static. Saye and Brush (2002) called these types of scaffolds soft and hard, respectively. Both hard and soft scaffolding are needed for effective questioning, as suggested by Ge and Land (2002) and Sharma and Hannafin (2007). While soft scaffolds refer to those supports provided by instructors and peers, hard scaffolds refer to "static supports that can be anticipated and planned in advance" (Saye & Brush, p. 81). Since they are written during course design, initial prompts are consistent with the definition of hard scaffolds.

Initial Prompts

While the use of questions to promote the kind of critical thinking required for intersubjectivity to develop is well established in the literature (see Yang, 2008), there is less research on initial questions or prompts. Wang's (2005) definition of questioning as an ~~"~~instructional device in directing student thinking through productive discussion" (p. 304) is particularly useful to a discussion of initial discussion prompts. Beaudin (1999) found that the most effective way to keep online discussions on topic was to carefully design the original questions used to prompt the discussion. More recently, Cheung, Hew, and Ng (2008) and Lee (2009) noted that those discussion topics which students find interesting and relevant have a greater influence on participation. In a related conclusion, Donnelly (2010) suggested that the multitude of low-level messages might be a result of the design of the discussion forum and the questions that are posed to stimulate discussion. Chin (2004) and Wang (2005) agreed that carefully designed questions are required tools for cognitively engaging students. In fact, Wang asserted that the ~~"~~level of student thinking is directly proportional to the level of questions asked" (p. 310) and that

knowledge construction occurs through responding to high-level questions. This study contributed evidence as to the veracity of this assertion.

Although previous to this study cognitive requirement of prompt (CROP) was explored more as a part of the course design, rather than peer or instructor facilitation, there was a call for such an inquiry. Without the purposeful design of initial discussion questions, Oliver and McLoughlin's (2001) observation that online discussions "produce volumes of unproductive communication" (p. 156) might continue. A decade ago, Hara, Bonk, and Angeli (2000) noted the need for pedagogy that encouraged online learners to engage in discussions beyond the minimum requirements. Similarly, Halpern (2003) argued for the redesign of curricula to incorporate higher-order learning objectives for the purpose of improving the critical thinking abilities of students. The instructional design elements that guide asynchronous, online discussions were studied by Gilbert and Dabbagh (2005), who concluded that additional research was needed on the influence of the discussion question on meaningful discourse. In a recent review on critical thinking in online environments, Shedletsky (2010) wondered if the lack of critical discourse in asynchronous tools is a function of some pervasive influence. Other work continued this call for an "instructional antidote" (Topçu, 2008, p. 902) to insufficient evidence of knowledge construction in online learning. Such an antidote could be informed by the results of this study, which focused on the kinds of questions asked at the beginning of a discussion thread. Similarly, Hopkins, Gibson, Ros i Solé, Savvides, and Starkey (2008) concluded that there was still a great need to focus on those factors that encouraged specific forms of interaction among learners. This study addressed these calls for

additional research related to higher levels of thought required by original discussion questions.

Although two studies (Bradley et al., 2008; Christopher et al., 2004) were identified that examine cognitive requirement of prompt (CROP) and online discussions, these studies could not fill the gap in the literature related to how initial question design influences course room discourse. These studies are considered at length because of their relevance to the research undertaken in this study.

Christopher et al. (2004) examined the levels of thought in question prompts and student responses, and any changes over time, among 10 graduate students participating in a hybrid course on gifted education. Bloom's taxonomy (Bloom & Krathwohl, 1956) was applied to both the questions and the responses in this study. The researchers found no pattern of change in the level of thinking that occurred over the course of the semester. Similarly, the results indicated no relationship between the level of thinking required in the question prompt and the level of thinking demonstrated in the response. In addition, Christopher et al. noted that the students stayed within their customary range (low, moderate, or high) of critical thinking despite any difference in question prompt. Thus, the researchers considered that individual factors might account more for the level of critical thinking than did the discussion prompt.

In their research using three hybrid sections of an undergraduate child development course across two semesters, Bradley et al. (2008) used Bloom's taxonomy (Bloom & Krathwohl, 1956) to code the responses to questions designed in accordance with six types of questions investigated by Andrews (1980). The level of higher-order

thinking achieved in a response was one of three dependent variables, along with word count and degree of answer completion.

Overall, the researchers (Bradley et al., 2008) concluded that students engaged primarily in lower-order thinking across all six question types. The question types that resulted in higher levels of thinking were course link, brainstorm, and direct link. Course link questions required the integration of a course concept with a topic from an assigned ―hot topic" article. Students often used prior knowledge and outside resources when answering these questions. Brainstorm questions solicited all possible solutions to an identified issue, while direct link questions targeted a specific portion of the assigned article and asked students to interpret or analyze this particular section. In answering both of these question types, students tended to drawn upon prior knowledge and personally relevant examples from their professional contexts. The other three types of questions (limited focal, open focal, and application) did not require students to make inferences in their answers. Drawing inferences within an answer would likely involve analysis, synthesis, or evaluation, consistent with the higher levels of Bloom's original taxonomy (Bloom & Krathwohl, 1956).

Several clear differences are present between the Bradley et al. (2008) study and the research undertaken in this study. One difference was the population and context of the studies. Bradley et al. used hybrid courses from a single discipline (child development) at the undergraduate level, while the current study focused solely on online courses. Another difference between the studies was the way in which Bloom's taxonomy was applied. The original taxonomy was used in the Bradley et al. (2008) study while Bloom's revised taxonomy (Anderson et al., 2001) was used in the current

study. In addition, the taxonomy was applied to the answers in the Bradley et al. study, whereas the taxonomy was applied to the prompts in the current study. A brief exploration of Bloom's revised taxonomy is conducted in order to justify its use in the current study.

Bloom's revised taxonomy. Bloom's revised taxonomy (Anderson et al., 2001), as illustrated in Figure 2, can be envisioned as a pyramid in which the lower half refers to lower-order cognitive processes (remembering, understanding, and applying) and the top half refers to higher-order cognitive processes (analyzing, evaluating, and creating).

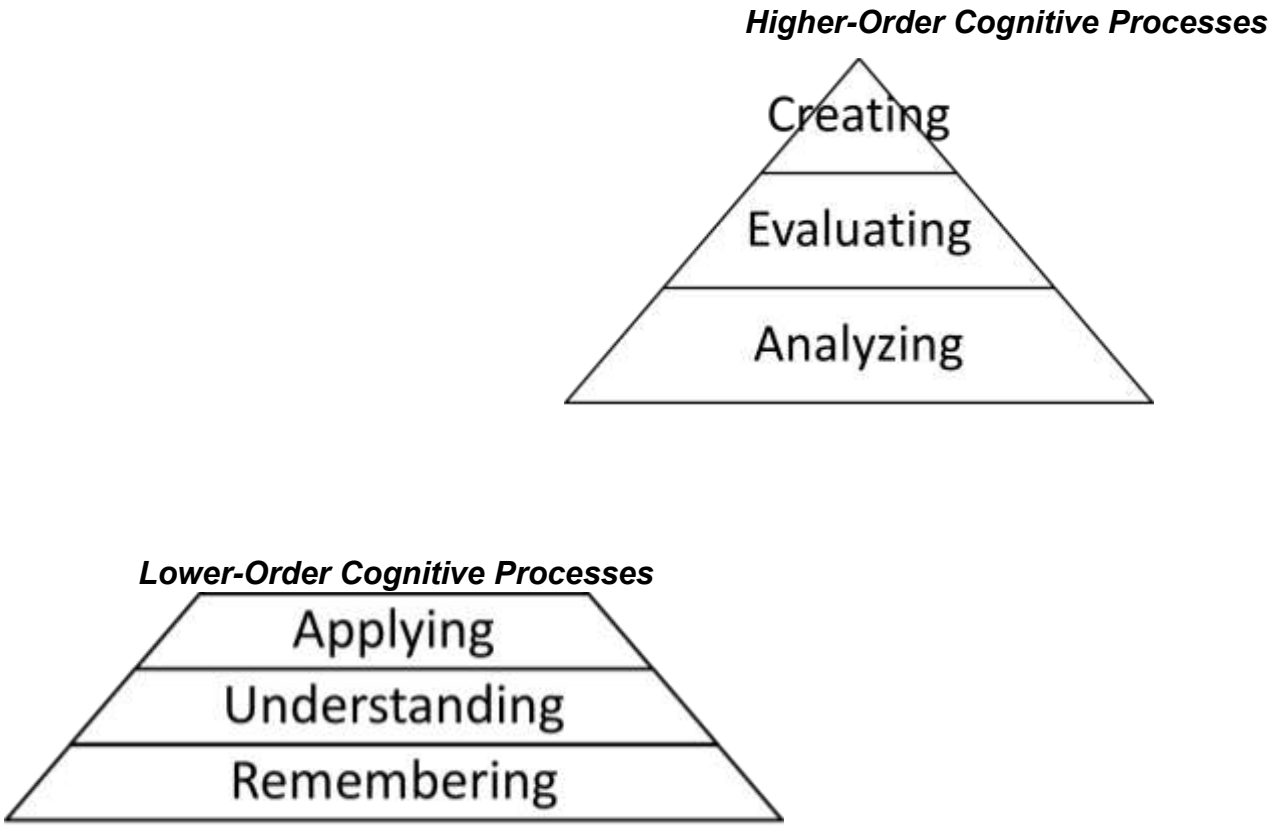

Figure 2. Higher- and lower-order cognitive processes associated with Bloom's revised taxonomy.

There are many philosophical approaches to knowledge and many ways to categorize knowledge. The knowledge dimension of Bloom's taxonomy admittedly presents just one classification. As Anderson et al. (2001) noted,

> Given the many different terms and the lack of agreement about the many aspects of the knowledge dimension, it is a difficult task to develop a taxonomy of knowledge that captures the complexity and comprehensiveness of our knowledge base while being relatively simple, practical, and easy to use, as well as maintain some parsimony in the number of categories. (p. 41)

The knowledge dimension of Bloom's taxonomy does not distinguish levels of knowledge, in the sense of levels being higher or lower than other levels. Rather, the taxonomy distinguishes categories of knowledge. The categories simply are different without reference to relative depths of knowledge. Unlike the knowledge dimension, the cognitive process dimension does address levels that are relative to one another as indicators of cognitive depth. Consider, for example, the cognitive processing differences between remembering and creating. Thus, the cognitive process dimension offers a scale on which prompts can be coded.

The literature supports the use of Bloom‘s revised taxonomy (Anderson et al., 2001) in exploring initial question design, including its use to evaluate e-learning. Although somewhat obvious, Athanassiou, McNett, and Harvey (2003) concluded that there was a growing awareness in the usefulness of the taxonomy among university educators involved in curriculum design. That same year, Chyung and Stepich (2003) noted the utility of Bloom‘s taxonomy as a guide in critical component of instructional design - developing congruence between the objectives, activities, and outcomes of a graduate-level, online course.

Halawi, McCarthy, and Pires (2009) used the revised taxonomy to study the relationship between individual factors, instructional factors, and learning outcomes through one particular online platform. While the results of their study suggested that individual and instructional factors do not play a major role in the learning process, the study and its findings were limited in several aspects.

The study is limited by its small size and narrow generalizability. The small sample (n=51) was drawn from students in only one management information course at a single university. Thus, results of the study can be generalized to only similar students in a similar course at a similar university in a similar region. This is an important factor considering the data collection instrument focused solely on the students‘ opinions, rather than an objective measure of performance.

The operational definition of the variable instructional factors (Halawi, McCarthy, & Pires, 2009, p. 376) is another problem for the study. Instructional factors were considered the effectiveness of the tools used, interaction with the professor, and ease of use of technology, two of which were dropped during factor analysis. These elements lack necessary breadth to represent a variable as diverse as ―instructional factors.” Also, as stated previously, only opinions were used to measure these constructs, rather than using more objective measures of performance like transcript analysis.

The data collection instrument in the Halawi et al. (2009) study consisted of a survey developed by combining two previous questionnaires which did not use Bloom‘s taxonomy as their basis. Thus, the adapted instrument used could have had unrecognized issues with validity or reliability. The focus on the opinions of the students means that only perceptions of outcomes, rather than actual outcomes, were studied. In addition, the

adapted instrument asked only 22 questions, nine of which were demographic in nature related to the variable of individual factors. Only one of the questions related to the ―instructional factors" variable addressed course discussions, and this one question combined the participants' opinions on course discussions with the private email and calendar functions of the platform. Thus, this study (Halawi, McCarthy, & Pires, 2009) does not consider how Bloom's taxonomy is applied to discussion questions used to generate course room dialogue.

These studies (Athanassiou, McNett, & Harvey, 2003; Chyung & Stepich, 2003; Halawi, McCarthy, & Pires, 2009) did support the use of the taxonomy in the research conducted in this study. The need for such a study was reiterated by Jorgensen (2009), who recommended that ―additional research be carried out to determine if discussion questions written at a higher cognitive level according to Bloom's Taxonomy could impact the cognitive level of responses posted" (p. 122).

In this section, research was reviewed on the influence of questions on the kinds of critical thinking and higher order thinking skills required for the development of intersubjectivity. While much of the research has focused on the use of moderating questions, such as the Socratic Method, as forms of instructional scaffolds, there was some research on initial question design. This research called for additional examination of the use of questions on cognitive development, similar to that conducted by the current study on the influence of cognitive requirement of prompt (CROP) and intersubjectivity. In addition, the use of Bloom's revised taxonomy (Anderson & Krathworthl, 2001) was justified using several sources from the literature. The next section reviews time in course (TIC) as the third variable in this study.

Time in Course (TIC)

The second research question asked about the association between intersubjectivity and time in course (TIC) within the discussion threads of online course rooms. TIC referred to the calculated percentage of time that had elapsed since the beginning of the course. There is a distinct difference that should be noted between the concepts of course length and TIC. The former concept considers only two points within the term of the course, those being the beginning and the end, while the latter concept considers multiple points of time throughout the term. Although a study was not identified in which TIC was related to intersubjectivity, time has been explored in several other ways within past literature. These ways include comparing traditional and accelerated courses, day of posting and thread growth, time delay between postings, and changes from the beginning to the end of the course.

One way in which time has been studied is through comparisons of courses offered during traditional and accelerated terms. Anastasi (2007) found that academic performance and course evaluations were consistent between courses offered in traditional and accelerated terms. These findings are similar to previous results described by Kretovics, Crowe, and Hyun (2005), Seaman (2004), and Daniel (2000). Similarly, Kucsera and Timmaro (2010) and Poellnitz (2008) found that instructors‘ effectiveness was equivalent between traditional and accelerated courses. Since academic performance or instructors‘ effectiveness are consistent among a variety of course lengths, the length of the course in this study did not present a confounding variable.

Another way that time has been explored is through its relationship with opportunities for participation. In an analysis of several studies of online participation,

Cheung, Hew, and Ng (2008) identified the availability of time as a factor that influences participation. Since students can continue conversations at any time, including after the primary discussion timeframe has passed, they can use this additional time to reflect or to ask questions. Many students in Meyer's (2003) study expressed appreciation for the equitable nature of online discussions, in that each student had the opportunity to express himself. This democratic sentiment is similar to the justification of discussion-based teaching asserted by Brookfield and Preskill (2008). Among other factors, a physical classroom and scheduled class time can inhibit equitable discussion. Previously, Meyer had noted that online discussions expand the amount of time that is spent on course objectives.

Time has also been explored by examining the relationship between when messages are posted and thread growth. Jeong and Frazier (2008) examined how the day in which messages are posted (early, midweek and weekend) and found that the day of posting had a significant effect on the number of responses elicited per message. The later in the week an initial message was posted, the fewer the number of peer responses posted to that message. This finding seems intuitive, as there is less time to respond before the close of unit at the end of the course week. However, Hewitt (2005) had previously noted that thread growth is stunted by attending to new posts and ignoring older posts. The finding that learners pay more attention and respond to the recent messages, rather than to the previous messages, would suggest that more responses would occur toward the end of the week, as learners attempt to comply with course expectations related to the number of peer responses per unit.

A fourth way in which time has been explored within the literature, related to course room interaction, is the time between initial posting and response. Although Garrison, Anderson, and Archer (2000) suggested that more time for critical reflection and to formulate a coherent, written argument is needed for intersubjectivity to develop in online discourse, other researchers have suggested that limiting time frames for discussion threads and the replies within these discussion threads would improve interactivity and social presence. Tu (2002) suggested defining an appropriate response time, such as within 72 hours, while Pendergast (2006) suggested limiting the time frame for the entire discussion, such as locking a discussion at the end of the unit. However, later research by Huntley and Thatcher (2008) concluded that time delay between discussion posts was not related to the knowledge construction that occurred within either the content of the individual discussion postings or the highest level of knowledge construction achieved within an entire discussion thread.

Two studies have contributed to the understanding of student responses and course length, though not time in course (TIC). Christopher et al. (2004) examined the levels of thought in question prompts and student responses, and any changes over time, among 10 graduate students participating in a hybrid course on gifted education. The researchers found no pattern of change in the level of thinking that occurred over the course of the semester. Although Boulter‘s (2010) study was not specifically about interaction and course length, she did note a small but significant indication that the depth of critical thinking exhibited within discussions increased toward the end of an 11-week course in both the treatment and control groups, using Socratic questioning as an intervention.

Now that each variable has been reviewed, the selected instrument for measuring the outcome variable, intersubjectivity, is examined.

Interaction Analysis Model (IAM)

Both research questions in the research conducted in this study related a particular characteristic of threaded discussions (cognitive requirement of prompt or time in course) to the construct of intersubjectivity. The instrument selected to measure intersubjectivity within the discussion threads of the online course rooms is the Interaction Analysis Model (IAM) developed by Gunawardena et al. (1997) and presented in Appendix A. This model, part of the broader category of content analysis, is one of the most frequently used tools for identifying the levels of knowledge construction within computer-mediated communication (Hall, 2010a). The framework of content analysis and the development of the IAM are discussed in this section, while the validity of the IAM is presented in Chapter 3.

Content Analysis

The IAM is one tool in the larger toolbox known as content analysis. As a broad term, content analysis represents various kinds of textual analyses that compare, contrast, and categorize data (Neuendorf, 2002). Although not called content analysis at the time, the Catholic Church demonstrated the first known application of content analysis in the late 1600s when it conducted a systematic examination of early newspapers in order to track the proportion of printed texts which were nonreligious (Krippendorff, 1980).

The actual term ―content analysis" first appeared in a book written in 1940 by Waples, Berelson, and Bradshaw (Hopkins, 2010). The authors of the book originally

defined content analysis as the ―objective, systematic, quantitative description of the manifest content of communication" (Berelson, 1952, p. 519). This focus on the quantitative description continued until 1984, when Woodrum (as cited in Clarà & Mauri, 2010) suggested that content analysis was situated between quantitative and qualitative approaches because the qualitative aspects of the text are transformed into codes that are analyzed with quantitative procedures. In noting the qualitative aspects of context analysis, Woodrum opened the door to the well-known qualitative content analysis method developed by Henri (1992). Henri's method is discussed in the section, ―Development of the IAM," as the basis for the instrument used in this study. The middle ground proposed by Woodrum is consistent with the interactive continuum of methodologies espoused by Newman and Benz (1998).

Content analysis has been established as an effective method for analyzing computer-mediated communication (Krippendorff & Bock, 2008) and is widely used in the field of computer-supported collaborative learning (Strijbos & Stahl, 2007). In terms of illuminating the learning process, content analysis can be used to better understand how learners present and refine their ideas and collaborate with other learners (Blake & Rapanotti, 2001). A key requirement of this now established social science methodology (Herring, 2010), according to one of the original authors who coined the term, is that ―all of the relevant content...be analyzed in terms of all of the relevant categories" (Berelson, 1952, p. 17). In the current study, all of the relevant content includes all of the learner posts within the course, and all of the relevant categories include the phases of the IAM (Gunawardena et al., 1997). Thus, the current study accomplishes the key requirement of

content methodology by comparing all learner-to-learner posts with all the categories of the IAM.

Development of the IAM

Gunawardena et al. (1997) first reviewed existing interaction analysis models in search of one that would be appropriate to analyze the transcript of a computer conference. The researchers considered several of the models reviewed by Mason (1991). These models included the message maps of Levin, Kim, and Riel (1990) which served as diagrams of conference conversations. The researchers also reviewed the model of Henri (1992), which evaluated conference content related to the social and interactive dimensions and cognitive and metacognitive skills. The model of Garrison (1992) was examined, too, as this tool measured critical thinking in both face-to-face and computer-supported group learning. The researchers also considered the work of Newman, Webb, and Cochrane (1995), who suggested that the five stages of Garrison's critical thinking related to the cognitive skills dimension of Henri's model. Upon testing these models to the transcripts of the computer conference, Gunawardena et al. concluded that the models were insufficient because they focused on a teacher-centered instructional paradigm, failed to distinguish between cognitive and metacognitive dimensions, or interpreted interaction as "mechanistic and descriptive" (p. 407). In a later publication (Gunawardena, Lowe, & Anderson, 1998), the researchers suggested that settling for the previously identified measures "is to overlook the unparalleled opportunity to observe knowledge construction in progress offered by transcript analysis" (p. 2).

Upon identifying the shortcomings of the existing interaction analysis models, Gunwardena et al. (1997) proceeded to use a grounded theory approach to develop their

own model, the IAM, which is the instrument used in this study. The researchers analyzed the transcript looking for four elements: types of cognitive activity performed, types of arguments advanced, resources used to explore and negotiate new meanings, and evidence of changes in personal knowledge constructions. These four elements were used to outline the process of negotiation representative of the social construction of knowledge. This process includes the five phases of sharing/comparing, dissonance, negotiation/co-construction, testing tentative constructions, and statement/application of newly-constructed knowledge. Each of the five phases within this model has three, four, or five indicators. The model is illustrated in Appendix A.

After developing the IAM using the principles of grounded theory, Gunawardena, et al. (1997) applied the IAM to the debate transcript. The unit of analysis was determined to be a participant's entire, single message because the message "embodied a participant's cognitive activity and contribution to the construction of knowledge" (p. 416). All five phases of the model were identified within the conference transcript, supporting the efficacy of the model for interaction analysis within constructivist environments. The validity of the IAM is discussed in Chapter 3.

Significance to Field of Instructional Design

As online course delivery continues to grow (Allen & Seaman, 2010), instructional designers will have increasing opportunities to design learning activities that promote quality course room discourse. Rather than relying on heuristics (Silber, 2007; Woo & Reeves, 2007), instructional designers would benefit from the development of research-based principles on which to design the prompts that direct the initial course room discussions. The purpose of this study was to investigate the relationships between

a measure of the quality of interaction in course room discourse, intersubjectivity, and the instructional design elements of cognitive requirement of prompt (CROP) and time in course (TIC). This study adds research to the knowledge base of instructional design by offering information about the relationship between the two elements of instructional design (CROP and TIC) and the identified indicator of quality in course room discourse (intersubjectivity).

Summary

Social constructionism, and its roots in constructivism, was examined as the theoretical framework for the study. Each of the three variables, which are intersubjectivity, CROP, and TIC, was reviewed within the context of the relevant literature. While interaction has been explored within the literature, this chapter noted the difference between interaction and intersubjectivity and identified significant gaps in understanding how elements of instructional design contribute to intersubjectivity. Similarly, while the role of questions and the impact of time have been explored in the literature, conclusions are contradictory or only indirectly related to the variables of this research. This study fills some of those gaps by examining the relationship between intersubjectivity and the design elements of CROP and TIC. The data collection instrument (IAM) used to measure intersubjectivity was examined. The results of this study assist instructional designers in understanding the influence of these design elements on the collaborative construction of knowledge in online courses. In Chapter 3, the quantitative methodology and correlational design are discussed.

CHAPTER 3. METHODOLOGY

The purpose of the study was to investigate the relationships between intersubjectivity, as a measure of the quality of interaction in course room discourse, and (a) cognitive requirement of prompt (CROP) and (b) time in course (TIC) within the threaded discussions of online course rooms.

The previous chapter explored the existing literature on the theory of social constructionism and the influence of discussion prompts and time on the intersubjectivity displayed in threaded discussions. This chapter explains the methodology of the current research as it is situated within the literature explored in the previous chapter. The philosophical foundations and methodological assumptions of the research design are briefly reviewed as they relate to the justification of the selected research method. The research questions are posed and the definitions of the variables are reviewed. The sampling design is explained, the data collection plan is described, and the data analysis plan is introduced. The final topics discussed in this chapter are the strategies employed to reduce threats to validity and the ethical issues related to the research conducted. The research design is explored first.

Research Design

The research design is the link between the research methods and the philosophical foundations and methodological assumptions of a particular approach. This research employed a quantitative methodology to consider intersubjectivity, cognitive requirement of prompt (CROP), and time in course (TIC) within the discussion threads of online course rooms. Creswell (2009) called the different designs within each

research method –strategies of inquiry" (p. 11). Quantitative strategies of inquiry include experimental and non-experimental designs, distinguished by the ability to directly manipulate an independent variable (Vogt, 2007). The current study used a non-experimental design because an independent variable was not manipulated; instead, the study examined the correlation between the variables and did not examine causation. An explanatory correlational design was used to measure the relationships between the variables. A brief review of the philosophical foundation and methodological assumptions of the quantitative approach support its use in this study.

Philosophical Foundation

The philosophical ideas behind any study should be illuminated because of their influence on the research (Creswell, 2009). The quantitative approach assumes reality is a single, tangible construct that keeps the –knower" and the –known" relatively independent (Yu, 2006). This approach seems contradictory to the study's theoretical framework of constructivism, which suggests that the –knower" and the –known" are inextricably intertwined. Constructivism is usually associated with a qualitative, rather than quantitative, methodology. Fortunately, as asserted by Strijbos and Fischer (2007), the best approach to address a particular research question may not be the approach most compatible with a researcher's particular philosophy or tradition. Instead, researchers should note that —itsi both possible to subscribe to the philosophy of one approach and employ the methods of the other" (Gelo, Braakmann, & Benetka, 2008, p. 268). This recognition is embraced within the current study in which the researcher subscribes to the philosophical foundations of a qualitative approach (social constructionism) while appreciating the necessity of a quantitative approach for the research questions posed.

Given the adoption of a quantitative methodology, the assumptions associated with that methodology can be considered briefly.

Methodological Assumptions

Quantitative studies are theory-driven because they start with a new or existing theory and then lead to a deduction about whether or not the theory is supported; thus, a quantitative study is appropriate when the purpose is to test a theory, thereby explaining, predicting, confirming, or validating the idea under study (Leedy & Ormrod, 2005). This study began with the theory of social constructionism and used this theory in explaining the relationship between three variables. The quantitative approach is nomothetic in that it is extensive and generalizing (Lamiell, 1998). With this brief introduction to the philosophical foundations and methodological assumptions of the research design, attention can now be turned to the particular elements of the method for this research.

Research Method

The procedures and techniques involved in data collection, analysis, and interpretation, in addition to sampling, comprise the topic of research methods. In this section, data collection, including sampling and coding, and data analysis are addressed. The development of the instrument to measure intersubjectivity was explored in Chapter 2, while the validity of that instrument is discussed later in this chapter. As a means of review, the research questions and definitions of the variables are offered first.

Research questions and variables. The purpose of the study was to investigate the relationships between intersubjectivity, as a measure of the quality of interaction in course room discourse, and (a) cognitive requirement of prompt (CROP) and (b) time in course (TIC) within the threaded discussions of online course rooms.

Cognitive requirement of prompt (CROP) is the level of thinking that should be evident in a response to a discussion prompt. This definition is supported by Wang's (2009) assertion that the ―level of student thinking is directly proportional to the level of questions asked" (p. 310) and that higher-order thinking is represented in the top three levels of Bloom's taxonomy. Similarly, Christopher et al. (2004) also categorized discussion prompts according to Bloom's taxonomy. Time in course (TIC) is defined as the amount of time that elapsed before a particular message was posted to the discussion board and will be measured using percentage of course completion. Intersubjectivity is the product of knowledge construction resulting from the coordination of multiple perspectives among learners engaged in course room discourse (Hall, 2010b). There were two research questions.

1. What is the association between intersubjectivity and CROP within the threaded discussions of online course rooms?
2. What is the association between intersubjectivity and TIC within the threaded discussions of online course rooms?

With this review of the research questions and variables, the data collection and analysis can be introduced.

Data Collection

Data for the research was collected from the archived transcript of one undergraduate level, wholly online course at a regionally accredited school. Content analysis, which represents various kinds of textual analyses that compare, contrast, and categorize data (Neuendorf, 2002), was used to review the transcript of the threaded

discussions. The validity of the data collection instrument, the sampling design, and coding are discussed in this section.

Validity of the IAM

Both research questions in the study related a particular characteristic of threaded discussions (cognitive requirement of prompt or time in course) to the construct of intersubjectivity. The instrument selected to measure intersubjectivity within the discussion threads of the online course rooms was the Interaction Analysis Model (IAM) developed by Gunawardena et al. (1997) and presented in Appendix A. The framework of content analysis and the development of the IAM were discussed in Chapter 2. This discussion focuses on the validity of the IAM as established in the literature.

Generally, validity refers to the accountability and legitimacy that exists in the data collection, analysis, and interpretation within a study. Messick (1989) noted that ―validity is an integrative, evaluative judgment of the degree to which theoretical rationales and empirical evidence support the adequacy and appropriateness of interpretations and actions based on test scores or other methods of assessment" (p. 13). However, Rourke and Anderson (2004) noted that researchers often fail to provide sufficient information to judge the validity of the content analysis protocols utilized in published studies. They concluded that using existing protocols, rather than creating new ones, added to the accumulating normative data and overall validity of the existing protocol. The popularity of the IAM has resulted in just such an accumulation. Given the criticality of intersubjectivity in this study, the validity and reliability of this research is inextricably linked to the validity of the instrument chosen to measure intersubjectivity.

Thus, significant attention is paid to the accumulation of data that support the validity and reliability of the IAM.

The IAM has been used more than any other interaction analysis model in the published literature (Hall, 2010a). Studies were identified through the searches in the following databases, the number of results of which are reported in parentheses and include duplication: Sage-Educational Collection (3), ProQuest-Education (54), Academic Search Premiere (69), ABI/Inform Global (3), ProQuest-Psychology (10), PsyArticles (0), SAGE-Psychology (3), and Science Direct College Edition-Social & Behavioral Sciences (80).

Several elements of support for the IAM can be extracted from this accumulation of consistent data in 40 published studies spanning 13 years. One element of support is the growing use of the IAM since its development in 1997, as illustrated in Figure 2.

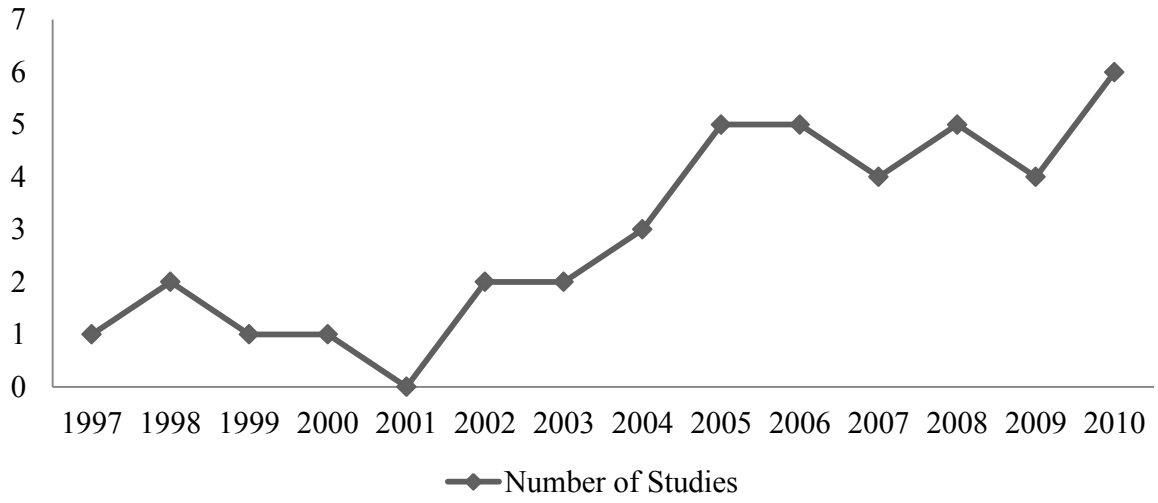

Figure 3. Number of published studies using the IAM between 1997 and June 2010.

In the first half of 2010, the IAM has been used in more published studies than in any other full year. Consistent and increasing use of the IAM represents its acceptance as a valid instrument for the analysis of course room transcripts.

Another element of support for the IAM comes from the high levels of inter-rater reliability among the 22 published studies in which the measure is reported. Measures of inter-rater agreement, after resolution, in these published studies are summarized in Appendix B. An average measure of inter-rater reliability would be invalid because of the different methods used to calculate each statistic. In addition, some studies reported ranges rather than exact numbers. Noting the high level of inter-rater reliability across the multiple uses of the IAM adds validity to the use of the instrument in the current study.

With an understanding of the instrument to be used, attention can now be turned to selection of the research site and coding the data.

Research Site

There were several requirements of a potential research site. The institution had to have regional accreditation, which served as a control measure to ensure a baseline level of quality among the chosen institution and its courses. The institution had to offer a wholly online course for which an archived transcript was available. In addition, a potential research site had to be willing to provide the transcript for research. Such a site was suggested during a routine conversation with an academic advisor.

The school was then contacted to identify the process of research approval required. Upon compliance with the institution‘s protocol and approval of the study by Capella University‘s Institutional Review Board, the transcript of the identified course

was obtained by a research assistant who removed all identifying information. The next step in the data collection was then coding the data.

Coding

The total number of posts was counted and recorded. The posts of the course instructor were marked, counted, and recorded. These messages were not coded, as the purpose of this study was to investigate knowledge construction among learners. To ensure the accuracy of the count, the number of learner posts and the number of instructor posts were added and the sum compared to the total number of posts. Next, the transcript was coded according to the operational definitions of time in course (TIC), cognitive requirement of prompt (CROP), and intersubjectivity.

Time in course (TIC) was the amount of time that elapsed before a particular message was posted to the discussion board and was measured using percentage of course completion. This percentage was calculated using a procedure similar to that outlined in the Code of Federal Regulations (34CFR668.22(f)(1)(i)) for determining *period of enrollment* for the treatment of Title IV grant or loan funds. Thus, the total number of calendar days completed prior to the date on which the message was posted to the discussion board was divided by the total number of calendar days of the length of the academic term. The result was rounded to the nearest whole number. This method allowed for an analysis of TIC after intersubjectivity was measured throughout the course. These percentages were marked on the transcript and entered into the data collection spreadsheet.

For example, Message 62 was posted on March 26, which was Day 68 of the course. The number of calendar days completed prior to this date was 67, which is

divided by the number of calendar days of the length of the academic term (91), resulting in a quotient of 0.736. When converted to a percent, the result is 73.6% and rounded to 74%. Thus, the percentage of course completion for Message 62 is 74%.

The transcript was then segmented according to discussion prompt and coded in numerical order beginning with ―1' These codes were marked on the transcript and entered into the data collection spreadsheet. Each prompt was then examined using Bloom's revised taxonomy (Anderson et al., 2001). Bloom's taxonomy has been used previously to identify the effectiveness of e-learning across curricula and delivery platforms (Christopher et al., 2004; Hawali, McCarthy, & Pires, 2009). The cognitive requirement of prompt (CROP) is the level of thinking that should be evident in a response to each discussion prompt and was measured as the highest level of Bloom's revised taxonomy required within a response to the prompt. Based on the highest level of the taxonomy required in a response, the prompt was coded as follows: remembering (1), understanding (2), applying (3), analyzing (4), evaluating (5), or creating (6). These codes were marked on the transcript and entered into the data collection spreadsheet.

The subsequent threads of each discussion question or prompt were then be coded for intersubjectivity using the Interaction Analysis Model (IAM) developed by Gunawardena et al. (1997). As shown in Appendix A, the IAM has five phases, with each phase having three, four, or five indicators. Although the original application of the IAM used Roman numerals to indicate phases, this study used Arabic numerals in order to facilitate later computer analysis. Consistent with previous studies (Beaudrie, 2000; Luebeck & Bice, 2005; Moore & Marra, 2005; Onrubia & Engel, 2005), each post was coded according to the highest phase of the IAM present within the response. Thus, a

post which demonstrated several indicators of different phases was assigned a single code according to the highest phase represented in the response. Examples are provided in Chapter 4.

Inter-Rater Reliability

Inter-rater reliability is an important measure of control within data coding. Data in the this study were coded by a research assistant who had coding experience and was trained in the application of the IAM and the data collection spreadsheet.

Inter-rater reliability was calculated before discussion of those posts with inconsistent codes. Krippendorff's alpha was used because this measure is functional in content analysis with any number of ratings, levels of measurement, or size of sample (Hayes & Krippendorff, 2007). There is some debate about researchers about the minimum quality threshold required, as some discourse-based content analysis studies have demonstrated reasonable quality with a 0.7 agreement, though some researchers have called for a threshold as high as 0.9 (Neuendorf, 2002). Generally, a 0.8 level of agreement is well supported as a quality standard (Artstein & Poesio, 2005).

In summary, the data were collected from the archived course transcript using codes for time in course (TIC), cognitive requirement of prompt (CROP), and intersubjectivity. Once the data were collected and recorded for each transcript, data analysis began.

Data Analysis

Analyzing the data refers to examining the results of the collection instruments in order to address the research question. In this study, the instruments used to collect the

data included Bloom's revised taxonomy (Anderson & Krathwohl, 2001) and the IAM (Gunawardena et al. 1997). The data collected included cognitive requirements of prompt (CROP), time in course (TIC), and level of intersubjectivity in order to answer two research questions. These two research questions were related to the relationship between intersubjectivity and CROP and the relationship between intersubjectivity and TIC.

In a quantitative study, the data are analyzed using statistical procedures that either do or do not provide a determined level of significance in the relationship between the variables (Gorard, 2001). Kendall's tau-c was used to analyze the categorical data. This calculation avoids assumptions about frequency distributions and linearity of relationship (Creswell, 2008). Furthermore, the calculation makes adjustments for ties in the data and is appropriate for rectangular contingency tables (Agresti, 2010), meaning the number of categories for each variable is unequal.

While the validity and reliability of the IAM are critical to the study and have been addressed in this chapter, there were other threats to validity that were addressed.

Potential Threats to Validity

A study's validity can be compromised in many ways. Vogt (2007) categorized more than 24 kinds of threats into four categories: construct validity, external validity, statistical conclusion, and internal validity. Each of these categories is discussed relative to ways that these threats were managed during this study.

Construct Validity

Creswell (2008) defined construct validity as "a determination of the significance, meaning, purpose, and use of scores from an instrument" (p. 638). Thus, a threat to construct validity would be in the measures with which the construct of interest was quantified. In this study, the construct of interest was intersubjectivity and the tool of measurement was the IAM. The operational definition of intersubjectivity has been drawn from the literature and the validity of the instrument has been established. Therefore, the threats to construct validity were minimal.

External Validity

Threats to external validity occur when inferences are incorrectly generalized from the sample to the population (Vogt, 2007). Within the category of external validity, Creswell (2009) identified three types of threats related to selection, setting, and history. This study minimized these threats because all of the peer responses were used, rather than just a sample of those responses. Since only one online course was studied, generalizations were not made to hybrid or on-site courses. Similarly, generalizations were not made to learners at different levels or in different domains.

Internal Validity

Internal validity is related to the ability to draw causal inferences about the participants, treatments, and procedures within a study. Since this study involved a correlational, versus causal, design, the threats to internal validity were minimal. Conclusions based on the research focused on association rather than causation.

Statistical Conclusion

Another category of threats to validity is that of statistical conclusion. According to Vogt (2007), such threats occur as the result of erroneous choices of statistical computations when analyzing the data. These choices include using a particular statistical technique when the data violate the assumptions of that technique. For example, a threat would occur if parametric statistics were used with nominal or categorical data that were not normally distributed. Another example would be selecting a computation that has low statistical power. To minimize the threats of statistical conclusion, Kendall's tau-c was used to analyze because this calculation avoids assumptions about frequency distributions and linearity of relationship (Creswell, 2008). In addition, inter-rater reliability was calculated and reported.

A final kind of threat that was considered was the threat to ethical tenets related to conducting research that involves records generated by human subjects.

Ethical Issues

The need to consider ethical issues exists throughout the design, conduct, and conclusion of research. Creswell (2009) identified several issues in these areas, including ethical issues in the purpose and questions, data collection, data analysis and interpretation, and in writing and disseminating the research. Each of these areas is considered below.

Purpose and Questions

Another opportunity to consider ethical issues was within the purpose and questions of the research. Creswell (2009) identified deception and sponsorship as two important elements to consider for this area. In this study, the purpose of the research

was thoroughly explained to the administrators at the potential research site, meaning the school from which a course transcript was obtained. The established procedures were followed for approving research at the school, which involved approval through the academic dean of the institution. Deception was unnecessary for the intent of this study and, thus, was avoided at all stages of the research. The research was not financially sponsored by another entity, either individual or institutional, and the name of the school participating in the research remains confidential.

Data Collection

The data collection phase involves many ethical considerations. The researcher had no affiliation with or influence on the course in which the data were collected. The study did not involve vulnerable populations and had a very low chance of physical, psychological, social, economic, or legal harm. These elements were identified by Sieber (1998) as ethical considerations during data collection. Since a transcript without identifying information was used in this research, the data were considered historical and informed consent forms were not necessary. As described in the data collection section on coding, identifying information was removed from the transcript. Electronic documents were password protected and printed documents were kept in an enveloped marked ~~–e~~onfidential" and stored in a locked box.

Another consideration of this phase is the ethical application of the instrument, which involves some subjectivity since the construct being measured is latent rather than manifest. Since a research assistant was used to establish inter-rater reliability, training was conducted and a confidentiality agreement was prepared and signed before data collection began.

Analysis and Interpretation

Creswell (2009) identified several ethical issues that could have arisen during data analysis and interpretation. In addition to using a course transcript without identifying information about the learners, the identity of the participating institution has been kept confidential, as well. Another consideration is ownership of the data, which remains with the doctoral researcher. Coded data, with no identifiable information about the students, faculty, or institution, will be retained on two digital storage devices stored at two separate locations for a period of five years, after which time the need for continued access to the data will be reviewed.

Writing and Dissemination

The writing and dissemination of the research also involves ethical issues. Creswell (2009) identified the need for the researcher to state a commitment, as is done here, that findings were not suppressed, falsified, or invented in order to meet the needs of the researcher or any particular audience. In addition, the researcher will make available all details of design, collection, and analysis for others to use in considering the credibility of the interpretations and conclusions of this research.

In addition to addressing these ethical issues, the research was reviewed and approved by the Institutional Review Board of Capella University and the established protocol at the research site.

Summary

This study used a non-experimental design because an independent variable was not manipulated; instead, the study examined the correlation between the variables (time

in course, cognitive requirement of prompt, and intersubjectivity) and did not examine causation. An explanatory correlational design was used to measure the relationships between the variables. Data for the research was collected from the archived transcript of one online communications course at a regionally accredited school. Convenience sampling was appropriate in this study because the school had to have an archived transcript available and had to be willing to provide the transcript for the research.

The transcript was coded for each variable. Time in course (TIC) was measured as the total number of calendar days completed prior to the date on which the message was posted to the discussion board divided by the total number of calendar days of the length of the academic term. The cognitive requirement of prompt (CROP) is the level of thinking that should be evident in a response to each discussion prompt and was measured as the highest level of Bloom‘s revised taxonomy required within a response to the prompt. The subsequent threads of each discussion prompt were then coded for intersubjectivity using the Interaction Analysis Model (IAM) developed by Gunawardena et al. (1997) and presented in Appendix A. Support for the IAM comes from its increasing use over the last 13 years and the high levels of inter-rater reliability among the 22 published studies in which the measure is reported.

In this study, inter-rater reliability was measured using Krippendorff‘s alpha. This measure was chosen because of its functionality in content analysis with any number of ratings, levels of measurement, or size of sample (Hayes & Krippendorff, 2007). Kendall‘s tau-c was used to analyze the categorical data. This calculation avoids assumptions about frequency distributions and linearity of relationship (Creswell, 2008). Furthermore, the calculation makes adjustments for ties in the data and is appropriate for

the rectangular contingency tables (Agresti, 2010) of this study, meaning the number of categories for each variable was unequal.

Threats to validity were minimized. Threats to construct validity were minimized by using an instrument (IAM) with established validity. The study reduced threats to external validity by qualifying generalizations drawn from the study. Threats to statistical conclusions were minimized by using a calculation (Kendall's tau-c) that avoids assumptions about frequency distributions and linearity of relationships.

Possible violations of ethical tenets were also avoided in this research. The purpose of the research was clear and the significance of the research questions was established. The study involved data without identifying information, did not involve vulnerable populations, and had a very low chance of physical, psychological, social, economic, or legal harm. A research assistant, used for establishing inter-rater reliability, was trained in order to ensure ethical application of the instrument (IAM). Research findings were not suppressed, falsified, or invented in order to meet the needs of the researcher or any particular audience. The data, with no identifiable information about the students, faculty, or institution, will be retained on two digital storage devices stored at two separate locations for a period of five years, after which time the need for continued access to the data will be reviewed.

CHAPTER 4. DATA COLLECTION AND ANALYSIS

Researchers have consistently noted that threaded discussions lack the continuity, progression, and dependencies needed to achieve knowledge construction in a constructivist learning environment. While interaction is inherent in constructivist learning, it is feasible to take interaction to a higher level. Course room discourse among learners has consistently lacked this higher level of quality.

With the content of discussion posts ranging from substantive to irrelevant, the problem investigated by this study was the lack of consistent quality in discussion board interactions. One way to measure the quality of discussion posts is the level of collaborative knowledge construction, or intersubjectivity, achieved within the post. Intersubjectivity, as the representation of knowledge construction achieved through a synergistic progression from individual contributions to sequences of interdependent contributions, represents this higher quality of synthesis among learners engaged in course room discourse.

Many factors influence intersubjectivity within the threaded discussions of online courses. This study examined two particular course elements that influence intersubjectivity: cognitive requirement of prompt (CROP) and time in course (TIC). The purpose of the study was to investigate the relationships between intersubjectivity, as a measure of the quality of interaction in course room discourse, and (a) cognitive requirement of prompt and (b) time in course within the threaded discussions of an online course room. There were two research questions.

1. What is the association between intersubjectivity and cognitive requirement of prompt (CROP) within the threaded discussions of online course rooms?
2. What is the association between intersubjectivity and time in course (TIC) within the threaded discussions of online course rooms?

An explanatory correlational design was used to measure the relationships between the variables. Content analysis, specifically the Interaction Analysis Model (IAM) of Gunawardena et al. (1997) was used to measure the intersubjectivity of student responses posted to the discussion boards. The cognitive requirement of prompt (CROP) was determined by the level of cognitive processing, according to Bloom's revised taxonomy (Anderson et al., 2001), required in a learner's response to the prompt. Time in course (TIC) was calculated as the percentage of time that had elapsed between the beginning of the course term and the date on which a message was posted.

This chapter is organized into two main sections: data collection and data analysis. The data collection section includes a description of the research site and the coding procedures. The data analysis section is divided by the two research questions.

Data Collection

Description of Research Site

The peer responses studied in this research were taken from the archived course room discussion posts of an online course in Communication offered during Spring 2010 at a regionally accredited community college in the Midwestern region of the United States of America. Although the transcripts of the threaded discussions had identifying

information removed prior to data collection and analysis, anonymous demographic information was available about the student population of the college.

Institutional demographics. According to a profile provided by the institution, there were 4,515 students enrolled at the institution during Spring 2010 with an average load of 10.4 hours per academic term. The gender distribution of students was 58% female and 42% male. Likewise, the age of the student population was nearly equally divided between traditional students (Age 24 and younger) and non-traditional students (Age 25 and older) with 59% and 41%, respectively. The overwhelming majority of students (87%) were White. Nearly two thirds (63%) of the students were considered freshmen, with less than 30 credit hours earned, versus sophomores. Of the 4,515 enrolled students, 2,250 (49%) were enrolled in at least one online course. Disaggregation of demographic information by online enrollment was not provided.

Course description. The course used to collect and analyze data was an online communications course in an associate‘s degree program offered using the Desire2Learn platform during Spring 2010. The instructor held a master‘s degree with nearly two decades of experience teaching communication courses at the post-secondary level. The instructor‘s amount of experience is relevant because an instructor‘s experience could influence the final design of the discussion prompts or at what point in the course different prompts are used. Requirements of the course included reading portions of the assigned textbook and lectures, participating in course discussions, completing quizzes and assignments, and participating in a group project. There were 21 students enrolled in the course.

Although the academic term was 17 weeks long, one week was a break with no course requirements. Of the remaining 16 weeks, discussions occurred in 10 of those weeks. With only one discussion prompt per week, and with Weeks 10 and 11 being combined under one discussion prompt, there was a total of nine discussion prompts. A total of 765 messages were posted, with the instructor posting 298 messages (39%) and students posting 467 messages (61%). Because the study focused on student-to-student interactions, three types of posts were not coded: initial posts from learners, messages posted from the instructor, and messages posted back to the instructor. While differences in a learner's initial post could affect the level of intersubjectivity in peer responses to that initial post, this variable is not under study in this research. The resulting number of qualifying posts was 167.

Coding Procedure

Access to the online course was granted by an administrator at the research site to a research assistant who extracted the text of the threaded discussions without identifying information about the institution or learners. Each discussion post was coded according to the three variables - cognitive requirement of prompt (CROP), time in course (TIC), and intersubjectivity.

Cognitive Requirement of Prompt (CROP). Bloom's revised taxonomy (Anderson et al., 2001) consists of a knowledge dimension (factual, conceptual, procedural, and metacognitive) and a cognitive process dimension (remember, understand, apply, analyze, evaluate, and create). Consistent with the method suggested by Anderson et al., the coding procedure considered the verb-noun combinations and

related the knowledge dimension with the process dimension. As mentioned in Chapter 2, the knowledge dimension distinguishes categories of knowledge without distinctions of depth. Thus, the prompts were coded using the cognitive process dimension, which does address levels that are relative to one another as indicators of cognitive depth.

CROP is the highest category in the cognitive process dimension that is required within the response to a discussion prompt. The selected level was marked on the transcript and in the data collection spreadsheet. Each category was coded as follows: Remember = 1, Understand = 2, Apply = 3, Analyze = 4, Evaluate = 5, and Create = 6.

The discussion prompt for Week 8 serves as an example of how prompts are coded according to a level of Bloom‘s revised taxonomy. The Week 8 prompt was

> Your task is to rephrase the 5 conflict messages below into statements that use the b-c-f sequence of describing "behavior", describing "consequences" and describing "feelings." Your first step is to revise the 5 statements. Then describe "how" or "why" your changes have helped you apply a win-win assertive approach to the situation transforming a negative conflict situation into a more productive one that can be resolved. Finally put your 5 revised statements into your discussion group. Be sure to look at how other students have revised their statements and you'll learn from one another how to calm down conflicts using the bcf sequence.

In accordance with the procedural knowledge dimension established by Anderson et al. (2001), this prompt asks about discipline-specific ~~–c~~riteria for determining when to use appropriate procedures” (p. 46) in the form of ~~–a~~ series or sequence of steps to be followed” (p. 52). The behavior-consequence-feelings sequence is part of the larger procedure of transforming a negative conflict situation into a more productive one. The cognitive process dimension for the prompt is the third level, apply, which Anderson et al. closely relate to the procedural knowledge dimension. The learner is asked to apply

the b-c-f sequence to the conflict messages in order to revise them into more productive communications. Thus, the Week 8 prompt is coded with "3."

There were a total of nine discussion prompts within the 10 weeks that required interaction through the discussion board, recalling that Weeks 10 and 11were combined under a single discussion prompt. All of the nine discussion prompts were coded within the lower three categories of Bloom's revised taxonomy: Remember (2 prompts), Understand (4 prompts), and Apply (3 prompts). Table 1 illustrates the level of Bloom's revised taxonomy coded for each week's discussion prompt.

Table 1
Taxonomy Level of Weekly Prompts

Week(s)	Taxonomy Level
1	Remember (1)
3	Understand (2)
5	Understand (2)
6	Understand (2)
8	Apply (3)
9	Remember (1)
10-11	Apply (3)
12	Apply (3)
13	Apply (3)

Time in Course (TIC). TIC was the amount of time that elapsed before a particular message was posted to the discussion board and is presented as a percentage of course completion. This percentage was calculated by dividing the total number of calendar days completed prior to the date on which the message was posted by the total number of calendar days of the length of the academic term. The result was converted into a percentage and rounded to the nearest whole number. Since student-to-student discussions did not occur in the final three weeks of the course, and the week of spring break was not counted, the number of days in the term was 91.

For example, Message 62 was posted on March 26, which was Day 68 of the course. The number of calendar days completed prior to this date was 67, which is divided by the number of calendar days of the length of the academic term (91), resulting in a quotient of 0.736. When converted to a percent, the result is 73.6% and rounded to 74%. Thus, the percentage of course completion for Message 62 is 74%.

Each student-to-student post was coded for TIC by identifying the percentage of course completion, as explained in the preceding paragraph. A spreadsheet was used for easier calculation of the percentage, which was marked on the transcript and in the data collection spreadsheet. For clarity of illustration, the percentages are grouped in sets of 10. Figure 4 provides the number of student-to-student posts per grouped percentage of course completion.

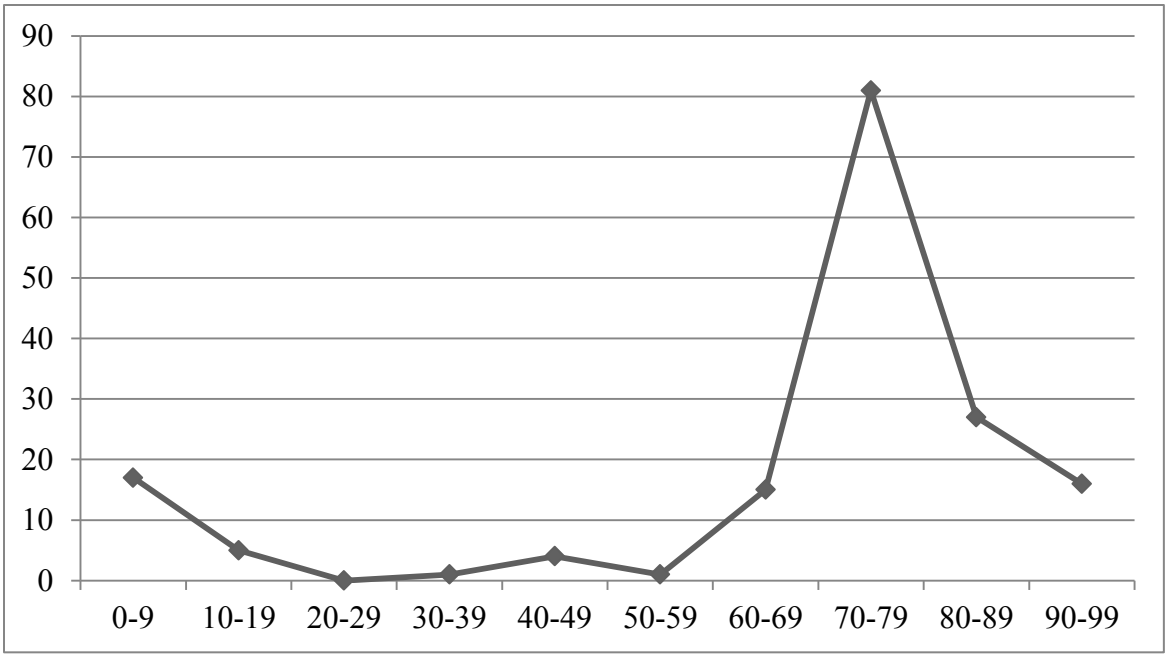

Figure 4 . Number of peer responses per percentage of course completion.

Intersubjectivity. In terms of course room discourse, intersubjectivity is the representation of knowledge construction achieved through a synergistic progression from individual contributions to sequences of interdependent contributions. The instrument selected to measure intersubjectivity within the discussion threads of the online course is the Interaction Analysis Model (IAM) developed by Gunawardena et al. (1997) and presented in Appendix A.

The first category of the IAM, *sharing and comparing*, involves a statement of observation or opinion; statement of agreement; corroborating examples; asking and answering questions to clarify details of statements; or the definition, description, or identification of a problem. An example of a post coded in this category is Message 44:

> I vote for [organization] too. I just looked at the website and wow. Lets do something for them if we can. My vote is for them…If we pick them, then what would we do for them? that is where I'm confused.

This post offers a statement of agreement because the learner voted for the same organization and asked a question for clarification of the task. Thus, this message is coded with a ―1" on the IAM.

The second category of the Interaction Analysis Model (IAM), *dissonance*, involves identifying and stating areas of disagreement; asking and answering questions to clarify the source and extent of disagreement; or restating the participant's position, possibly through advancing arguments with references to the learner's experience, literature, formal data collection, or the proposal of a relevant metaphor or analogy to illustrate a particular point of view. An example of a post coded in this category is Message 63:

> I was thinking that our focus/thesis should be on the food and clothing services [organization] provides and why they are important, and that we must persuade the audience to support them. For my portion of the presentation, I am planning to share personal stories of the children I've had in foster care who has used the [organization], as well as some stats on homeless people/youths in [city]. I hope to have my work posted here tonight, with any luck.

This message was posted in response to a learner who suggested a different focus for a group project. Thus, Message 63 identified and stated areas of disagreement between two members of the group. The author of this message supported this focus through reference to personal experience and formal data collection. Thus, this message was coded with a ―2" from the IAM.

The third category of the Interaction Analysis Model (IAM) is *negotiation and co-construction*. This category involves negotiation or clarification of the meaning of terms, negotiation of the relative weight to be assigned to arguments identification of areas of agreement or overlap among conflicting concepts, proposal and negotiation of new

statements embodying compromise, co-construction, and proposals integrating or accommodating metaphors or analogies. Message 148 was an example of a post coded in this category.

> If we decide to go with the idea of our goal being to inspire the audience that [organization] is worth investing in, I would go in that direction. Maybe start with a little history and what they‘re all about. Maybe just briefly touch on how they are able to provide services to all children, regardless of income.

The author of this message negotiated the content of the group presentation by proposing elements that were similar to those in the previous message as well as elements that were in addition to the contents in the previous message. Thus, the message was coded with a ~~–3~~" for the third category of the IAM. None of the posts was coded in Phase 4 (testing tentative constructions) or Phase 5 (statement and application of newly constructed knowledge). The number of student-to-student posts coded in each stage of the IAM is provided in Table 2.

Table 2
Peer Posts Per Phase of IAM

IAM Phase	# Peer Responses
1 Sharing & Comparing	141
2 Dissonance	23
3 Negotiation & Co-Construction	3
4 Testing Tentative Constructions	0
5 Statement & Application of Newly Constructed Knowledge	0

Consistent with coding practices used in previous studies (Beaudrie, 2000; Luebeck & Bice, 2005; Moore & Marra, 2005; Onrubia & Engel, 2005), each post was coded according to the highest phase of the IAM present within the response. Thus, a post that indicated different phases was assigned a single code according to the highest phase represented in the response. An example is Message 128: "I believe our audience would be our memebers [sic] of the class." While this message does state an observation or opinion, consistent with the first level of sharing and comparing, the post also identifies an area of disagreement, which is consistent with the second level of dissonance. Thus, the post is coded with the higher level "2."

Inter-Rater Reliability

Inter-rater reliability is an important measure of control within data coding. Data in the study were coded by the researcher and an assistant who had coding experience and was trained in the application of the Interaction Analysis Model (IAM) and the data collection spreadsheet. Krippendorff's alpha (Hayes & Krippendorff, 2007) was used because this measure is functional in content analysis with any number of ratings, levels of measurement, or size of sample. Posts (167 peer posts and nine discussion prompts) were separately coded and then compared. The initial Krippendorff alpha for the nine discussion prompts (cognitive requirement of prompt, CROP) was 0.891, and the alpha for the 167 peer posts (intersubjectivity) was 0.914, both of which exceed 0.8, the minimum threshold of acceptable reliability (Artstein & Poesio, 2005).

Data Analysis

The data collected in this study were analyzed using both descriptive and inferential statistics. The data collected are from categorical, or nominal, scales and Kendall's tau-c was used for analysis. This non-parametric statistical calculation avoids assumptions about frequency distributions and linearity of relationship (Creswell, 2008). Furthermore, the calculation makes adjustments for ties in the data and is appropriate when the number of categories for each variable is unequal (Agresti, 2010). In this study, the variable time in course (TIC) has 10 categories, cognitive requirement of prompt (CROP) has six categories, and intersubjectivity has five categories. The analyses are reported in order of the research question.

CROP and Intersubjectivity: Research Question 1

The first research question asked, "What is the association between intersubjectivity and CROP within the threaded discussions of online course rooms?" Table 3 shows the number of posts coded in each phase of the Interaction Analysis Model (IAM) and level of Bloom's revised taxonomy. Since there were no discussion prompts at Levels 4, 5, or 6 of Bloom's taxonomy or peer responses at Phases 4 or 5 of the IAM, these categories have been omitted from the table.

Table 3
Cognitive Requirement of Prompt Per Phase of IAM

IAM Phase	1 Remember	2 Understand	3 Apply
1 Sharing & Comparing	35	7	99
2 Dissonance	1	1	21
3 Negotiation & Co-Construction	0	0	3

The null hypothesis for Question 1 was that there is no relationship between cognitive requirement of prompt (CROP) and intersubjectivity. The value of Kendall's tau-c was 0.091 with a level of significance at 0.001. As illustrated in the scatterplot in Figure 5, as cognitive requirement of prompt (CROP) increases, so does intersubjectivity, indicative of a positive correlation. Thus, the null hypothesis was rejected in favor of the alternate hypothesis that there is a relationship between intersubjectivity and cognitive requirement of prompt (CROP). There is a positive association between intersubjectivity and CROP within the threaded discussions of online course rooms. Because the scales for intersubjectivity and CROP used integers, with no fractions, what appears to be only one point on the graph actually represents multiple points at the exact same location on the graph.

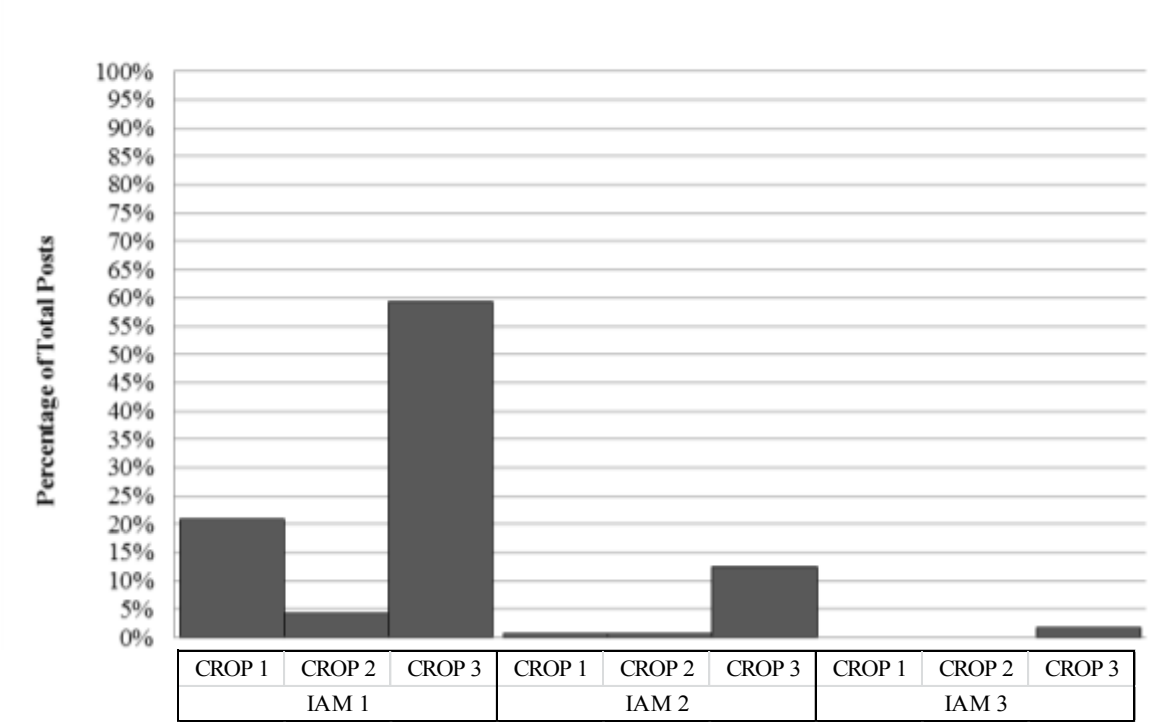

Figure 5. Histogram for cognitive requirement of prompt (CROP) and intersubjectivity, as measured using the Interaction Analysis Model (IAM).

TIC and Intersubjectivity: Research Question 2

The second research question asked, "What is the association between intersubjectivity and TIC within the threaded discussions of online course rooms?" Intersubjectivity was measured using the Interaction Analysis Model (IAM), and time in course (TIC) was measured using percentage of course completion. The contingency table is provided in Table 4. Since there were no responses at Phases 4 or 5 of the IAM, these categories have been omitted from the table.

Table 4
Percentage of Course Completion and Phase of IAM

% Complete	1 Sharing & Comparing	2 Dissonance	3 Negotiation & Co-Construction
0-9	15	2	0
10-19	5	0	0
20-29	0	0	0
30-39	1	0	0
40-49	3	1	0
50-59	1	0	0
60-69	15	0	0
70-79	67	11	3
80-89	19	8	0
90-99	15	1	0
Totals	141	23	3

The null hypothesis for Question 2 was that there is no relationship between time in course (TIC) and intersubjectivity. The value of Kendall's tau-c was 0.096 with a significance level of 0.032. As illustrated in the histogram in Figure 6, as time in course (TIC) increases, so does intersubjectivity, indicative of a positive correlation. Thus, the null hypothesis was rejected in favor of the alternate hypothesis that there is a relationship between intersubjectivity and time in course (TIC). There is a positive

association between intersubjectivity and TIC within the threaded discussions of online course rooms.

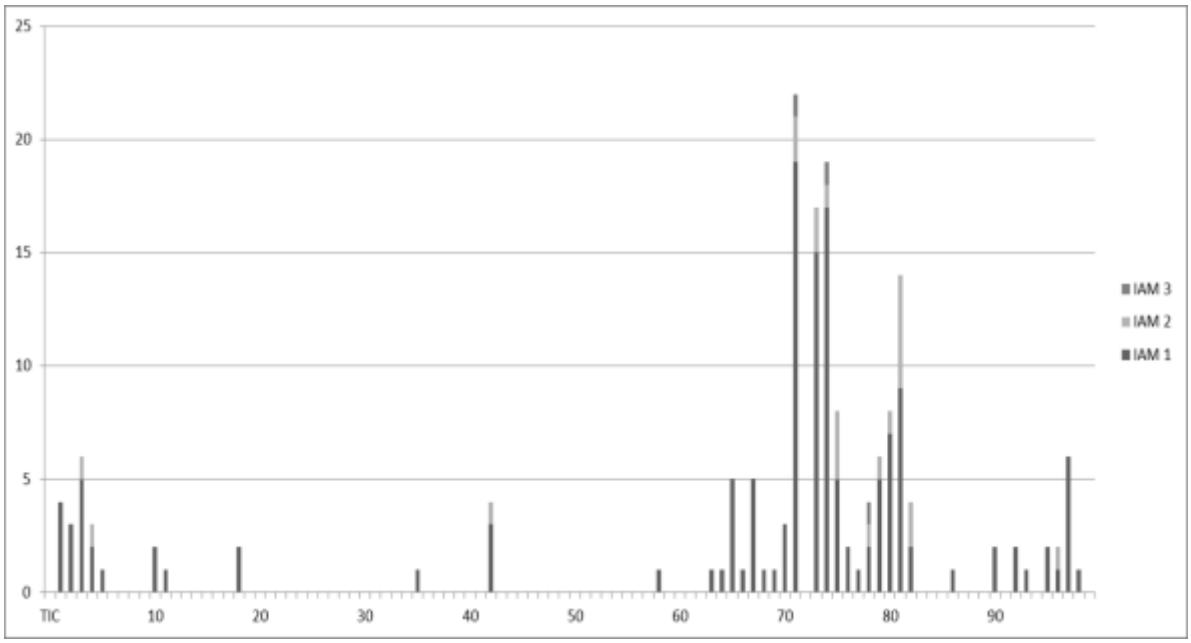

Figure 6. Phase of IAM (intersubjectivity) per percentage of course completion (TIC).

Summary

An explanatory correlational design was used to measure the relationships between (a) cognitive requirement of prompt and (b) time in course within the threaded discussions of an online course room. All of the peer responses were studied from an accredited, online course in Communication offered during Spring 2010 through a community college in the Midwestern region of the United States. Nine discussion prompts were coded using Bloom's revised taxonomy to measure the construct of cognitive requirement of prompt (CROP). The 167 student-to-student responses were coded using the Interaction Analysis Model (IAM). Inter-rater reliability was measured

using Krippendorff‘s alpha, which revealed levels of agreement above the minimum threshold for quality assurance.

A positive relationship was found between CROP and intersubjectivity. Thus, changes in the cognitive processing requirement of the discussion prompts corresponded with changes in the learners‘ responses to their peers. Time in course (TIC) was calculated as the percentage of course completion prior to the day on which a message was posted. As with cognitive requirement of prompt (CROP), a positive relationship was found also between time in course and intersubjectivity. That is, changes in the different levels of interaction within peer responses corresponded with different points of time within the course. The findings of this study, that there are positive relationships between 1) CROP and intersubjectivity and 2) TIC and intersubjectivity, inform the work of instructional designers in several ways. These implications are explored further in the next chapter.

CHAPTER 5. RESULTS, CONCLUSIONS, AND RECOMMENDATIONS

In a survey of research articles in the 20th century, Berge and Mrozowski (2001) concluded that one of the three topics addressed most often was how to increase interactivity. Gunawardena et al. (1997) defined interaction as ―the process through which negotiation of meaning and the co-creation of knowledge occurs" (p. 407). This study focused on discussion boards, which have been called the ―life blood and center of energy" for the online course (Mäkitalo-Siegl, 2009, p. 55) because the threaded discussions are the most common space in which collaborative knowledge construction is demonstrated (Calvani et al., 2010).

Successful knowledge construction requires ―active and broad participation" (Sing & Khine, 2006, p. 254) occurring at a higher level than surface interaction, as noted by Dennen and Wieland (2007). Knowledge construction at this more advanced level of interaction occurs through the opportunities for cognitive engagement required for the higher-order learning processes indicated by Bloom's taxonomy (Bloom & Krathwohl, 1956). As Jerolmack (2009) pointed out, interaction does not require the shared understandings or intentions implicit in intersubjectivity. While interaction is inherent in all the forms of constructivist learning, intersubjectivity takes interaction to a higher level (Dennen & Wieland, 2007; Martin et al., 2008).

With past research indicating that the content of discussion posts overall range from substantive to irrelevant, the problem investigated by this study was the lack of consistent quality in discussion board interactions. The purpose of the study was to investigate the relationships between intersubjectivity, as a measure of the quality of interaction in course room discourse, and (a) cognitive requirement of prompt and (2)

time in course within the threaded discussions of an online course room. There were two research questions.

1. What is the association between intersubjectivity and cognitive requirement of prompt within the threaded discussions of online course rooms?
2. What is the association between intersubjectivity and time in course within the threaded discussions of online course rooms?

An explanatory correlational design was used to measure the relationships between the variables. Content analysis, specifically the Interaction Analysis Model (IAM) of Gunawardena et al. (1997) was used to measure the intersubjectivity of student responses posted to the discussion boards. The cognitive requirement of prompt (CROP) was determined by the level of cognitive processing, according to Bloom‘s revised taxonomy (Anderson et al., 2001), required in a learner‘s response to the prompt. Time in course (TIC) was calculated as the percentage of time that had elapsed between the beginning of the course term and the date on which a message was posted.

This chapter is organized into five sections. The first discussion explores the findings of the study, in order of research question, followed by a discussion of the significance of the study to the field of instructional design. The next discussion notes the limitations of the study, followed by suggestions for future research. A final conclusion summarizes the most significant elements of the study.

Discussion of Findings

The data analyzed in the previous chapter are interpreted in this discussion of the findings, which is divided according to research question.

CROP and Intersubjectivity: Research Question 1

In terms of course room discourse, intersubjectivity is the representation of knowledge construction achieved through a synergistic progression from individual contributions to sequences of interdependent contributions. Intersubjectivity within the discussion threads was measured using the Interaction Analysis Model (IAM) developed by Gunawardena et al. (1997) and presented in Appendix A. An effective means of determining the level of cognitive process is Bloom's taxonomy (Jorgensen, 2009). Cognitive requirement of prompt (CROP) was defined as the highest category in the cognitive process dimension of Bloom's revised taxonomy (Anderson et al., 2001) that was required within the response to a discussion prompt.

The first research question asked, "What is the association between intersubjectivity and CROP within the threaded discussions of online course rooms?" In other words, this research question examined if there was a correlation between the level of intersubjectivity within peer responses and the level of cognitive thought required by the initial discussion prompt. The results of the study indicate a weak but significant positive relationship between intersubjectivity and CROP. Thus, higher levels of interaction within peer responses corresponded with higher level cognitive processes according to Bloom's revised taxonomy (Anderson et al., 2001). For example, a discussion prompt requiring a response at Bloom's first level (remember) was associated with a peer response at the first level of the IAM (sharing and comparing). Likewise, just as there were no discussion prompts at the higher levels of Bloom's revised taxonomy, there were no peer responses at the higher levels of the IAM.

The findings of this study uphold the assertions and conclusions of other scholars. According to Lim (2004), the communication that occurs in any learning environment is the most important aspect of the educational process that happens in that environment. In the online learning environment designed within a constructivist framework, the majority of the dialogue occurs through the discussion boards (Jeong, 2003; Schwartman, 2006; Thompson, 2009). The results of this study support the assertions of Calvani et al. (2010) that the interaction that occurs within threaded discussions is important to achieving the learning objectives of instruction situated within a constructivist environment, and of Thomas (2002), that learners who engage these discussion boards may be able to achieve a high level of cognitive processing.

The study reinforces Wang's (2005) definition of a question as a particular kind of prompt that directs student thinking through productive discussion. In particular, this study supports Wang's assertion that the "level of student thinking is directly proportional to the level of questions asked" (p. 310) and that knowledge construction occurs through responding to high-level questions. These findings are consistent with those of Rosenshine and Meister (1992) and Wruck (2010), who suggested that there are different ways to design prompts, as instructional devices or strategies, which influence student thinking.

Consistent with the suggestion of Donnelly (2010) that the multitude of low-level messages might be a result of the design of the discussion forum and the questions that are posed to stimulate discussion, this study supports the assertion of Tu and Corry (2003) that effectively planning the use of discussion boards is important in achieving a high level of cognitive engagement. Furthermore, the study supports the conclusions of

Asherian (2007) and DeLoach and Greenlaw (2007) that one element of planning for cognitive engagement is the design of the initial discussion prompts and the more firm assertion of Chin (2004) that carefully designed questions are required tools for cognitively engaging students.

TIC and Intersubjectivity: Research Question 2

TIC is the amount of course time that has elapsed before a particular message was posted to the discussion board, as indicated by percent of course completed at the time the response is made. The abundance of courses with varying lengths makes it difficult to examine intersubjectivity along these multiple points and across courses. The calculation of "percentage of course completion" makes possible accurate comparisons across courses of different lengths.

The second research question asked, "What is the association between intersubjectivity and time in course within the threaded discussions of online course rooms?" In other words, this research question examined if there was a correlation between the level of intersubjectivity within peer responses and the amount of time that had elapsed in the course term (TIC). The results of the study indicate a weak but significant positive relationship between intersubjectivity and TIC. Thus, higher levels of intersubjectivity were observed later in the course.

Consistent with previous research (Daniel, 2000; Kretovics, Crowe, & Hyun, 2005; Seaman, 2004), Anastasi (2007) found that academic performance and course evaluations were consistent between courses offered in traditional and accelerated terms. Combined with the findings of Kucsera and Timmaro (2010) and Poellnitz (2008) that

instructors‘ effectiveness was equivalent between traditional and accelerated courses, the total length of the course did not present a confounding variable.

The current study refutes the findings of Christopher et al. (2004), who found no pattern of change in the level of thinking that occurred over a semester-long course. Instead, the study supports the tangential findings of Boulter (2010), who noted a small but significant indication that the depth of critical thinking exhibited within discussions increased toward the end of an 11-week course in both the treatment and control groups.

In summary, the findings of this study revealed two things. One accomplishment of these findings is the support of the results from previous studies of similar variables. This support is particularly evident in the case of cognitive requirement of prompt (CROP) because of the large number of published studies on the use of questions in cognitive engagement than the number of studies published with variables similar to time in course (TIC). Also, the study provided data about two unique correlations that had not been studied previously. The significance of these findings is discussed next.

Significance to the Field of Instructional Design

Despite the extensive research conducted since the end of the last century and detailed within the literature review in Chapter 2, quality in online discourse remains inconsistent and ephemeral. As online course delivery continues to grow (Allen & Seaman, 2010), the challenge for instructional designers is the identification and implementation of those course elements which facilitate intersubjectivity in online courses. This study examined two such elements: the cognitive requirements of prompts

(CROP) used to elicit learner responses and the points of time within the course (TIC) of the peer responses.

The findings of this study, that significant positive relationships exist between CROP and intersubjectivity and between TIC and intersubjectivity, inform the work of instructional designers in several ways. The value of the initial prompt designed to stimulate each threaded discussion is greater than the singular focus on soliciting learners‘ summaries and reflections. This study shows the importance of considering the cognitive process level at which a learner response is expected and the opportunity that the prompt creates for dissonance, resolution, and the construction of knowledge during instructional design. While discussion prompts at all levels of Bloom‘s revised taxonomy are valid, designers should be particularly cognizant of the alignment between the learning objectives of each course segment and the cognitive process level of the prompt that frames the development of the threaded discussion that follows. The initial prompt is one of the first pieces of scaffolding necessary for the knowledge construction requisite in a constructivist learning environment. Instructional designers should continue to recognize that the strength of the construction of knowledge, as evidenced in the threaded discussion, depends upon the strength of the scaffolding that supports that construction. If the scaffolding, as in the initial prompt, is weak, the knowledge construction may vacillate and fail to meet the learning objective.

Limitations of the Study

Although the study has produced useful and significant findings for the field of instructional design, the results of the study include several limitations.

The first limitation of the study is related to the assumptions on which it rests. One assumption of the study is the validity of the theoretical framework. The study is framed by social constructionism, a learning theory the lineage of which can be traced from Kant (1781/2007) through Piaget (1952), Vygotsky (1978), and Papert (1991). The results of this study are valid only to the extent to which the social constructionism is considered a valid learning theory. The manifestation of and ability to detect evidence of knowledge construction within course room discussions are further assumptions. That is, the results of the study are limited by their dependence on the assumption that knowledge construction occurs within course room discourse and that these occurrences can be detected. Another assumption of the study is that the design of the instruction influences the extent of knowledge construction that occurs within these discussions. The findings of this study would be invalid if knowledge construction were independent of instructional design factors.

Another limitation is related to the characteristics of the course under study. Only one course was examined, resulting in 167 peer responses. Thus, the results of the study may be specific to the characteristics of the institution, course, instructor, or learners within this one course. A different size course, or multiple courses, might have produced different results. The discipline of the course was communications, so interactions might be different in courses from other disciplines. Likewise, peer interaction could be different at four-year institutions versus two-year institutions, or at the graduate versus undergraduate level. For example, learners in four-year program would have had more academic experience than their peers in two-year programs; likewise, learners in a

graduate program would have had more experience than learners in an undergraduate program.

The student characteristics represent another potential limitation. Age is one characteristic that may have limited the study. The age of the students who were enrolled in the course could have affected their levels of life experience upon which to draw reflections and share insights. For example, one student was participating in a dual enrollment program between high school and college. While the institution‘s entire enrollment was divided equally between traditional students (Age 24 and younger) and non-traditional students (Age 25 and older), nearly two thirds of all students enrolled were considered freshmen in the first year of the two-year program. Though this information is known at the institutional level, the age and status of those students in the course under study is unknown. Different levels of life experience could affect the ability of the students to engage the discussion topics at a deep level, to recognize and resolve dissonance, and to co-construct knowledge related to the course themes. The coordination of perspectives evidenced within the content of the message is what determines whether or not intersubjectivity has been achieved (Dennen & Wieland, 2007; Wertsch, 1985). Thus, without multiple perspectives, there is no coordination to lead to intersubjectivity.

Ethnic diversity, or lack thereof, is another limitation related to student characteristics. About nine out of 10 students enrolled at the university were White. Although it is not being suggested that all Whites have similar life experiences, the limited ethnic diversity that can be extrapolated from the institutional enrollment to the course enrollment could have contributed to a lack of dissimilar experiences with which

to approach problems, challenge ideas, create dissonance, and envision a new perspective required for the co-creation of knowledge.

Another limitation is the explanatory correlational design, which measures the degree of association between the variables of intersubjectivity, cognitive requirement of prompt (CROP), and time in course (TIC), but offers no predictive or causal descriptions. Thus, while a correlation does exist, the correlation does not suggest that writing discussion prompts which require higher levels of cognitive processing causes higher levels of intersubjectivity within the peer responses.

A final limitation is the fact that the discussion board does not capture all of the cognitive processes of the learners. A learner may engage a peer‘s post at a higher level of cognitive processing than the learner records within the threaded discussion. The positive relationship between cognitive requirement of prompt (CROP) and intersubjectivity might be even stronger if all of a learner‘s cognitive processing were captured through the discourse. Thus, the extent of the positive relationship found in this study is limited by the inability to encapsulate completely the cognitive processing of individual learners.

Suggestions for Future Research

The conclusions of this study stimulate more questions than the study answers. Thus, there are many directions for future research.

One direction is to consider how the technology platform might influence the studied variables. Ligorio et al. (2008) noted that tools, which would include delivery platform, are part of ~~t~~he architecture sustaining intersubjectivity" (p. 352). The course

in this study used the Desire2Learn platform. Are there differences in the variables when the prompts are similar but the platform is different? Of course, the great debate by Clark (1983, 1994, 2001) and Kozma (1994a, 1994b, 2000) supposedly settled questions about media and methods, and Sims (1997) summarized the popular viewpoint that ―quality in an instructional resource is a function of the design effort, not the technology" (p.158). Yet, the navigational requirements of different learning management systems could affect a learner's cognitive load and influence the learner's cognitive processing and written responses.

Additional information is needed about how intersubjectivity, cognitive requirement of prompt, and time in course might differ according to academic program level, such as associate, bachelor's, master's, or doctoral degrees. Certificate programs or non-doctoral terminal degrees might also be fruitful places to explore. Even secondary courses are worth studying in this regard, as Ash's (2011) work with at-risk, high school students revealed that they found their peers' responses valuable and motivational in their own learning.

Another area for future research relates to the idea of quality peer interaction. Perhaps quality, like beauty, is in the eye of the beholder. An instructional designer and participant in a study by Ashbaugh (2011) suggested that ―the majority of the instruction is going to remain inferior" (p, 158) if quality does not become the focus of attention in the field of online instructional design. But what does quality look like? Parker (2004) accurately stated that ―the greatest challenge for trying to define quality in any product or service is that quality remains a relative experience, realized in large part through an individual's level of expectation" (p. 387). Thus, future research could consider the

relationships among various objective measures of quality, in terms of course outcomes, and the expectations of instructional designers, online classroom facilitators, and learners.

Differences in individual courses, disciplines, and institutions could also be reviewed. Future studies could examine multiple courses to create a larger pool of data. In order to gain information about intersubjectivity within specific courses or disciplines, additional research could compare similar courses within the same discipline or compare courses in different disciplines. Such comparisons could be made within a single institution or between multiple institutions.

Since each week of the current study had only one discussion prompt, future research might consider courses with multiple prompts during each segmentation, such as week or unit. How might intersubjectivity change if there were two or three prompts each week? Does it make a difference if each week has the same number and type of prompt or different numbers of prompts? This research could be extended even into an examination of how the cognitive process levels of multiple prompts within the same week were associated with one another or with other variables like intersubjectivity.

A final area of potential research discussed here relates to learner persistence in online courses. If learner engagement leads to greater persistence, and if high levels of peer interaction contribute to such learner engagement and motivation, as suggested by Moore and Kearsley (2005), then what role might the discussion prompts play in persistence? Given the continued findings that persistence rates in online environments range from 10 to 20 percentage points lower than in their brick-and-mortar counterparts (Hershkovita & Nachmias, 2011), the influence on learner persistence of instructional

design factors such as cognitive requirement of prompt and time in course is an interesting area of potential research.

Conclusion

A call for a paradigm shift in education from the instructor-centered model focused on the dissemination of knowledge to the learner-centered model focused on the construction of knowledge has echoed since the second half of the last century (Reigeluth & Carr-Chellman, 2009). Concurrent with this was Gibson's (2009) assertion that discussion-based teaching "reverses the focus of the industrial-age paradigm by emphasizing learning as the priority, not teaching" (p. 102). This study examined two elements of course design that were associated with peer responses with threaded discussions. Both cognitive requirement of prompt (CROP) and time in course (TIC) were found to have weak but significant correlations with intersubjectivity, a measure of quality in online classroom discourse. Though there were limitations to this study and many opportunities to extend the current research, instructional designers should continue to consider how the design of initial prompts and the placement of those prompts throughout the course will relate to the learner's ability to summarize, share, challenge, and construct knowledge within a constructivist learning environment. On a final note, the multiple meanings drawn from the multidisciplinary roots of the term *intersubjectivity* could be cumbersome when discussing the construct within this specific context. Thus, consideration could be given to an alternate label such as reciprocal responses, shared cognition, or response connectivity.

REFERENCES

Ackermann, E. (2001). Piaget's constructivism, Papert's constructionism: What's the difference? In J. J. Ducret (Ed.), *Constructivism: Uses and perspectives in education* (pp. 85-94). Geneva, Switzerland: Research Center on Education. doi:10.1.1.132.4253

Agresti, A. (2010). *Analysis of ordinal categorical data* (2nd ed.). Hoboken, NJ: Wiley.

Allen, I. E., & Seaman, J. (2010). *Class differences: Online education in the United States, 2010*. Newburyport, MA: The Sloan Consortium.

Anastasi, J. S. (2007). Full semester and abbreviated summer courses: An evaluation of student performance. *Teaching of Psychology, 34*(1), 19-22. doi:10.1207/s15328023top3401_4

Anderson, L. W., & Krathwohl, D. R. (Eds.). (2001). *A taxonomy for learning, teaching and assessing: A revision of Bloom's Taxonomy of educational objectives: Complete edition*. New York, NY: Longman.

Andresen, M. A. (2009). Asynchronous discussion forums: Success factors, outcomes, assessments, and limitations. *Educational Technology & Society*, *12* (1), 249–257. Retrieved from http://www.ifets.info/

Andrews, J. D. W. (1980). The verbal structure of teacher questions: Its impact on class discussion. *POD Quarterly, 2*, 129-163. Retrieved from http://www.podnetwork.org

Artstein, R., & Poesio, M. (2008). Inter-coder agreement in computational linguistics. *Computational Linguistics, 34*(4), 555-596. doi:10.1162/coli.07-034-R2

Ash, D. S. (2011). *Participatory design for intervention: Enhancing engagement and motivation for at-risk students*. (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses. (3440243)

Asherian, V. (2007). Distance education: Synchronous communication and its assessing benefits. *Distance Learning, 4*(2), 15-19. Retrieved from www.usdla.org

Athanassiou, N., McNett, J. M., & Harvey, C. (2003). Critical thinking in the management classroom: Bloom's taxonomy as a learning tool. *Journal of Management Education, 27*(5), 533-555. doi:10.1177/1052562903252515

Ausubel, D. P., & Fitzgerald, D. (1962). Organizer, general background, and antecedent learning variables in sequential verbal learning. *Journal of Educational Psychology, 53*(6), 243-249. Retrieved from http://www.apa.org/pubs/journals/edu/

Baker, M., Hansen, T., Joiner, R., and Traum, D. (1998, June). *"Grounding" for intersubjectivity and learning*. Paper presented at the Fourth Congress of the International Society for Cultural Research and Activity Theory. Aarhus, Denmark.

Beaudin, B. P. (1999). Keeping online asynchronous discussions on topic. *Journal of Asynchronous Learning Networks, 3*(2), 41–53. Retrieved from http://www.sloanconsortium.org/publications/jaln_main

Beaudrie, B. P. (2000). *Analysis of group problem-solving tasks in a geometry course for teachers using computer-mediated conferencing* (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses. (9962225)

Berelson, B. (1952). *Content analysis in communication research*. Glencoe, IL: Free Press.

Berge, Z. L., & Mrozowski, S. (2001). Review of research in distance education, 1990-1999. *American Journal of Distance Education, 15*(3), 5-19. doi:10.1080/08923640109527090

Blake, C. T., & Rapanotti, L. (2001). Mapping interactions in a computer conferencing environment. In P. Dillenbourg, A. Eurelings, & K. Hakkarinen (Eds), *Proceedings of the European perspectives on computer supported collaborative learning conference, Euro-CSCL 2001.* University of Maastricht. Retrieved from http://www.ll.unimaas.nl/euro-cscl/Papers/163.pdf

Bloom, B. S., & Krathwohl, D. R. (1956). *Taxonomy of educational objectives The classification of educational goals, by a committee of college and university examiners. Handbook 1: Cognitive domain*. New York, NY: Longman.

Bober, M. J., & Dennen, V. P. (2001). Intersubjectivity: Facilitating knowledge construction in online environments. *Educational Media International, 38*(4), 241-250. doi:10.1080/09523980110105150

Boulter, M. L. (2010). *The influence of Socratic questioning in online discussions on the critical thinking skills of undergraduate students: An exploratory study based on a business course at a proprietary university* (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses. (3397620)

Bradley, M. E., Thom, L. R., Hayes, J., & Hay, C. (2008). Ask and you will receive: How question type influences quantity and quality of online discussions. *British Journal of Educational Technology, 39*(5), 888-900. doi:10.1111/j.1467-8535.2007.00804.x

Brookfield, S. D., & Preskill, S. (2008). *Discussion as a way of teaching: Tools and techniques for democratic classrooms* (2nd ed.). San Francisco, CA: Jossey-Bass.

Bures, E. M., Abrami, P. C., & Schmid, R. (2010). Supporting quality online dialogue: Does labelling help? *Journal of Interactive Learning Research, 21*(2), 187-213. Retrieved from http://www.editlib.org/p/29424

Calvani, A., Fini, A., Molino, M., & Ranieri, M. (2010). Visualizing and monitoring effective interactions in online collaborative groups. *British Journal of Educational Technology, 41*(2), 213–226. doi:10.1111/j.1467-8535.2008.00911.x

Carr, S. (2000, February 11). As distance education comes of age, the challenge is keeping the students. *The Chronicle of Higher Education, 46*(23), 39–41. Retrieved from http://chronicle.com

Chang, C. C. (2003). Towards a distributed web-based learning community. *Innovations in Education and Teaching International, 40*(1), 27–42. doi:10.1080/1355800032000038831

Cheung, W. S., Hew, K. F., & Ng, C. S. L. (2008). Toward an understanding of why students contributed in asynchronous online discussions. *Journal of Educational Computing Research, 38,* 29-50. doi:10.2190/EC.38.1.b

Chin, C. (2004). Questioning students in ways that encourage thinking. *Teaching Science, 50*(4), 16–21. Retrieved from http://www.asta.edu.au/resources/teachingscience

Cho, K. L., & Jonassen, D. H. (2002). The effects of argumentation scaffolds on argumentation and problem solving. *Educational Technology Research & Development*, *50*(3), 5–22. doi:10.1007/BF02505022

Christopher, M. M., Thomas, J. A., & Tallent-Runnels, M. K. (2004). Raising the bar: Encouraging high level thinking in online discussion forums. *Roeper Review, 26*(3), 166-171. doi:10.1080/02783190409554262

Chyung, S. Y., & Stepich, D. (2003). Applying the ―congruence" principle of Bloom's taxonomy to designing online instruction. *The Quarterly Review of Distance Education 4*(3), 317-330. Retrieved from http://www.infoagepub.com/Quarterly-Review-of-Distance-Education.html

Clarà, M., & Mauri, T. (2010). Toward a dialectic relation between the results of CSLC: Three methodological aspects of content analysis schemes. *International Journal of Computer Supported Collaborative Learning, 5*(1), 117-136. doi:10.1007/s11412-009-9078-4

Clark, R. E. (1983). Reconsidering research on learning from media. *Review of Educational Research, 53*(4), 445-459. doi:10.3102/00346543053004445

Clark, R. E. (1994). Media will never influence learning. *Educational Technology Research and Development, 42*(2), 21-29. doi:10.1007/BF02299088

Clark, R. E. (Ed.). (2001). *Learning from media: Arguments, analysis, and evidence*. Greenwich, CT: Information Age.

Cobb, P. (1996). Where is the mind? A coordination of sociocultural and cognitive constructivist perspectives. In C. T. Fosnot (Ed.), *Constructivism: Theory, perspectives, and practice* (pp. 34-52). New York, NY: Teachers College Press.

Creswell, J. W. (2008). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (3rd ed.). Upper Saddle River, NJ: Pearson.

Creswell, J. W. (2009). *Research design: Qualitative, quantitative, and mixed methods approaches* (3rd ed.). Los Angeles, CA: Sage.

Daniel, E. L. (2000). A review of time-shortened courses across disciplines. *College Student Journal, 34*(2). 298-308. Retrieved from http://www.tcrecord.org/

De Wever, B., Van Keer, H., Schellens, T., & Valcke, M. (2009). Structuring asynchronous discussion groups: The impact of role assignment and self-assessment on students‘ levels of knowledge construction through social negotiation. *Journal of Computer Assisted Learning, 25*(2), 177–188. doi:10.1111/j.1365-2729.2008.00292.x

De Wever, B., Van Keer, H., Schellens, T., & Valcke, M. (2010). Roles as a structuring tool in online discussion groups: The differential impact of different roles on social knowledge construction. *Computers in Human Behavior, 26* (4), 516–523. doi:10.1016/j.chb.2009.08.008

DeLoach, S. B., & Greenlaw, S. A. (2007). Effectively moderating electronic discussions. *Journal of Economic Education, 38*(4), 419-434. doi:10.3200/JECE.38.4.419-434

Dennen, V. P., and Wieland, K. (2007). From interaction to intersubjectivity: Facilitating online group discourse processes. *Distance Education, 28*(3), 281-297. doi:10.1080/01587910701611328

Donnelly, R. (2010). Interaction analysis in a ―learning by doing" problem-based professional development context. *Computers & Education, 55*(3), 1357-1366. doi:10.1016/j.compedu.2010.06.010

Driscoll, M. P. (2005). *Psychology of learning for instruction* (3rd ed.). Boston, MA: Pearson.

Duffy, T. M., Dueber, C., & Hawley, B. L. (1998). *Critical thinking in a distributed environment: A pedagogical base for the design of computer conferencing systems* (Technical Report No. 5-98). Bloomington, IN: Center for Research on Learning and Technology.

Elder L. & Paul R. (1998). The role of Socratic questioning in thinking, teaching, and learning. *The Clearing House, 71*(5), 297–301. doi:10.1080/00098659809602729

Fişek, G. O. (2010). Relationality, intersubjectivity, and culture: Experiences in a therapeutic discourse of virtual kinship. *Studies in Gender and Sexuality, 11*(2), 47-59. doi:10.1080/15240651003666292

Fosnot, C. T. (1996). Constructivism: A psychological theory of learning. In C. T. Fosnot (Ed.), *Constructivism: Theory, perspectives, and practice* (pp. 8-33). New York, NY: Teachers College Press.

Garrison, D. R. (1992). Critical thinking and self-directed learning in adult education: An analysis of responsibility and control issues. *Adult Education Quarterly, 42*(3), 136-148. Retrieved from http://aeq.sagepub.com/

Garrison, D. R., Anderson, T., & Archer, W. (2000). Critical inquiry in a text-based environment: Computer conferencing in higher education. *The Internet and Higher Education, 2*(2), 87-105. doi:10.1016/S1096-7516(00)00016-6

Garrison, D. R., Anderson, T., & Archer, W. (2001). Critical thinking and computer conferencing: A model and tool to assess cognitive presence. *American Journal of Distance Education*, *15*, 7–23. Retrieved from http://hdl.handle.net/2149/740

Ge, X., & Land, S. M. (2002). A conceptual framework for scaffolding ill-structured problem-solving processes using question prompts and peer interactions. *Educational Technology Research and Development, 52*(2), 5-22. doi:10.1007/BF02504836

Gelo, O., Braakmann, D., & Benetka, G. (2008). Quantitative and qualitative research: Beyond the debate. *Integrative Psychological and Behavioral Science, 42*(3), 266-290. doi:10.1007/s12124-008-9078-3

Gibson, J. T. (2009). Discussion approach to instruction. In C. M. Reigeluth & A. A. Carr-Chellman (Eds.), *Instructional-design theories and models* (Vol. III) (pp. 99-116). New York, NY: Routledge.

Gilbert, P. K., & Dabbagh, N. (2005). How to structure online discussion for meaningful discourse: A case study. *British Journal of Educational Technology*, *36*(1), 5–18. doi:10.1111/j.1467-8535.2005.00434.x

Gorard, S. (2001). *Quantitative methods in educational research: The role of numbers made easy*. New York, NY: Continuum.

Gunawardena, C. N., Anderson, T., & Lowe, C. A. (1997). Analysis of a global online debate and the development of an interaction analysis model for examining the social construction of knowledge in computer conferencing. *Journal of Educational Computing Research, 17*(4), 395-429. Retrieved from http://baywoodjournals.com/index.php/OJS

Gunawardena, C. N., Lowe, C. A., & Anderson, T. (1998, August). Transcript analysis of computer-mediated conferences as a tool for testing constructivist and social-constructivist learning theories. Paper presented at the Annual Conference on Distance Teaching and Learning, Madison, WI.

Guzdial, M., & Turns, J. (2000). Effective discussion through a computer-mediated anchored forum. *Journal of the Learning Sciences*, 9(4), 437-470. doi:10.1207/S15327809JLS0904_3

Halawi, L. A., McCarthy, R. V., & Pires, S. (2009). An evaluation of e-learning on the basis of Bloom‘s taxonomy: An exploratory study. *Journal of Education for Business, 84*(6), 374-380. doi:10.3200/JOEB.84.6.374-380

Hall, B. M. (2010a). In support of the interaction analysis model (IAM) for evaluating discourse in a virtual learning community. Manuscript submitted for publication.

Hall, B. M. (2010b). Interaction is insufficient: Why we need intersubjectivity in course room discourse. *Journal of eLearning and Online Teaching, 1*(12). Retrieved from http://www.theelearninginstitute.org

Halpern, D. (2003). The ―how and why" of critical thinking assessment. In D. Fasko (Ed.), *Critical thinking and reasoning: Current research, theory and practice* (pp. 355-366). Cresskill, NJ: Hampton Press.

Hannafin, M. J. (1989). Interaction strategies and emerging instructional technologies: Psychological perspectives. *Canadian Journal of Educational Communication, 18*(3), 167−179. Retrieved from http://www.cjlt.ca/index.php/cjlt/article/download/274/208

Hara, H., Bonk, C. J., & Angeli, C. (2000). Content analysis of online discussion in an applied educational psychology course. *Instructional Science*, *28*(2), 115–152. Center for Research on Learning and Technology Technical Report No. 2-98. Retrieved from http://crlt.indiana.edu/publications/journals/techreport.pdf

Harel, I., & Papert, S. (1991). Software design as a learning environment. In I. Harel & S. Papert (Eds.), *Constructionism* (pp. 41-84). Norwood, NJ: Ablex.

Hayes, A. F., & Krippendorff, K. (2007). Answering the call for a standard reliability measure for coding data. *Communication Methods and Measures, 1*(1), 77-89. doi:10.1080/19312450709336664

Henri, F. (1992). Computer conferencing and content analysis. In A. R. Kaye (Ed.), *Collaborative learning through computer conferencing: The Najaden Papers* (pp. 115-136). Heidelberg, Germany: Springer-Verlag.

Heo, H., Lim, K., & Kim, Y. (2010). Exploratory study on the patterns of online interaction and knowledge co-construction in problem-based learning. *Computers & Education, 55*(3), 1383-1392. doi:10.1016/j.compedu.2010.06.012

Herbert, M. (2006). Staying the course: A study in online student satisfaction and retention. *Online Journal of Distance Learning Administration, 9*(4), n.p. Retrieved from http://www.westga.edu/~distance/ojdla/winter94/herbert94.htm

Herring, S. C. (2010). Web content analysis: Expanding the paradigm. In J. Hunsinger, M. Allen & L. Klastrup (Eds.), *The international handbook of internet research* (pp. 233-249). Berlin, Germany: Springer Verlag.

Hershkovita, A., & Nachmias, R. (2011). Online persistence in higher education web-supported courses. *The Internet and Higher Education, 14*(2), 98-106. doi:10.106/j.iheduc.2010.08.001

Hewitt, J. (2005). Toward an understanding of how threads die in asynchronous computer conferences. *Journal of the Learning Sciences, 14*(4), 567-589. doi:10.1207/s15327809jls1404

Hopkins, J., Gibson, W., Ros i Solé, C., Savvides, N., & Starkey, H. (2008). Interaction and critical inquiry in asynchronous computer-mediated conferencing: A research agenda. *Open Learning, 23*(1), 29-42. doi:10.1080/02680510701815301

Hou, H. T., Chang, K. E., & Sung, Y. T. (2007). An analysis of peer assessment online discussions within a course that uses project-based learning. *Interactive Learning Environments, 15*(3), 237-251. doi:10.1080/10494820701206974

Hull, D. M., & Saxon, T. F. (2009). Negotiation of meaning and co-construction of knowledge: An experimental analysis of asynchronous online discussion. *Computers and Education, 52*(3), 624-639. doi:10.1016/j.compedu.2008.11.005

Huntley, B. C., & Thatcher, A. (2008). The impact of time delay on the content of discussions at a computer-mediated conference. *AIP Conference Proceedings*, 1060, 38-41. doi:10.1063/1.3037100

Husserl, E. (1931). *Cartesian meditations: An introduction to phenomenology* (D. Cairns, Trans.). Dordrecht, Holland: Kluwer.

Jamaludin, A., & Lang, Q. C. (2006). Using asynchronous online discussions in primary school project work. *Australasian Journal of Educational Technology, 22*(1), 64-87. Retrieved from http://www.ascilite.org.au/ajet/ajet.html

Järvelä, S., & Häkkinen, P. (2002). Web-based cases in teaching and learning – the quality of discussions and a stage of perspective taking in asynchronous communication. *Interactive Learning Environments, 10*(1), 1-22. doi:10.1076/ilee.10.1.1.3613

Jeong, A. C. (2003). The sequential analysis of group interaction and critical thinking in online threaded discussions. *The American Journal of Distance Education, 17*(1), 25-43. Retrieved from http://bbproject.tripod.com/SequentialAnalysis%5fJeong2003.pdf

Jeong, A., & Frazier, S. (2008). How day of posting affects levels of critical discourse in asynchronous discussions and computer-supported collaborative argumentation. *British Journal of Educational Technology, 39*(5), 875-887. doi:10.1111/j.1467-8535.2007.00789.x

Jerolmack, C. (2009). Humans, animals, and play: Theorizing interaction when intersubjectivity is problematic. *Sociological Theory, 27*(4), 371-389. doi:10.1111/j.14679558.2009.01353.x

Jonassen, D. H. (1999). Designing constructivist learning environments. In C. M. Reigeluth (Ed.), *Instructional design theories and models: A new paradigm of instructional theory* (Vol. II) (pp. 215-239). Mahwah, NJ: Erlbaum.

Jorcak, R. L., & Bart, W. (2009). The effect of task characteristics on conceptual conflict and information processing in online discussion. *Computers and Human Behavior, 25*(5), 1165-1171. doi:10.1016/j.chb.2009.04.010

Jorgensen, J. (2009). Examining the relationship between online discussion responses and learner achievement. (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses. (3355341)

Kafai, Y., & Resnick, M. (Eds.) (1996). *Constructionism in practice: Designing, thinking, and learning in a digital world*. Mahwah, NJ: Erlbaum.

Kaiser, L. M. (2011). *Generational differences in preferences for interactivity*. (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses. (3445238)

Kant, I. (2007). *Critique of pure reason* (M. Weigelt, Trans.). New York, NY: Penguin.

Kanuka, H., Rourke, L., & Laflamme, E. (2007). The influence of instructional methods on the quality of online discussion. *British Journal of Educational Technology, 38(2),* 260–271. doi:10.1111/j.1467-8535.2006.00620.x

Ke, F. (2010). Examining online teaching, cognitive, and social presence for adult students. *Computers and Education, 55*(2), 808-820. doi:10.1016/j.compedu.2010.03.013

Ke, F., & Xie, K. (2009). Toward deep learning for adult students in online courses. *Internet in Higher Education, 12*(3-4), 136-145. doi:10.1016/j.iheduc.2009.08.001

Khine, M. S., Yeap, L. L., & Lok, T. C. (2003). The quality of message ideas, thinking and interaction in an asynchronous CMC environment. *Education Media International, 40*(1-2), 115-125. doi:10.1080/0952398032000092161

Kozma, R. B. (1994a). Will media influence learning? Reframing the debate. *Educational Technology Research and Development, 42(*2), 7-19. doi:10.1007/BF02299087

Kozma, R. B. (1994b). A reply: Media and methods. *Educational Technology Research and Development, 42(*3), 11-14. doi:10.1007/BF02298091

Kozma, R. B. (2000). Reflections on the state of educational technology research and development. *Educational Technology Research and Development, 48*(1), 5-15. doi:10.1007/BF02313481

Kretovics, M. A., Crowe, A. R., & Hyun, E. (2005). A study of faculty perceptions of summer compressed course teaching. *Innovative Higher Education, 30*(1)*,* 37–51. doi:10.1007/s10755-005-3295-1

Krippendorff, K. (1980). *Content analysis: An introduction to its methodology*. Newbury Park, CA: Sage.

Krippendorff, K. (2004). *Content analysis: An introduction to its methodology* (2nd Ed.). Thousand Oaks, CA: Sage.

Krippendorff, K. H., & Bock, M. A. (Eds.). (2008). *The content analysis reader*. Thousand Oaks, CA: Sage.

Kucsera, J. V., & Zimmaro, D. M. (2010). Comparing the effectiveness of intensive and traditional courses. *College Teaching, 58*(2), 62-68. doi:10.1080/87567550903583769

Lamiell, J. T. (1998). Nomothetic and idiographic: Contrasting Windelband's understanding with contemporary usage. *Theory & Psychology, 8*(1), 23-38. doi:10.1177/0959354398081002

Lang, Q. C. (2010). Analysing high school students‘ participation and interaction in an asynchronous online project-based learning environment. *Australasian Journal of Educational Technology, 26*(3). 327-340. Retrieved from http://www.ascilite.org.au/ajet/ajet.html

Lee, L. (2009). Scaffolding collaborative exchanges between expert and novice language teachers in threaded discussions. *Foreign Language Annals, 40*(2), 212-228. doi:10.1111/j.1944-9720.2009.01018.x

Leedy, P. D., & Ormrod, J. E. (2005). *Practical research: Planning and design* (8th ed.). Upper Saddle River, NJ: Pearson.

Levin, J., Kim, H., & Riel, M. (1990). Analyzing instructional interactions on electronic message networks. In L. Harasim (Ed.), *Online education* (pp. 185-213). New York, NY: Praeger.

Li, Y., Dong, M., & Huang, R. (2009). Toward a semantic forum for active collaborative Learning. *Educational Technology &Society*, *12* (4), 71–86. Retrieved from http://www.ifets.info/

Li, Z. (2010). *Asynchronous discourse is a web-assisted mathematics education course*. (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses. (3381983)

Ligorio, M. B., Cesareni, D., & Schwartz, N. (2008). Collaborative virtual environments as means to increase levels of intersubjectivity in a distributed cognition system. *Journal of Research on Technology and Education, 40*(3), 339-357. Retrieved from http://www.iste.org/jrte.

Lim, T (2004). Towards an Asian model of face. *Human Communication*, 7(1), 53-66. Retrieved from http://www.paca4u.com

Luebeck, J. L., & Bice, L. R. (2005). Online discussion as a mechanism of conceptual change among mathematics and science teachers. *Journal of Distance Education 20*(2), 21-39. Retrieved from http://www.jofde.ca

Mackeracher, D. (2004). *Making sense of adult learning* (2nd ed.). Canada: University of Toronto Press.

Mäkitalo-Siegl, K. (2009). *Interaction in online learning environments: How to support collaborative activities in higher education settings*. Saarbrücken, Germany: Lambert.

Maor, D. (2007, December). The cognitive and social processes of university students' online learning. Paper presented at the annual conference of the Australian Society for Computers in Learning in Teritiary Education (ASCILITE), Singapore. Retrieved from http://www.ascilite.org.au/conferences/singapore07/procs/maor.pdf

Martin, J., Sokol, B. W., & Elfers, T. (2008). Taking and coordinating perspectives: From pre-reflective interactivity, through reflective intersubjectivity, to meta-reflective sociality. *Human Development, 51*(5/6), 294-317. doi:10.1159/000170892

Mason, R. (1992). Methodologies for evaluating applications of computer conferencing. In A. R. Kaye (Ed.), *Collaborative learning through computer conferencing: The Najaden Papers* (pp. 105-116). Heidelberg, Germany: Springer-Verlag.

Matzat, U. (2010). Reducing problems of sociability in online communities: Integrating online communication with offline interaction. *American Behavioral Scientist, 53*(8), 1170-1193. doi:10.1177/0002764209356249

Matusov, E. (1996). Intersubjectivity without agreement. *Mind, Culture, and Society, 3*(1), 26-45. doi:10.1207/s15327884mca0301_4

McLoughlin, C. (2002). Learner support in distance and networked learning environments: Ten dimensions for successful design. *Distance Education, 23*(2), 149-162. doi:10.1080/0158791022000009178

McMahon, M. N. (1999). Applying Stolorow's theory of intersubjectivity to Hendrix's Imago techniques. *Smith College Studies in Social Work, 69*(2), 311-334. doi:10.1080/00377319909517557

Messick, S. (1989). Validity. In R. L. Linn (Ed.), *Educational measurement* (3rd ed.) (pp. 13-103). New York, NY: Macmillan.

Meyer, K. A. (2003). Face-to-face versus threaded discussions: The role of time and higher-order thinking. *Journal of Asynchronous Learning Networks, 7*(3), 55-65. Retrieved from http://www.sloanconsortium.org/publications/jaln_main

Moore, M., & Kearsley, G. (2005). *Distance education: A systems view*. Belmont, CA: Thomson Wadsworth.

Moore, J. L., & Marra, R. M. (2005). A comparative analysis of online discussion participation protocols. *Journal of Research on Technology in Education 38*(2), 191-212. Retrieved from http://www.iste.org

Muirhead, B., & Juwah, C. (2004). Interactivity in computer-mediated college and university education: A recent review of the literature. *Educational Technology & Society, 7*(1), 12−20. Retrieved from http://www.ifets.info/

Natterson, I. (1993). Turning points and intersubjectivity. *Clinical Social Work Journal, 21*(1), 45-56. Retrieved from http://www.springer.com/psychology/journal/10615

Neuendorf, K. (2002). *The content analysis guidebook*. Thousand Oaks, CA: Sage.

Newman, D. R., Webb, B., & Cochrane, C. (1995). A content analysis method to measure critical thinking in face-to-face and computer supported group learning. *Interpersonal Computing and Technology, 3*(2), 56-77. Retrieved from http://www.aect.orgIntranet/Publications/ipct-j/index.html

Newman, L., & Benz, C. R. (1998). *Qualitative-quantitative research methodology: Exploring the interactive continuum*. Carbondale, IL: Southern Illinois University Press.

Niemczyk, M., & Savenye, W. (2010). Improving learning in computer-based instruction through question type and grouping strategies. *Journal of Educational Multimedia and Hypermedia, 19*(1), 79-102. Retrieved from http://www.editlib.org

Oliver, R. (2008) *Interactions in multimedia learning materials: The things that matter.* Retrieved from http://elrond.scam.ecu.edu.au/oliver/docs/96/IMMS.pdf

Oliver, R., & McLoughlin, C. (2001). Using networking tools to support online learning. In F. Lockwood & A. Gooley (Eds.), *Innovation in open and distance learning: Successful development of online and web-based learning* (pp. 148-159). London: Kogan Page

Onrubia, J., & Engel, A. (2009). Strategies for collaborative writing and phases of knowledge construction in CSCL environments. *Computers & Education, 53*(4), 1256–1265. doi:10.1016/j.compedu.2009.06.008

Osman, G., & Herring, S. C. (2007). Interaction, facilitation, and deep learning in cross-cultural chat: A case study. *Internet and Higher Education, 10*(2), 125-141. doi:10.1016/j.iheduc.2007.03.004

Papert, S. (1980). *Mindstorms: Children, computers, and powerful ideas*. New York, NY: Basic Books.

Papert, S. (1991). Situating constructionism. In I. Harel & S. Papert (Eds.), *Constructionism* (pp. 1-11). Norwood, NJ: Ablex.

Parker, N. K. (2004). The quality dilemma in online education. In T. Anderson & F. Elloumi (Eds.), *Theory and practice in online learning* (pp. 385-421). Canada: Athabasca University.

Paul, R. (1993). *Critical thinking: How to prepare students for a rapidly changing world.* Rohnert Park, CA: Sonoma State University Center for Critical Thinking and Moral Critique.

Paulus, T. M. (2006). Challenge or connect? Dialogue in online learning environments. *Journal of Computing in Higher Education, 18*(1), 3-29. doi:10.1007/BF03032722

Pawan, F., Paulus, T. M., Yalcin, S., & Chang, C-F. (2003). Online learning: patterns of engagement and interaction among in-service teachers. *Language Learning & Technology*, *7*(3), 119–140. Retrieved from http://llt.msu.edu/vol7num3/pawan/

Pendergast, M. (2006). An analysis tool for the assessment of student participation and implementation dynamics in online discussion forums. *ACM SIGITE Newsletter, 3*(2), 10-17. doi:10.1145/1142152.1142153

Piaget, J. (1952). *The origins of intelligence in children* (M. Cook, Trans.). New York, NY: International Universities Press.

Piaget, J. (1973). *To understand is to invent: The future of education* (G-A. Roberts, Trans.). New York, NY: Grossman.

Poellnitz, F. D. (2008). *Student evaluation of instruction: Traditional 14-week semester versus 7-week accelerated end-of-course evaluations* (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses. (3292906)

Reich, W. (2010). Three problems of intersubjectivity – and one solution. *Sociological Theory, 28*(1), 40-63. doi:10.1111/j.1467-9558.2009.01364.x

Reigeluth, C. M. (1999). *Instructional design theories and models: A new paradigm of instructional theory* (Vol. II). Mahwah, NJ: Erlbaum.

Reigeluth, C. M., & Carr-Chellman, A. A. (Eds.). (2009). *Instructional-design theories and models* (Vol. III). New York, NY: Routledge.

Renaud, R. D., & Murray, H. G. (2007). The validity of higher-order questions as a process indicator of educational quality. *Research in Higher Education, 48*(3), 319-351. doi:10.1007/s11162-006-9028-1

Rogoff, B., & Wertsch, J. V. (1984.) *Children's learning in the zone of proximal development*. San Francisco: Jossey-Bass.

Romeo, L. (2001). Asynchronous environment for teaching and learning: Literacy trends and issues online. *The Delta Kappa Gamma Bulletin, 6*(3), 24-28. Retrieved from http://www.dkg.org

Rosenshine, B., & Meister, C. (1992). The use of scaffolds for teaching higher-level cognitive strategies. *Educational Leadership, 49*(7), 26-33. Retrieved from http://www.ascd.org/publications/educational-leadership.aspx

Rourke, L., & Anderson, T. (2004). Validity in quantitative content analysis. *Educational Technology, Research & Development, 52*(1), 5-18. doi:10.1007/BF02504769

Salmon, G. (2000). *E-moderating: The key to teaching and learning online.* London: Kogan Page.

Saritas, T. (2008). The construction of knowledge through social interaction via computer-mediated communication. *The Quarterly Review of Distance Education, 9*(1), 35-49. Retrieved from http://www.infoagepub.com/Quarterly-Review-of-Distance-Education.html

Saye, J. W., & Brush, T. (2002). Scaffolding critical reasoning about history and social issues in multimedia-supported learning environment. *Educational Technology Research and Development, 50*(3), 77-96. doi:10.1007/BF02505026

Schellens, T., & Valcke, M. (2005). Collaborative learning in asynchronous discussion groups: What about the impact of cognitive processing? *Computers in Human Behavior, 21*(6), 957-975. doi:10.1016/j.chb.2004.02.025

Schellens, T., Van Keer, H., & Valcke, M. (2005). The impact of role assignment on knowledge construction in asynchronous discussion groups: A multilevel analysis. *Small Group Research, 36*(6), 704-745. doi:10.1177/1046496405281771

Schellens, T., Van Keer, H., Valcke, M., & De Wever, B. (2007). Learning in asynchronous discussion groups: A multilevel approach to study the influence of student, group, and task characteristics. *Behaviour and Information Technology, 26*(1), 55-714. doi:10.1080/01449290600811578

Schwartzman, R. (2006). Virtual group problem solving in the basic communication course: Lessons for online learning. *Journal of Instructional Psychology, 33*(1), 3-14. Retrieved from http://roypoet.com/files/Virtual_Group_Problem_Solving.pdf

Seamon, M. (2004). Short- and long-term differences in instructional effectiveness between intensive and semester-length courses. *Teachers College Record, 106*(4), 852–874. doi:10.1111/j.1467-9620.2004.00360.x

Sharma, P., & Hannafin, M. J. (2007). Scaffolding in technology-enhanced learning environments. *Interactive Learning Environments,15*(1), 26-46. doi:10.1080/10494820600996972

Shedletsky, L. (2010). *Cases on online discussion and interaction: Experiences and outcomes*. Hershey, PA: IGI Global.

Sieber, J. E. (1998). Planning ethically responsible research. In L. Bickman & J. Rog (Eds.), *Handbook of applied social science methods* (pp. 127-156). Thousand Oaks, CA: Sage.

Silber, K. H. (2007). A principle-based model of instructional design: A new way of thinking about and teaching ID. *Educational Technology Magazine, 47*(5), 5-19. Retrieved from http://asianvu.com

Sims, R. (1997). Interactivity: A forgotten art? *Computers in Human Behavior, 13*(2), 157-180. doi:10.1016/S0747-5632(97)00004-6

Sing, C. C., & Khine, M. S. (2006). An analysis of interaction and participation patterns in online community. *Educational Technology & Society*, *9*(1), 250–261. Retrieved from http://www.ifets.info/

Spatariu, A., Quinn, L. F., & Hartley, K. (2007). A review on research of factors that impact aspects of online discussions quality. *TechTrends, 51*(3), 44-45. doi:10.1007/s11528-007-0041-9

Strijbos, J. W., & Fischer, F. (2007). Methodological challenges for collaborative learning research. *Learning and Instruction, 17*(4), 389-393. doi:10.1016/j.learninstruc.2007.03.004

Strijbos, J. W., & Stahl, G. (2007). Methodological issues in developing a multi-dimensional coding procedure for small-group chat communication. *Learning and Instruction, 17*(4), 394–404. doi:10.1016/j.learninstruc.2007.03.005

Suthers, D. (2006). Technology affordances for intersubjective meaning-making: A research agenda for CSCL. *International Journal of Computers Supported Collaborative Learning, 1*(3), 315-337. Retrieved from http://lilt.ics.hawaii.edu/lilt/papers/2006/Suthers-ICCE-2006-Keynote.pdf

Thomas, M. J. W. (2002). Learning within incoherent structures: The space of online discussion forums. *Journal of Computer Assisted Learning, 18*(3), 351-366. doi:10.1046/j.0266-4909.2002.03800.x

Thompson, J. (2009). To question or not to question: The effects of two teaching approaches on students‘ thinking dispositions, critical thinking skills, and course grades in a critical thinking course. (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses. (3355859)

Topçu, A. (2008). ‗Intentional repetition‘ and learning style: Increasing efficient and cohesive interaction in asynchronous online discussions. *British Journal of Educational Technology, 39*(5), 901-919. doi:10.1111/j.1467-8535.2007.00783.x

Tu, C. H. (2002). The impacts of text based CMC on online social presence. *Journal of Interactive Online Learning, 1*(2), 1-24. Retrieved from http://www.ncolr.org/jiol/

Tu, C. H., & Corry, M. (2003). Designs, management tactics, and strategies in asynchronous learning discussions. *The Quarterly Review of Distance Education, 4*(3), 303-415. Retrieved from http://www.infoagepub.com/Quarterly-Review-of-Distance-Education.html

Turkle, S., & Papert, S. (1991). Epistemological pluralism. In I. Harel & S. Papert (Eds.), *Constructionism* (pp. 161-191). Norwood, NJ: Ablex.

Vogt, W. P. (2007). *Quantitative research methods for professionals*. Boston, MA: Allyn & Bacon.

Von Glaserfeld, E. (1995). A constructivist approach to teaching. In L. P. Steffe & J. Gale (Eds.), *Constructivism in education* (pp. 3-15). Hillsdale, NJ: Erlbaum.

Von Glaserfeld, E. (1996). Aspects of constructivism. In C. T. Fosnot (Ed.), *Constructivism: Theory, perspectives, and practice* (pp. 3-7). New York, NY: Teachers College Press.

Vygotsky, L. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Wagner, E. D. (1994). In support of a functional definition of interaction. *American Journal of Distance Education, 8*(2), 6−26. doi:10.1080/08923649409526852

Wan, D., & Johnson, P. (1994, October 22). *Computer supported collaborative learning using CLARE: The approach and experimental findings*. Proceedings of the Conference on Conputer Supported Cooperative Work (pp. 187-198). New York, NY: ACM Press.

Wang, C. H. (2005). Questioning skills facilitate online synchronous discussion. *Journal of Computer Assisted Learning, 21*(4), 303-313. doi:10.1111/j.1365-2729.2005.00138.x

Wang, Q., Woo, H. L., & Zhao, J. (1999). Investigating critical thinking and knowledge construction in an interactive learning environment. *Interactive Learning Environments, 17*(1), 95-104. doi:10.1080/10494820701706320

Weare, C., & Lin, W. Y. (2000). Content analysis of the World Wide Web—Opportunities and challenges. *Social Science Computer Review, 18*(3), 272-292. doi:10.1177/089443930001800304

Wells, G. (1999). *Dialogic Inquiry.* United Kingdom: Cambridge University Press.

Wertsch, J. V. (1985). *Vygotsky and the social formation of mind.* Cambridge, MA: Harvard University Press.

Wickersham, L. E., & Dooley, K. E. (2006). A content analysis of critical thinking skills as an indicator of quality of online discussion in virtual learning communities. *Quarterly Review of Distance Education, 7*(2), 185–193. Retrieved from http://www.aect.org/intranet/publications/QRDE/subguides.html

Wise, A. F., Padmanabhan, P., and Duffy, T. M. (2009). Connecting online learners with diverse local practices: The design of effective common reference points for conversation. *Distance Education, 20*(3), 317–338. doi:10.1080/01587910903236320

Woo, Y., & Reeves, T. C. (2007). Meaningful interaction in web-based learning: A social constructivist interpretation. *Internet and Higher Education, 10*(1), 15-25. doi:10.1016/j.iheduc.2006.10.005

Wood, D., Bruner, J., & Ross, G. (1976). The role of tutoring in problem solving. *Journal of Child Psychology and Psychiatry, 17*(2)*,* 89-100. doi:10.1111/j.1469-7610.1976.tb00381.x

Wruck, L. M. (2010). *Computer-mediated communication: Instructional design strategies that support the attainment of Bloom's higher-order cognitive skills in asynchronous discussion questions.* (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses. (3409304)

Yang, Y. C. (2008). A catalyst for teaching critical thinking in a large university class in Taiwan: Asynchronous online discussions with the facilitation of teaching assistants. *Educational Technology Research Development, 56*(3), 241-264. doi:10.1007/s11423-007-9054-5

Yang, Y. C., Newby, T. J., & Bill, R. L. (2005). Using Socratic questioning to promote critical thinking skills through asynchronous discussion forums in distance learning environments. *American Journal of Distance Education, 19*(3), 163–181. doi:10.1207/s15389286ajde1903_4

Yu, C. H. (2006). *Philosophical foundations of quantitative research methodology*. Lanham, MD: University Press of America.

Zhang, T., Koehler, M. J., & Spatariu, A. (2009). The development of the Motivation for Critical Reasoning in Online Discussions Inventory (MCRODI). *The American Journal of Distance Education, 23*(4), 194-211. doi:10.1080/08923640903294411

APPENDIX A. INTERACTION ANALYSIS MODEL (IAM)

Phase	Category	Indicators
1	Sharing & Comparing	• Statement of observation or opinion • Statement of agreement • Corroborating examples • Asking and answering questions to clarify details of statements • Definition, description, or identification of a problem
2	Dissonance	• Identifying and stating areas of disagreement • Asking and answering questions to clarify the source and extent of disagreement • Restating the participant‘s position, and possibly advancing arguments or considerations in its support by references to the participant‘s experience, literature, formal data collected or proposal of relevant metaphor or analogy to illustrate point of view
3	Negotiation & Co-Construction	• Negotiation or clarification of the meaning of terms • Negotiation of the relative weight to be assigned to arguments • Identification of areas of agreement or overlap among conflicting concepts • Proposal and negotiation of new statements embodying compromise, co-construction • Proposals integrating or accommodating metaphors or analogies
4	Testing Tentative Constructions	• Testing the proposed synthesis against ‗received fact‘ as shared by the participants and/or their culture • Testing against existing cognitive schema • Testing against personal experience • Testing against formal data collected • Testing against contradictory testimony in the literature
5	Statement & Application of Newly Constructed Knowledge	• Summarization of agreement(s) • Applications of new knowledge • Metacognitive statements by the participants illustrating their (cognitive schema) has changed as a result of the interaction

Note. From ―Analysis of a global online debate and the development of an interaction analysis model for examining the social construction of knowledge in computer conferencing," by C.N. Gunawardena, T. Anderson, and C.A. Lowe, 1997, *Journal of Educational Computing Research, 17*(4), p. 414. Copyright 1997 by the Baywood Publishing Company. Adapted with permission.

APPENDIX B. INTER-RATER AGREEMENT USING IAM

Study	Cohen's κ	Krippendorff's α	Cronbach's α	Other	Method Not Provided
Luebeck & Bice (2005)	.83				
Moore & Marra (2005)	.61	.93			
Schellens & Valcke (2005)			.88-.99		
Schellens, et al. (2005)				.90[a]	
Yang et al. (2005)				.93[b]	
Jamaludin & Lang (2006)	.82				
Lu & Cheng (2006)	.76				
Hou et al. (2007)	.73				
Maor (2007)					
Osman & Herring (2007)					>.80
Schellens et al. (2007)			.87		
Huntley & Thatcher (2007)	.94				
Saritas (2008)					>.80
Yang (2008)	.91				
De Wever et al. (2008)		.40 < > .80			
Hull & Saxon (2009)	.77				
Ke & Xie (2009)					.87
Onrubia & Engel (2009)					> .90
De Wever et al. (2010)		.52			
Heo et al. (2010)					.86
Li (2010)				.839[c]	
Lang (2010)	.85				

[a] Holsti's percent agreement. [b] Miles & Huberman's percent agreement. [c] Pearson's *r* (p <.001)