1-1-2006

The influence of the discussion leader procedure on the quality of arguments in online discussions

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A dissertation submitted in partial fulfillment
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Doctor of Philosophy Degree in Learning and Technology
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Graduate College
University of Nevada, Las Vegas
December 2006

UNLV
UNIVERSITY OF NEVADA LAS VEGAS

Thesis Approval

The Graduate College
University of Nevada, Las Vegas

May 10, 20 06

The Thesis prepared by

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Entitled

The Influence of the Discussion Leader Procedure on the Quality of Arguments in Online Discussions

is approved in partial fulfillment of the requirements for the degree of

Doctor of Philosophy in Learning and Technology

Examination Committee Chair

Dean of the Graduate College

Examination Committee Member

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1017-53

ABSTRACT

The Influence of the Discussion Leader Procedure on the Quality of Arguments in Online Discussions

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Online discussions can lead to an enriched understanding of course content. This study explored the influence of a discussion leader procedure with specific instructions on the quality of online argumentation and interactivity. Sound analysis of both sides of an issue and movement towards a final resolution has not been evaluated within online discussions current research. Subjects were 44 undergraduate students who participated in online discussions on a technology issue over two weeks. Participants also completed a need for cognition scale developed by Cacioppo, Petty, and Kao (1984). Results indicated that students participating in groups receiving specific argumentation instructions from the leader produced better online argumentation for the second week and exhibited increased interactivity patterns for both weeks.

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CHAPTER 1

INTRODUCTION

Online discussion forums are becoming common practice in many areas of education. Online discussions are seen as a vital component in enhancing student communication, evoking thought and debate; thus leading to an enriched understanding of course content. According to Winiecki (2003) "discussion" could be viewed as one of the oldest forms of instruction. However, through technological advancement "discussion" has evolved from face to face verbal communication to a computer-based, online forum that can be accessed consecutively by multitudes of individuals at their convenience. Researchers' understanding of the workings of online discussions is necessary as use of them in both distance education and hybrid courses is increasing. To date, several researchers have explored key factors that influence the quality of online discussions. This research study will explore the influence of the discussion leader procedure with argumentation instructions on the quality of student discussion, particularly on the process of online argumentation.

This chapter begins with an overview of the evolution of distance education, in particular online courses. Following, the educational value and role of discussions is presented. Next, argumentative writing and its importance to the learning process is discussed as well as different modes of intervention used to improve the quality of

argumentation and critical thinking. Lastly, the theoretical background and purposes of this research study are introduced.

Evolution of Distance Education and Need of Empirical Research

Distance education has rapidly developed at postsecondary institutions primarily evolving from correspondence courses. In the late 1800s at the University of Chicago, the first major correspondence program in the United States was developed. This program joined learners and teachers in different geographic locations (McIsaac & Gunawardena, 1996). Also, Penn State developed a program of correspondence study in 1892. The program offered agricultural studies to rural areas (Penn, 2005). In the 1990s the advancement of technology such as fiber optics, television, and the Internet has provided new delivery options for distance education. The Internet in particular has opened new perspectives for distance education through a variety of mediums (i.e., chat-synchronous communication, email, discussion forums-asynchronous communication, online resources, video streaming, etc.). These mediums have allowed for interaction and collaboration at a distance (Saba, 2003).

The rapid evolution and development of distance education has been extensively documented. A survey of the National Center for Educational Statistics (1999) reported approximately 30 percent of the Nation's 2-year and 4-year postsecondary education institutions offered distance education courses during the 12-month 1997–98 academic year; with enrollment of approximately 1,700,000 students. In contrast during the 12-month 2000–2001 academic year, nearly double (56 percent) of all 2-year and 4-year postsecondary institutions offered distance education courses with student enrollment

estimated at 3,077,000 (NCES, 2002). Also approximately 90 percent of public 2-year and 4-year institutions offered distance education courses. According to the U.S. Department of Education (2003), 89% of public, 4-year institutions offered distance education courses during the 2000–2001 academic year, 90% of which offered Internet courses. In addition, two Sloan Surveys (2003, 2004) of online learning show a significant increase of student enrollment in online courses throughout the U.S. Higher Education system. The Sloan surveys polled over 1,100 colleges and universities in the U.S. Results indicated that over 1.6 million students were studying online in the fall of 2002, and that schools expected that number to grow substantially by the fall of 2003. The 2004 survey indicated a 300,000 student enrollment increase totaling over 1.9 million students. The online enrollment growth rate is expected to rise rapidly by 24.8% per year.

The evidenced advantages and widespread use of online distance education courses have triggered new fields of educational study. As learners are at the heart of distance education activities, research in the field of distance learning should be concentrated on how students acquire knowledge through this medium and what continued improvements need to be made. For example, an analysis by Koble and Bunker (1997) determined that only 17% of the 117 articles published in the American Journal of Distance Education in the first 8 years of existence had a focus on learners and the learning process. A similar analysis by Coldeway, as cited in Gibson (2003), of the Canadian Journal of Distance Education found only 19.5% of the articles focused on learners and the learning process. Rourke and Szabo (2002) conducted a content analysis of research articles published in the Canadian Journal of Distance Education from 1986 to 2000. The analysis focused on

the type, topic, and research method of each article. The results reveal that four item types, Empirical, Description, Publication Review, and Viewpoint accounted for approximately 70% of the total number of articles. Empirical studies accounted only for approximately 22% of the total.

These publication analyses were not concerned with the soundness of the empirical articles (educational theory foundation, statistical power) nor evidenced what aspects of learning at the distance were researched (online asynchronous, online synchronous, teleconferencing). Thus, it can be inferred that research articles concerned directly with online learning (via Internet) might account for a very small percentage of the total and only some of them might have a sound theoretical or conceptual foundation. The need for more educational research on online learning environments is very evident.

Based on analyses of distance education journal articles, Gibson (2003) raised two concerns regarding distance education research. One concern is the scarce supply of research in this field focused on learners. The second major concern is the lack of a sound theoretical foundation of learners and the learning process. Winiecki (2003) points out the need for sound research related to four essential phases of on-line instruction. These stages are identified by Wilen (1990) as entry, clarification of subject matter, collaborative investigation (including online discussions), and closure or synthesis. Winiecki's (2003) specific interest lies in finding out how these four important elements of classroom instruction work successfully in online settings. These concerns can only be addressed by continuous and sustained research endeavors in the area of online education. This research study will address a fundamental gap in the area of distance education, generating and maintaining quality discussions in online forums. Particularly,

the study examines how the discussion leader procedure with pre-determined argumentation instructions affects the argumentative process and interactivity patterns in online discussions. Participants in the study are preservice teachers enrolled in hybrid education technology courses. The face to face component of the class consists of hands on technology activities in the computer lab. The online component of the class consists of readings discussions and assignments in WebCT software. Participants will conduct online asynchronous discussions via WebCT on a pertinent educational technology issue.

Discussions and the Learning Process

Discussions are "strategies designed to stimulate thinking, challenge attitudes and beliefs, and develop interpersonal skills" (Eggen & Kauchak, 1999, p.554). Online discussions are a good medium for discourse and reflection. Discourse refers to structured, coherent language sequences. Researchers consider quality discourse to be one of the most important aspects of effective schooling (Kuhn, Shaw, & Felton, 1997). Traditional classrooms however have not been promoting quality discourse and student reflection (Bruning, Schraw, & Ronning, 1999). In online discussion forums there are numerous opportunities for participation. Additionally, encouraging online interaction can increase students' expression, reflection, and critical thinking. One of the requirements of rich discourse, as Chinn and Waggoner (1992) suggest, is that instructors need to ensure students possess enough background knowledge to initiate and maintain a discussion topic. This knowledge can be based on prior interactions, assigned readings, or other sources. Besides having a knowledge base, in order to achieve quality discourse, students must be encouraged to share alternative perspectives and the discourse has to

have an open participation structure (Erkens, 1997, Veerman & Treasure-Jones, 2000). The intervention in this research study supports sharing alternative perspectives by prompting for counter arguments and has an open ended structure by engaging the students in analyzing both sides of the educational technology issue. Also, through the pre-determined instructions, elaborated argumentation over the topic is supported as the main component of critical thinking.

More advantages of structuring effective educational discussions are discussed below. Calfee, Dunlap, & Wat, (1994) suggest four ways discussions help accumulate knowledge and develop reflective thought. First, discussions supply connections for learning. Students make use of prior knowledge and use metacognition to generate coherent thoughts thus creating a new body of shared knowledge. Second, discussions facilitate knowledge organization. Students integrate new information with prior knowledge and build new schemas. Third, discussions promote reflection by pushing students to externalize and question existing ideas and beliefs and eventually come to some conclusions. Fourth, discussions extend knowledge. Student discourse can lead to discovery of new domains and develop new interests.

Participating in online discussion forums presupposes writing and reading, which are important components of knowledge building. Flower and Hayes (1984) view writing as problem solving with three components: task environment, long-term memory, and short term memory. The task environment refers to the writing assignment and the external storage. The writing assignment is the scope of the writing and targeted audience. The external storage is the actual text and notes or other texts used to write it. Long term memory stores content knowledge and discourse knowledge. Through discussions and

writing this knowledge continuously changes and evolves. The quality of the written piece depends on the writer's ability to use content and discourse knowledge in a particular writing task (Bereiter & Scarmadalia, 1987). Information received from the outside and the one retrieved from long term memory is combined in working memory. Working memory is where most cognitive processes take place while writing. Flower and Hayes (1984) further discuss three processes occurring in working memory: planning, translating, and reviewing. Participants in online courses use discussion forums to read each others postings related to assigned readings such as book chapters and articles. In this study students read a technology dilemma and participated in online discussions. The discussions that took place on the technology issue, presuppose writing which involves use of content knowledge (other course readings) and discourse knowledge (making valid arguments).

Moreover, online discussions are conducive to the following mental processes: elaboration, self-elaboration, self-organization, and forming connections. According to Woolfolk elaboration is "adding and extending meaning by connecting new information to existing knowledge (2001, p. 255)." Within the elaboration process schemas are applied and new understanding is constructed. The knowledge people already have changes through elaboration. Online discussions, if designed properly, place students in an active role of connection making. Writing responses to other students' postings involves them in elaborating and organizing the information for themselves and for the audience as well.

Classroom discourse is characterized by certain conversation elements that occur in online learning environments as well. Winiecki (2003) describes in depth four

fundamental components of conversation, turn-taking, overlap, repair, and formulations, and how they apply to online discussions. For example, speakers usually take turns in a conversation. In face to face classroom interaction the teacher usually guides the pace and turns of the conversation. Turn taking is manifested in both synchronous and asynchronous discussions. In asynchronous discussions turn taking usually occurs through reconstructing previous messages in new messages (some software makes this easier through the use of threading and quoting systems). In synchronous discussions turn taking, overlapping (for example turn taking before somebody finishes his/her thought in a chat room), and/or repairing (calling or correcting prior statements) take place in real time. Formulations occur when a threaded discussion gets too long and some students reformulate so that the meaning of what has been said is conveyed in just a couple of sentences. The WebCT discussion forum used in this study allows for all components of conversation to occur but mostly for formulations and turn taking. The following are a few examples of how conversations take place in a WebCT educational technology course.

Message no. 64[Branch from no. 42] Posted by Name of Student on Wednesday, September 7, 2005 2:18pm Subject: Re: digital kids from Name of Student.

I agree with your views on "Digital Tools for Digital Kids." Technology is extremely prevalent in our society. Students are growing up in this new digital era. Computer programs are fun yet can now be used as learning tools. If teachers could make learning fun for students that will last them throughout their education career. We need to make the curriculum based on the students needs, and that is through computers.

Message no. 65 Posted by Name of Student on Wednesday, September 7, 2005 4:50pm Subject: Name of Student in response to Digital Tools for Digital kids

As future teachers we need to take account for all students learning abilities. School is an institution where children should learn to the maximum of their capabilities. This is now a technology age, so teachers should accommodate for students needs. Now more than ever, computers and various teaching programs are available and should be taken advantage of.

Message no. 66[Branch from no. 59] Posted by Name of Student on Wednesday, September 7, 2005 5:23pm Subject: Re: Name of Student response to digital kids.

R (name of student) I also remember a teacher who would use the overhead projector for goofing off and drawing pictures. It was when I was taking my first algebra class and I really enjoyed the class and it made the pure torture of algebra less painful!

The one thing that I am worried about is, as a teacher and not having any kids of my own, it will be really hard to keep up with the technology that students know. Hopefully once I am in the classroom, it will be a lot easier. I have a lot of catching up to do already!!

Turn taking examples: "I agree with your views on..."; "R (name of student) I also remember a teacher who..."

Formulation examples: "This is now a technology age, so teachers should accommodate for students needs. Now more than ever..."; "Technology is extremely prevalent in our society. Students are growing up in this new digital era."

In conclusion, online discussions can offer equal opportunity for participation, promote cooperative work, and allow for reading, writing, and cognitive processes. Online discussions can also help students clarify course content, reflect, examine and understand each other beliefs, attitudes, and cultural values. In order to make a discussion effective, which entails benefiting students understanding of content, developing reflective thought, and writing clearly, different researchers have adopted different strategies for designing online forums. Some of these strategies will be further discussed with an emphasis on argumentative writing as it directly concerns the current study.

Argumentative Writing and Online Discussions

Many educational psychologists believe that critical thinking needs to be developed in schools. Two approaches to developing good thinking are direct teaching of critical thinking skills and embedded development of thinking skills in the curriculum (Woolfolk, 2004). The current study embeds thinking skills in the discussion of a pertinent technology dilemma by having the experimental group conduct argumentation discussion through a leader who prompts for rich arguments, counter arguments, and responses to counters. Critical thinking refers to a "wide range of cognitive skills and intellectual dispositions needed to effectively identify, analyze, and evaluate arguments and truth claims; to discover and overcome personal prejudices and biases; to formulate and present convincing reasons in support of conclusions; and to make reasonable, intelligent decisions about what to believe and what to do." (p.1) In other words critical thinking is the study of arguments. Each argument chooses a side or has a view of a particular issue or topic. According to Bassham, Irwin, Nardone, and Wallace (2005) critical thinking is characterized by the following intellectual standards: clarity, precision, accuracy, relevance, consistency, logical correctness, completeness, and fairness. Stimulating critical thinking argumentation is central to the development of quality discussions. There is research that shows the relatedness of constructing quality arguments to improving literacy skills (Pilkington & Walker, 2003), problem solving (Bruggen & Kirschner, 2003) and learning outcomes (Alexopoulu & Driver, 1996). The current study examines how discussions conducted within small groups with a leader can trigger argumentation as an important component of critical thinking.

Argumentation moves in conversation often start as early as 5 years of age (Weiss & Sachs, 1991). Even before the age of 5 children are involved in persuasive verbal actions (Golder & Pouit, 1999). Also, children were shown to be able to produce logical reasoning similar to adults starting with age 5 and later (Coirier, Andriessen, & Chanquoy, 1999). Given three requirements, familiarity with the situation, minimal level of subjective involvement, understandable and memorable data of the issue, children 8 years of age and later can produce sound reasoning favoring their standpoint (Stein & Miller, 1990). Coirier et al. (1999) argue that the most critical aspect of argumentation is writing it not just verbally producing it. In order for argumentation to occur certain pre-requisites have to be met. Researchers have identified a number of pre-requisites necessary for the development of elaborated argumentative text: (a) recognizing a conflict between two different positions on the same topic, (b) recognizing the topic as debatable socially, ideologically, and contextually, (c) being willing to resolve the conflict through argumentation, (d) claiming a position and supporting it with reasons, and (e) considering the opposite claim and using counter argumentation (Stein & Miller, 1993; Coirier et al., 1999; Golder & Pouit, 1999).

In order to satisfy argumentation pre-requisites, this study involves discussions over an educational dilemma, which meets the *existence of a conflict* requirement. The conflict was chosen from a collection of controversial issues in education (Abbeduto, 2000) and it relates to whether schools should adopt technologies or not. Claiming a position and developing arguments will be realized through instructing the group members to disagree with each other by supporting the claims with adequate evidence. Argumentation in open ended problem-solving is particularly productive when there is a focus on the problem

(Erkens, 1997, Veerman, Andriessen, & Kanselaar, 1999), new information is checked against existing knowledge, and multiple perspectives are examined (Veerman et al., 2000). To satisfy these requirements, in the current study, students are placed in small groups that receive one educational dilemma to discuss (focus), the dilemma relates to the use of technology in schools which pertains to student interests as they are education majors enrolled in an educational technology course (argument checking), and the discussion leader gives instructions that invite the group members to a debate that entails arguments, counter arguments, and responses to counters (multiple perspectives). Determinants of discourse argumentation are also related to the students' cognitive and social development and the existing dominant social position (Golder & Pouit, 1999). The selected dilemma for this study pertains to the level of the cognitive (topic appropriate for discussion in an undergraduate educational technology course), social (an issue that directly concerns current schooling system), and domain level of the subjects (the issue concerns them directly as future teachers faced with the rapid advancement of learning technologies).

Research on Online Arguments and Critical Thinking

This research study involves online argumentation over an open-ended educational controversy. Participants are enrolled in a required, undergraduate educational technology course. The intervention will last two weeks and consists of discussions via the WebCT discussion board. In the first week the experimental group has a discussion leader who gives certain instructions for triggering and maintaining argumentation on both sides of the technology issue towards reaching common ground. The control group

receives the same open-ended technology dilemma but has a discussion leader who does not give pre-determined instructions. In the second week both group leaders are asking for a reaction to the evolution of the discussion in the first week and a final resolution to the dilemma. Previous research on argumentation and critical thinking will be briefly described below. Lastly, a research study with a similar methodology to evaluating online discussions will be introduced. A more detailed description of the related research studies and methodological approaches will be provided in the literature review chapter.

Langille and Pelletier (2003) examined the use of cognotes and students' tendency to use higher order argumentation patterns in online discussions. Cognotes are defined as evaluation frameworks that students use to assess their own postings (MacKinnon, 2003). Previous research conducted on the use of cognotes utilized them as an assessment tools in addition to collaborative functions (Aylward & MacKinnon, 1999, MacKinnon & Aylward, 2000). Findings revealed that the communication of expectations and accountability within the cognotes exercise seem to have made an impact on higher order argumentation. The cognotes approach is somewhat similar to note starters and response constraints approaches described later in the sense that students choose what kind of position they are adopting, agreement or opposition, before they start posting. This study adopts a different approach to triggering argumentation than the one described above. Participants in the experimental group are not given argumentation frameworks to choose from, they will be prompted by the discussion leader to post arguments, counter arguments, and responses to counter arguments and supporting their claims with evidence or reasoning.

Joung (2004) examined the effects of high structured versus low structured group differences on preservice teachers' critical thinking and interaction patterns in an online educational technology course. The high structured groups had pre assigned debate positions (pre-structure), argumentation scaffolding (task structure), and evaluation scaffolding (content structure). The results indicated that high level structured group was more helpful than low level structure group in facilitating critical thinking and interaction in the online environment. The argumentation scaffolding was realized through message labeling which is similar to cognotes, note starters, and message constraints. This research study is also different from Joung's (2004) pro/con situation approach as it allows participants to choose supporting either position to begin with but then counter each other and respond to counters thus analyzing the multiple facets of the issue.

Langille and Pelletier (2003) and Joung (2004) did not address the influence that thinking pre dispositions or personality variables could possibly have on argumentative moves. Bendixen, Hartley, Sas, & Spatariu (2003), Nussbaum, Hartley, Sinatra, Reynolds, & Bendixen (2002), and Nussbaum (2005) addressed these issues by looking at possible influences epistemological beliefs (simplicity of knowledge), personality differences (extroversion), and need for deep versus shallow thinking (need for cognition) may have on online argumentation. This study also takes into consideration the possible influence of students' need for cognition on the quality of online argumentative moves.

Nussbaum et al. (2002) conducted an experiment using note starters and elaborated cases to trigger more student argumentation in undergraduate educational courses. Prior to writing a message online students chose one of the note starters such as "on the opposite side" or "to me this means" and then continued writing. The elaborated cases

pertained to educational psychology topics. The results indicated that note starters interacted with personality variables. They were more helpful for students with low openness to ideas. They were also helpful to students low in assertiveness as they encouraged more independence. Note starters appeared to be encouraging less disagreement in anxious students. Another study by Nussbaum (2005) examined the effect of goal instruction and need for cognition on students' written argumentation in an online context. Subjects of the study were undergraduate students enrolled in an introductory educational psychology class. The results of the study show that both goal instruction and need for cognition had a salient effect on argumentation. The goals to persuade and generate reasons had the strongest effect on students' argumentation by generating more claims.

This study adopts an approach that involves a group leader providing pre-determined argumentation instructions. These instructions ask for at least three postings from each group member in the experimental group, the first one being an initial posting followed by a counter argument to a different initial posting and continuing with a response to the counter. The shortcoming of note starters and similar approaches such as cognotes and message labeling is less efficiency in production of argumentative moves supporting both sides of the issue with solid evidence and also less attempt of reaching some consensus. This study adopts an approach that is designed to not only trigger disagreement but also encourage production of convincing arguments (production of supported arguments, counter arguments, and responses to counters the first week) and movement towards common ground (reaction to first week discussion and final resolution the second week).

Bendixen et al. (2004) examined the quality of undergraduate students' on-line argumentation discussions and their relationship with personal epistemology (i.e., beliefs about knowledge and knowing). Two open-ended dilemmas were used as subjects of discussion for small groups of students (3 to 5 students) enrolled in an Educational Psychology class. Postings were evaluated in terms of the number of claims made, supporting evidence given indicated as solid or weak, and overall quality of the argument. Participants' personal epistemology was assessed using the Epistemic Beliefs Inventory (Schraw, Bendixen, & Dunkle, 2002). Results revealed that belief in the certainty/simplicity of knowledge was a significant predictor of solid, more credible evidence given to support an argument. This study utilizes a slightly modified version of Bendixen et al. (2004) coding scheme. The coding scheme will be discussed in detail in the methodology section.

Overview of the Current Study

This study explores ways argumentation can be triggered and maintained in online discussions through the use of a discussion leader procedure. Previous research investigated the different factors that influence online discussions but not through the involvement of a discussion leader with argumentation instructions for online interactions. Two weeks of the course will be dedicated to the discussion of an educational technology issue. The educational issue will be given to both the experimental and control groups and it addresses pros and cons related to the learning process with the advent of advanced technology and whether or not schools should adopt the technology. The intervention was designed to generate arguments on both sides of

the issue through scaffolding. The students in the experimental group have a leader who gives specific instructions for generating arguments, counter arguments, and response to counter arguments in at least three messages the first week. The students in the control group have a discussion leader who do does not give argumentation instructions other than asking for at least three postings related to the same dilemma as a discussion topic for the first week. The second week extends the discussion by having the leader ask both groups to react to the first week's discussions and provide a final resolution to the issue presented. The purpose of the study is two fold. The first purpose is to determine if the scaffolding type instructions received by students from the discussion leader will have a role in the quality of online argumentation. Secondly, this study investigates the role of the discussion leader procedure with instructions in the online interactivity patterns.

Debating in online discussions is important to improving students' argumentative skills and understanding. Argumentative skills refer to making convincing claims (backed up by sound evidence) and understanding refers to grasping various aspects of an issue. Argumentative moves can be generated and maintained in online forums by having discussion leaders encourage group members to analyze both sides of a technology issue and support their claims with sound reasoning or evidence. This study will serve to address two research questions: First, will students participating in groups having discussion leaders with pre-determined argumentation instructions produce better online argumentation? Second, will students having discussion leaders with pre-determined argumentation instructions exhibit increased interactivity patterns?

This study hypothesizes that argumentation and interactivity are likely to be generated and increased through the scaffolding discussion leader procedure in online discussion forums.

This study is significant to the contribution of educational research for several reasons. First, use of online education in postsecondary institutions increasing at a rate of 24.8% per year with a current estimate of 1.9 million users (The Sloan Consortium, 2004), understanding of instructional design issues related to structuring valuable online experiences will be necessary for educators.

Secondly, this study contributes greatly to the body of research on online education, particularly online discourse by revealing and exploiting the importance of communication advantages embedded in different online technologies. Researchers point out the need for sound educational research on various issues of online learning (Rourke & Szabo, 2002; Gibson, 2003; and Winiecki, 2003).

Thirdly, of major importance to the field are the potential positive effects of the discussion leader procedure in eliciting online argumentation. Argumentation is an important component of thinking critically and a way of solving open ended problems and clarifying content. Researchers have examined two types of factors that influence online discussions: type of instructional intervention and personal characteristics of learners. Instructional interventions researched are: cognotes (Langille & Pelletier, 2003; MacKinnon & Aylward, 2000), note starters and goal instructions (Nussbaum et al., 2002; Nussbaum, 2005), group structure (Joung, 2004), response constraints, and message labels (Jeong & Joung, 2003), mentoring and scaffolding (Peterson-Lewinson, 2002), discussion leaders (Heflich & Putney, 2001), and message triggers (Poscente &

Fahy, 2003). Personal characteristics of learners researched are: personality variables and (Nussbaum et al., 2002), need for cognition (Nussbaum 2005), and personal epistemology traits (Bendixen at al. 2003). This study examines the influence of the discussion leader with pre-determined instructions procedure on argumentation in online discussions.

An additional contribution of significant importance from a methodological perspective is the potential of better understanding online discussions evaluation through a coding scheme. The coding scheme adopted for this study is based on two already existing coding schemes (Bendixen et al., 2003; Schaeffer, McGrady, Bhargava, & Engel, 2002). These coding schemes measure argumentation and interactivity and have already been used in research.

A final contribution of this study is to provide pedagogical insights to online instructors for better structuring discussion forums to suit the course needs in particular, thus improving learning and reducing the technology disconnect between schools and students. Apple Computers (2005) points out the disconnection between today's students and today's schools which stems from the evolution of students in the digital world and the incapacity of schools to keep up with them. The reality is that today's students are digital native hyper-comunicators and multitaskers. They are surrounded by cell phones, PDAs, DVDs, email, Internet and they enjoy text messaging, chatting, and doing homework at the same time. Today's instructors need a better understanding of how these students interact and learn in online environments.

Summary

Online discussion forums are becoming common practice in all areas of education. Online argumentation is seen as vital in developing thinking and understanding content. The use of the discussion leader with pre-determined argumentation instructions procedure can increase the likelihood that learners generate sound arguments on both sides of an educational technology issue and increase interactivity patterns. Although various instructional strategies in generating quality discussions have been somewhat studied as described above, details of online argumentation have not been explored thoroughly. This study will thus explore the potential of the discussion leader procedure with argumentation instructions to boost online argumentation.

CHAPTER 2

LITERATURE REVIEW

This literature review has been divided into five sections. The first section describes the theoretical frameworks of small group online discussions. The second section describes research on different factors that impact online discussions. In particular, studies related to critical thinking are emphasized. The third section reviews research on argumentation in undergraduate online discussions. The fourth section describes different frameworks of discussion analysis, and the last section discusses frameworks of analysis specifically designed to capture online argumentation. The literature reviewed will note identified gaps that this research study will seek to address.

Theoretical Framework

Discussions have to meet four main characteristics in order to be effective. These characteristics include focus, student background knowledge, emphasis on understanding, and student-student interaction (Eggen and Khauchak, 1999). The four characteristics apply to both face to face and online discussions. Having a focus in discussions means they are revolving around a specific topic or an issue. Activating students' background knowledge refers to choosing topics or issues that pertain to students' life or are related to previous knowledge. Understanding refers to involving reasoning; important to clarifying

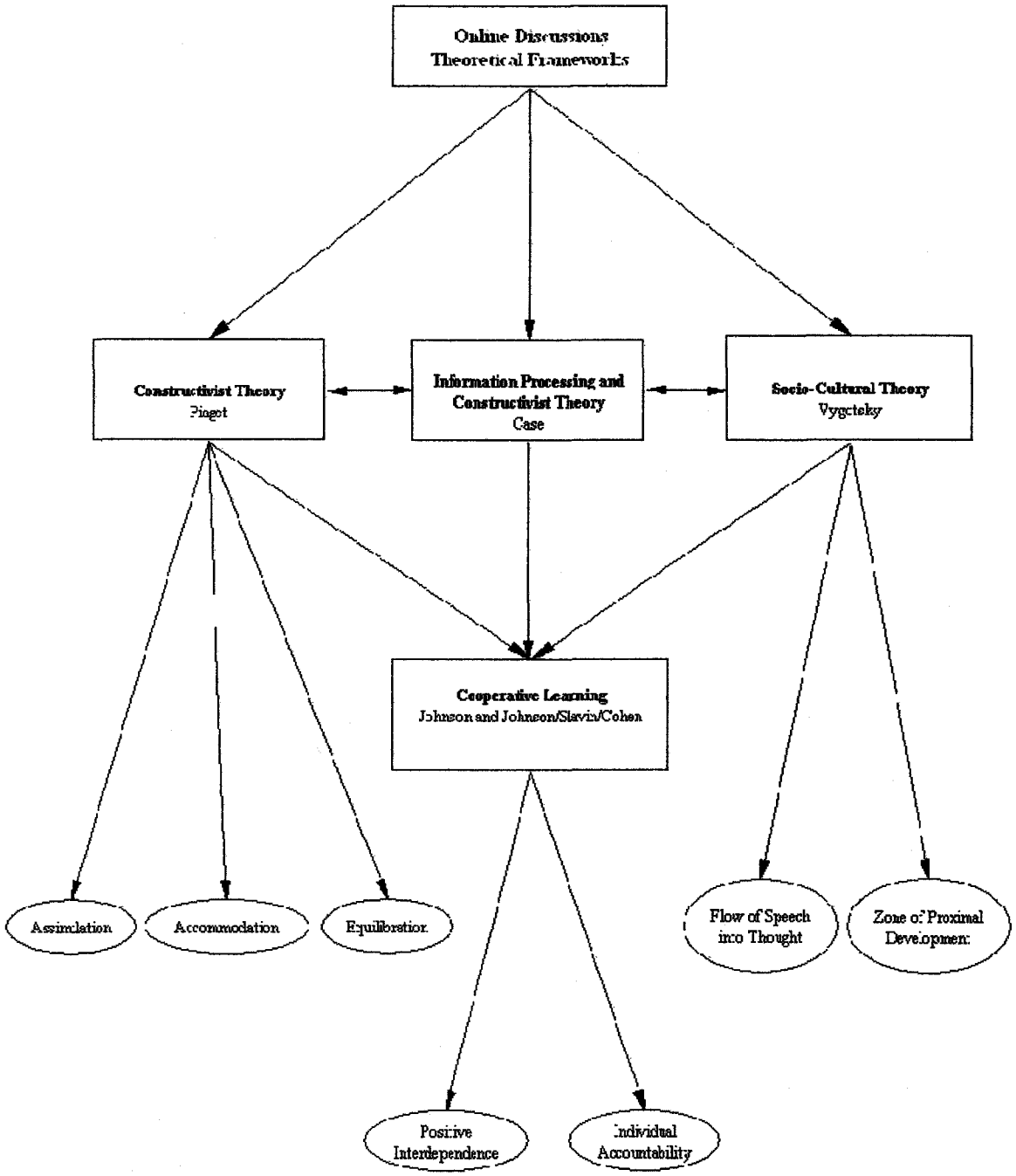
course content and solving problems. Lastly, student-student interaction promotes exploration of topics and collaboration.

Discussions trigger such complex mental processes and influence belief systems that their role in cognition cannot be fully explained by just one theory. For this reason, the theoretical framework of this research study will integrate 3 theories of human development: constructivist, information-processing, and socio-cognitive. Constructivist and information processing theories of cognitive development (Piaget and Case) will be presented first. Secondly, socio-cognitive views of development will be described (Vygotsky). Then, issues, implications for instruction, and relatedness of each of the abovementioned theories to the current study will also be explained. Finally, as a practical recommendation of these theories for instruction, the topic of cooperative learning will be presented as well. The following diagram outlines the theoretical inter-relatedness and structure of the study.

Constructivist Theory

In the 1950-1960s Piaget introduced new ideas in an attempt to explain cognitive development in children and adolescents. His research is based on the belief that children are not passively receiving information through their senses from the outside world but rather are actively seeking out information to explain the things they observe and hear (Piaget, 1965). For this reason, his theory is called constructivism. This theory postulates that actively constructed knowledge is organized in schemas which are groups of similar actions or thoughts. According to Piaget, although schemas are initially behavioral in nature, they eventually become more cognitive through repetition of experience.

Figure 1. Online Discussions Theoretical Framework



Piaget (1965) proposed that learning occurs through two different processes: assimilation and accommodation. Assimilation refers to the acquisition of new environmental sensations into the existing schemes. An example of assimilation would be building a house from wooden blocks. Through this task, a child confers meaning to a new experience (manipulating the wood) based on old experiences (knowing what a house looks like). Accommodation refers to adjusting prior information in order to adapt new information and if no similar scheme exists already a new one is formed. For example, a child is seeing a marine creature on TV that looks like a fish he/she has. The creature is identified initially as a fish but it does not quite look the same so the child develops a new schema, a "sea horse." The two processes of accommodation and assimilation complement each other and work hand in hand.

According to Piaget (1965) both physical and social interaction within the context of a child's environment is crucial to his/her cognitive development. Through manipulation of objects (physical interaction) for example, children acquire an understanding of cause-effect relationships in the world. Through interaction with others, (social interaction), children begin to gain awareness that individuals have different views other than their own. Piaget theorizes that when a child encounters new information that does not make sense mental discomfort (disequilibrium) takes place. Disequilibrium is resolved through the replacement and reorganization of existing schemes towards more complex ones. Equilibration occurs through both assimilation and accommodation and leads the individual to adaptation. Mental development is directed towards a broader and more flexible cognitive structure for adaptation to new and unpredictable social or physical events (Flavell, Miller, & Miller, 1993). In this study, the discussion leader creates

controversy over the adoption and usefulness of new technologies in schools. The different ideas generated by controversial interaction lead individuals to questioning their existing beliefs. Through assimilation and accommodation processes, participants either changed their ideas or acquired new ones ("It was great to think from both points of view! And being made aware of the cons against my supportive argument identified some wholes in my original thoughts.").

Piaget studied child development and proposed four stages of cognitive development as a result of age-related maturation and experience: sensorimotor, preoperational, concrete operational and formal operational. In the *sensorimotor stage* (birth to 2 years) children learn through processing sensorial information acquired through interaction with primary caregivers and surrounding objects, and through practicing motor skills thus, they are preoccupied mainly with what they are observing and doing. Toward the end of this stage, they gain understanding of cause and effect relationships and develop symbolic thought. In the *preoperational stage* (2 to 6 years) expressive language develops very rapidly. Although capable of verbal interaction, children at this stage of development are exhibiting 'preoperational egocentrism' and are not able to accommodate what another knows or wants. Towards the end of this stage, logical thinking begins takes more shape. In the *concrete operational stage* (7 to 12 years) children begin to exhibit logical thinking patterns. They start understanding that their own thoughts might not accurately represent reality. In the *formal operational stage* (12 through adulthood) individuals are capable of logical thinking processes (e.g., if A is larger than B and B is larger than C therefore A is larger than C), number conservation, and abstract thought processes (e.g., infinity, negative numbers). Theoretical reasoning

also takes shape in this stage. Participants in this study are situated in the formal operational stage. They are education students capable of logical and abstract thinking. Thus, the approaches selected to challenge and expand their existing beliefs and ideas, were argumentative.

Based on Piaget's theoretical stages of development, educators have suggested corresponding instructional strategies. Ormrod (2005) recommends the following principles for instruction: 1) educators need to provide opportunity for hands on activities so students can actively interact with the environment and discover new things; 2) when verbally interacting with students, they need to be asked to explain their thoughts and reasoning when showing signs of egocentric speech or inconsistencies in thinking; and 3) students need to be engaged in more complex tasks after they acquire certain basic capabilities. One of Piaget's most important assumptions was that individuals, through interactions with the environment, acquire new systems of cognitive operations that modify existing ones. This, therefore, means that the design of instructional experience(s) needs to take into account the cognitive structures that are already available to the learner and materials that need to be presented so that they can be assimilated by these structures. This study's instructional intervention is in accordance with recommended instructional strategies based on Piaget's theory. The discussion is mainly argumentative, which exposes the participants to points of view different than their own making the discourse a more complex and challenging task than they are usually used to.

Several issues have been raised concerning Piaget's theory of human development. Interaction with the physical environment, while very important to development, may be less critical than Piaget considered. Students with special needs, for example, interact less

with the environment but nonetheless learn through observation and communication (Ormrod, 2005). Another weakness of Piaget's theory is the underestimation of children's cognitive abilities. Some children exhibit certain thinking patterns at a very young age while others exhibit them in later years (Flavell et al., 1993). This means cognitive development may not be as clearly delineated in stages as initially thought, but rather is continual and gradual. In addition, Piaget did not factor in individual, cultural, and personality differences (Vygotsky, 1978; Ormrod, 2005). Given the noted weaknesses, Neo-Piagetian theorists such as Robbie Case (1992) have retained the main assumptions of Piaget's cognitive development theory and added findings from information processing theory about the role of attention, memory, and strategies.

Information Processing and Constructivist Theory

Case (1992), proposes that children go through a series of stage like changes of cognitive development that are not very clearly delineated and depend upon information processing capabilities. Within these stages, higher mental structures are built upon lower mental structures which draw from context and prior knowledge. Case's (1992) systematic examination of subjects' short term memory capacity suggests that children may have less capability to process pieces of information than adults. Adults usually can process seven (plus or minus two) pieces of information simultaneously (Miller, 1956). Information-processing theory as applied to instruction, points to the value of group discussion in helping students rehearse, elaborate, and expand their knowledge base. This theory posits that as group members begin to pose questions and explain their point of view, they undergo a process of organizing their knowledge, making connections, and reviewing thought processes that support information processing and memory. According

to Woolfolk (2001), elaboration is "adding and extending meaning by connecting new information to existing knowledge (p. 255)." Within the elaboration process schemas are applied and new understanding is constructed. The knowledge people already have changes through elaboration. Online discussions, if designed properly, place students in an active role of connection making. Writing responses to other students' postings for example involves them in elaborating and organizing the information for themselves and for the audience as well.

The current study integrates both the Piagetian and the Neo-Piagetian theories of human development. Subjects in the current study are undergraduate education students capable of logical and abstract thinking which generally places them in the formal operational stage of cognitive development. The type of intervention used in the experimental group (i.e., argument, counter argument, and response to counter argument instructions) is conducive to a challenging discussion of the educational technology issue. These views are not always in agreement with students' existing beliefs on the issue thus creating antagonism, which can lead to cognitive disequilibrium. Group discussions help resolve the divergent views and through assimilation and accommodation of information, cognitive equilibrium may be reached.

Socio-Cultural Theory

The current study also draws on Vygotsky's socio-cultural theory which gives more attention to language interaction and communication than Piaget and Case's theories. Vygotsky (1978) focuses on the relationship between thinking and speech and that a child's cognitive development is strongly connected to his/her social cultural development.

Vygotsky argues that through interactions with adults and peers children acquire language meaningful to the culture they live in. This meaning can be transmitted through art, music, symbols, and primarily speech. Piaget proposed that through assimilation and accommodation, children build more and more complex schemas and that makes development more individualistic. Vygotsky, in contrast, proposes a socio-cultural mechanism as the promoter of cognitive development. In his view, thought and language are distinct in infants. Integration of both occurs later when children begin verbalizing. Vygotsky's notion of self-talk or private speech occurs about the same time and it is similar to Piaget's notion of egocentric speech. The self-talk eventually evolves into inner speech. Another major assumption Vygotsky makes is that children learn best if situated within their zone of proximal development, the notion that they can perform with the support of an adult or peer before they cannot perform independently (Vygotsky, 1978). Once children internalize social processes, they gradually start using them independently. According to Vygotsky, the process of internalization is how culture is assimilated and propagated.

In applying Vygotsky's hypothesis to learning, internalization best occurs when students are taught within their zone of proximal development. If the instructor structures learning activities that are too simplistic no new learning occurs. Lack of learning also happens when the activities are too complex and beyond students' zone of proximal development. Ormrod (2005) makes four recommendations for instruction based on Vygotsky's socio-cognitive theory of learning: 1) teachers need to assign tasks that students can perform successfully with help from others; 2) since students are situated at different levels of development, individualized instruction is also recommended; 3)

sufficient and appropriate scaffolding is required for solving challenging tasks with gradual withdraw as proficiency emerges; and 4) complex tasks can be accomplished by small group work when students are on a somewhat equal level of development.

Insufficiencies of Vygotsky's theory include focus on explanations of the process through which children develop rather than on the abilities children have at a particular age. Moreover some critics argue these processes are described imprecisely and not to a detailed level which makes them difficult to be researched (Ormrod, 2005; Wertsch, 1984). In order to be able to research complex thought processes they have to be as precisely described as possible so they are recognizable. That is where information processing theories come into place with explanations of cognitive capacity. The major contribution of Vygotsky's theory is his explanation of how culture is transmitted form one generation to another and how development is influenced by the social context. Social interaction is central to learning because higher mental functions such as reasoning, comprehension, and critical thinking originate in social interactions and are then internalized by each person. Children can complete mental tasks with social support from peers or adults before they can perform them alone. Thus, group discussions guided by a leader with pre-determined instructions can provide the social support and scaffolding that students need to move learning forward.

The current study draws on Vygotsky's socio-cultural theory of development as speech is an important mechanism in cognitive development. Education students make sense of the technology dilemma through small group discussions. The discussion is mediated by a discussion leader who is providing scaffolding for accomplishing the task at hand (understanding and attempting to solve the dilemma). The scaffolding is in

accordance with the theoretical recommendations described previously and consists of division of tasks (making an initial posting on one side of the issue then making a second posting challenging an existing one and finally making a third posting as a response to the challenge during the first week) and providing structure for how the task should be accomplished (giving a final resolution to the technology dilemma the second week after exploring both sides of the issue the first week).

Cooperative Learning

One classroom practice used to stimulate both face-to-face and online discussions is defined as cooperative learning. Within cooperative situations, students are usually working in small groups focused on discussing particular assigned course topics with the aim of individuals seeking outcomes that are beneficial to themselves and all other group members (Johnson, Johnson, & Holubec, 1998).

Baker (2005) identifies three main theoretical frameworks for cooperative learning strategies: constructivist, socio cultural, and cognitive. The table below illustrates these frameworks and specific theorists associated with them. These three frameworks that support cooperative learning instruction recommendations will be described below. Within constructivist views of learning, disequilibrium among individuals' schemas can be reached through disagreement in cooperative learning situations. The mechanism of change consists of recognition of different responses and resolution of doubt. The inter-individual disagreements and doubt lead to intra-individual disequilibrium and desire to resolve cognitive dissonance. Through this search of going beyond both inter and intra disequilibrium individuals make cognitive progress (Baker, 2005). Piaget advocated that opportunities for becoming less egocentric are more likely to be found within cooperative

situations as children engage in discussions in which they must face the fact that not everyone has the same perspective on a situation. Several researchers who examined conservation tasks have found that children who were paired with a more advanced child were later able to solve conservation tasks at a higher level, while children who worked individually did not improve (Tudge & Caruso, 1989; Tudge, 1991).

Slavin (2000) refers to Vygotsky's theory when he discusses two main key principles important to cooperative learning. The first one is the assumption that children learn best how to problem solve through interactions with adults and peers. Within cooperative learning situations students are exposed to their peers' thinking process. The exposure makes the learning outcome available to all students and also makes other students' thinking processes available to all. Vygotsky noted that successful problem solvers talk themselves through difficult problems. Cooperative situations allow children to hear how successful problem solvers are thinking through their approaches. The second principle is the idea that children learn best the concepts that are in their zone of proximal development. When students are working together with instructor guidance, each of them is likely to have a peer performing on a given task at a slightly higher cognitive level, exactly within the child's zone of proximal development.

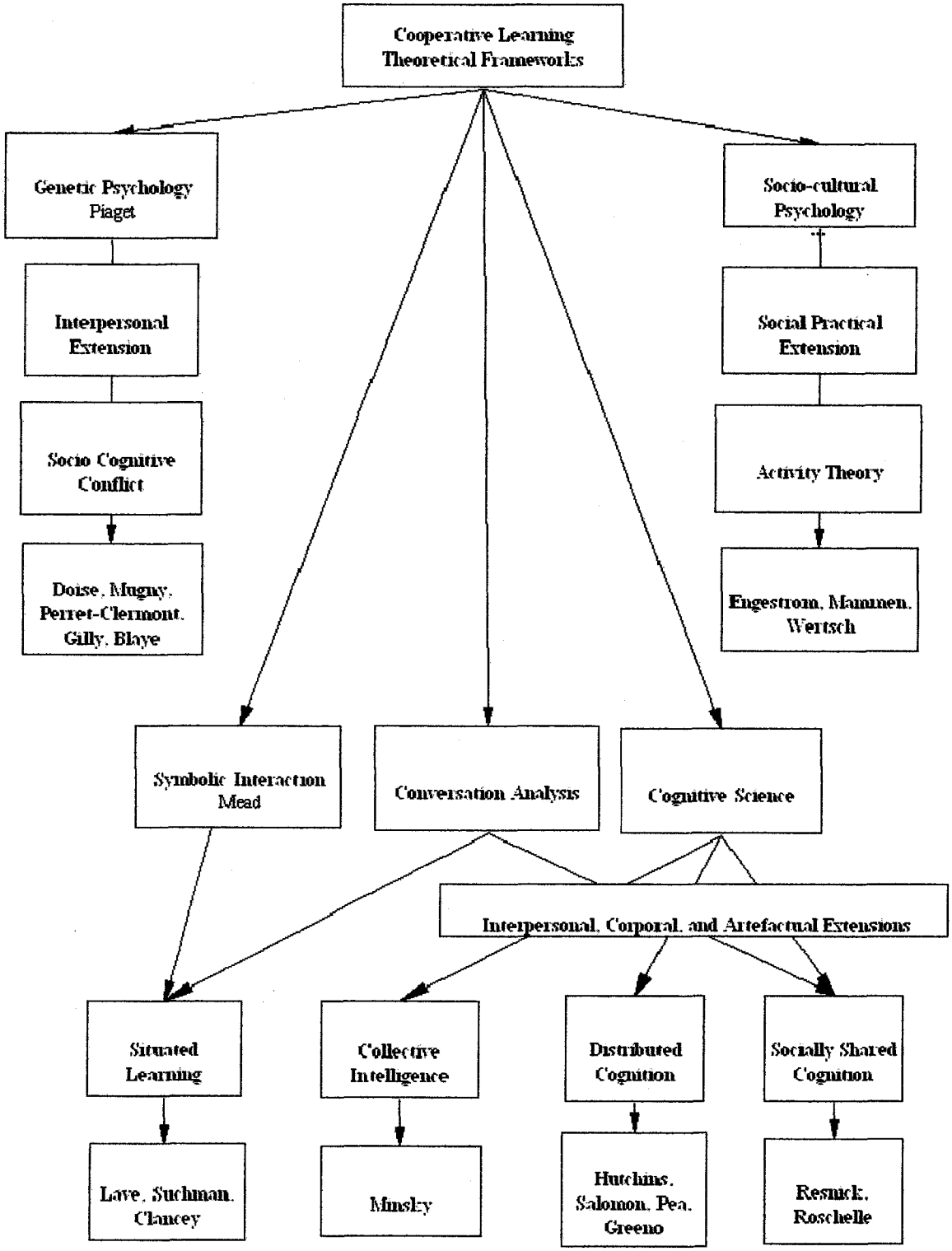
Baker (2005) explains how symbolic cognitivism plays a role in cooperative situations. Social interaction allows for knowledge elaboration through mechanisms such as self-explanation and peer tutoring effects (one student explains something to another one and they both acquire more understanding). Interaction also allows for sharing of the cognitive load through division of responsibilities by subtasks. Finally, interaction also

allows for mutual regulation and increased self regulation as the necessity to resolve disagreements leads to expression of strategic decisions.

Constructivist, information-processing, and socio-cognitive views of learning have fueled interest in collaboration and cooperative learning. Different approaches favor cooperative learning for different reasons. Constructivist Piagetian perspectives suggest that interactions in groups can create the cognitive conflict and disequilibrium that lead an individual to question his or her understanding and try out new ideas. Information-processing theorists point to the value of group discussion in helping participants rehearse, elaborate, and expand their knowledge. As group members question and explain, they have to organize their knowledge, make connections, and review all processes that support information processing and memory. Social cognitive theory suggest that social interaction is important for learning because higher mental functions such as reasoning, comprehension, and critical thinking originate in social interactions and are then internalized by individuals. Children can accomplish mental tasks with social support before they can do them alone. Thus, cooperative learning provides the social support and scaffolding that students need to move learning forward.

There are three main cooperative learning models that have been employed in classroom practice. These models were constructed by Johnson et al. (1998), Slavin (1995), and Cohen (1994). Each of the models recommends a number of components viewed as necessary to proper implementation of cooperation in the classroom setting. Two of these components are viewed as essential in making cooperative learning work by all the three models. These elements are positive interdependence and individual accountability.

Figure 2. Cooperative Learning: Theoretical Framework.



Positive interdependence is linking students together so one cannot succeed unless all group members succeed. Group members have to know that they "sink or swim together" (Johnson et al., 1998, p. 4:7). Johnson et al. (1998) describe nine different types of positive interdependence that can be implemented in the classroom. The main ones are positive goal and task interdependence. They are structured in the current study through assigning the goal of discussing and resolving a technology dilemma (goal interdependence) and organizing the discussion sequentially by providing posting and disagreement instructions which allow for follow up agreements or counters after initial claims are being made (task interdependence). Individual accountability is the measurement of whether or not each group member has achieved the groups' goal by assessing the quality and quantity of each member's contributions (Johnson et al., 1998). There are many ways to structure and increase individual accountability: by keeping the size of the group small, by giving an individual test to each student, or by checking for understanding by questioning.

This study structures individual accountability through keeping the group size small (3 to 5 students each) and having the leader monitor the discussion (asking for more explanation related to claims and evidence). Two other important elements of the Johnson et al. (1998) cooperative learning model are also considered in the study design: interpersonal skills, and group processing. Working in groups especially in discussing controversial course issues, presupposes employment and development of social skills. This was structured in the current study through the explanation to subjects prior to discussion that this is a learning activity where students are encouraged to communicate their ideas without reservation but contradict each other professionally by backing up

claims made with solid evidence. Group processing occurs when students discuss how well they are achieving their goals and maintaining relationships (Johnson et al., 1999). This element was structured in the current study through a closure to the topic that occurred in the second week of discussions when students were asked to both analyze how the debate evolved and provide a final resolution to the dilemma.

This research study satisfies the theoretical premises of structuring effective discussions identified above. Online discussion small groups were formed (cooperative learning and interaction). Discussions revolved sequentially around a technology issue related to the course content (common goal and task structure). Participants were engaged in guided opportunities for structured interaction and disagreement via the WebCT discussion tool (critical thinking, elaboration and expansion of information, and scaffolding).

In conclusion, online discussions can offer equal opportunity for participation, promote cooperative work, and allow for reading, writing, and cognitive processes. Online discussions can also help students clarify course content, reflect, examine and understand each other beliefs, attitudes, and cultural values. In order to make a discussion effective, which entails benefiting students' solid understanding of content, developing reflective thought, and writing clearly, researchers have adopted different strategies for designing online forums. Some of these strategies will be further discussed with an emphasis on argumentative writing as it directly concerns the current study.

Research on Factors that Impact Online Discussions

The increased use of online learning makes research in areas related to online discourse worthy of investigation. However, there has been a limited amount of research conducted in these areas. To date, researchers have examined various factors that influence different aspects of the quality of online discussions including: group structure (Joung, 2004), roles within groups (Rose, 2004), mentoring and scaffolding (Peterson-Lewinson, 2002), discussion leaders (Heflich & Putney, 2001), and message triggers (Poscente & Fahy, 2003).

Joung (2004) examined the effects of high structured versus low structured group differences on preservice teachers' critical thinking and interaction patterns in an online educational technology course. The high structured groups had pre assigned debate positions (pre-structure), argumentation scaffolding (task structure), and evaluation scaffolding (content structure). The task was to evaluate two WebQuests. The pre-structure was accomplished through assigning students in a pro or con position relative to the teaching effectiveness of the WebQuests. The task structure was accomplished through the use of labels for their messages before posting. The content structure was accomplished through the use of a WebQuest evaluation rubric. The low structure group, which was the control group, was not assigned a pro or con position towards the WebQuests, no labeling was used for posting messages, and no evaluation rubrics were provided. The results indicated that high level structured group was more helpful than low level structure group in facilitating critical thinking and interaction in the online environment.

Peterson-Lewinson (2002) examined the potential for computer mediated communication (CMC) tools to promote reflective thinking among preservice teachers. A mixed methods research design was used to see the extent to which computer mediated communication among six groups of preservice teachers was influenced by the focus and structure of the discussion forums, and the interactions and social dialogue among students. Six teams of 5-6 students each participated in discussion forums in addition to classroom instruction in an Elementary Science course. Two of the groups displayed statistically higher levels of cognitive processing than the other groups. The highly interactive manner in which discussions took place in the first group facilitated high levels of cognitive processing. One of the group members, through peer mentoring and scaffolding, led her peers toward more complex levels of thinking. The second group displayed high levels of social dialogue as well as high levels of cognitive processing. This finding contrasts with face to face classrooms where usually social dialogue takes time away from on task behaviors. Results of the study indicated that the flexibility of online discussion forums mentoring and scaffolding processes can lead to deep levels of cognitive processing.

A similar study (Heflich & Putney, 2001) also revealed, through qualitative analysis of postings, that the discussion leader may have a role in triggering student reflection. Heflich and Putney (2001) analyzed the online discussions of a cohort of students involved in a field-based practicum at a Professional Development School. The focus of the analysis was on the reflective thought and moral development of preservice teachers. The analysis design involved one student assuming the role of leading a discussion online. The leader would come up with a question related to the field practice, discuss it

with the instructor (to develop the question into a leading one), and then post it for discussion. The other students had the option of responding either to the main posting or to other people postings. Qualitative analysis of the topical development of discussions demonstrated student growth in reflection. By discussing concrete issues from the field based practicum, the instructor developed a better understanding of colleagues own pedagogical practices and understood the importance of communicating and sharing ideas. In addition, utilization of a leader questioning technique (Heflich and Putney, 2001) seemed to be related to more reflective thought while a scaffolding and mentoring discussion leader approach appeared to be related to developing critical thinking skills (Peterson-Lewinson, 2002). This study makes use of a discussion leader procedure but differs from research by Heflich and Putney (2001) and Peterson-Lewinson (2002) because the discussion leaders receive specific argumentation instructions.

Rose (2004) examined the influence of group structures in six groups of graduate students on the message connectedness. Students conducted asynchronous online discussions in a problem-based learning activity. Two coding schemes were used to evaluate postings, Henri and Rigault's (1996) content analysis framework and Howell-Richardson and Mellar's (1996) connectedness guidelines. The results indicated that group conferences with role assignment had higher levels of interconnected messages. Weekly comparisons also indicated higher perceptions of intersubjectivity and deep processing for the role assignment group during the initial weeks of the activity. This study supports previous research that relates certain group structures to quality of online postings (Heflich & Putney, 2001; Peterson-Lewinson, 2002; Joung, 2004).

Poscente and Fahy (2003) investigated the roles of triggers in asynchronous computer mediated communication in a graduate level distance education course. Triggers and duds were identified. Triggers were defined as postings which either included evidence of intending to generate interaction (posing questions or trying to take the discussion to a new level), or generated action (if posting received 4 or more responses). Duds were postings which, intended to trigger interaction, however, failed yielding no response. The results suggest that triggers were associated with open-ended questions, experience, and maturity. Community of inquiry (time taken to get acquainted with the online environment) appeared to influence student responses to triggers and moderator behavior appeared in one circumstance to be mirrored by the students. This study investigated what could be related to a natural occurrence of interaction. The findings (open ended questions and the maturity of the community) supported previous research findings related to the use of dilemmas in getting online argumentation started (Nussbaum, 2005; Abbeduto, 2000). It also suggested that finding ways to generate more triggers may lead to increased interaction.

The abovementioned research studies imply two main conclusions. First, cooperative learning structures, message types, use of open-ended problems can influence different aspects of quality in online discussions (Joung, 2004; Heflich & Putney, 2001; Peterson-Lewinson, 2002; and Rose, 2004). Second, certain interventions (peer mentoring and scaffolding and group structure) appeared to be able to influence students' critical thinking and interaction patterns (Peterson-Lewinson, 2002, Joung, 2004).

Research on Factors that Impact Online Arguments

The current study places an emphasis on generating rich online argumentation and interactivity. In this study, participants will debate an educational technology dilemma within small online discussion groups. During this asynchronous discourse process, group leaders instructions will elicit and steer argument towards analyzing both aspects of the dilemma and providing solid supporting evidence for claims. This will be done during the first week of discussions by asking students in the experimental group for arguments, counter arguments, and responses to counter arguments to be posted. Argumentation, as the main component of critical thinking, has been related to improving literacy skills (Pilkington & Walker, 2003), problem solving (Bruggen & Kirschner, 2003) and learning outcomes (Alexopoulu & Driver, 1996).

Martunnen (1998), Veerman et al. (1999), and Veerman & Treasure-Jones (1999) consider rich argumentation to be the core of quality discussions and view it as a vehicle to solving issues. While different approaches have been adopted within literature to get students to argue more such as cooperation (Heflich & Putney, 2001; Jeong 2004) or pro/con situations (Nussbaum, 2005; Joung, 2004), almost all researchers seek as outcome a productive argumentation in which students support their statements with sound evidence..Research concerned strictly with online argumentation is extremely limited. The following studies investigated different ways of boosting argumentation in undergraduate online courses. Merits and gaps of this research will be noted as they pertain to this study.

Jeong (2004) looked at group interaction and elements of critical thinking, in particular, argumentation, in online threaded discussions over ethical dilemmas. The

Discussion Analysis Tool was used to identify patterns in interactions and determine which interactions were related to critical thinking. Transitional probabilities provided useful quantitative descriptions of interaction patterns and critical thinking categories. The findings reveled that interactions involving conflicting viewpoints promoted more discussion and critical thinking, Disagreements were rarely posted in response to position statements and arguments, whereas agreements were ten times more likely to be posted in response. The study also revealed that students rarely responded to arguments with evaluation of the argument's accuracy, validity, and relevancy. The study indicates an important possible issue related to online dialogue. Students' tendency to agree with each other without questioning the soundness of evidence supporting a claim appears to be very common in threaded discussions even on controversial topics (ethical issues in this case). Undergraduate student reluctance to criticize each others view point has also been noted by Nussbaum et al. (2002). Woodruff and Brett (1999) research on solving mathematical problems also revealed that students' tendencies are not to engage in another issue once a response has been generated in the discussion area. Because of the argument avoidance behavior, researchers have taken different, more direct, approaches to boosting online argumentation (Jeong et al., 2003; Nussbaum et al, 2002, Nussbaum, 2005, Langille et al., 2003). As these approaches have direct implications for the intervention described in this study, they will be described in more detail below.

Jeong et al. (2003) examined the effects of response constraints and message labels on interaction patterns and argumentation in online discussions in an educational technology course. In this study, a total of 43 pre service teachers were assigned to three groups. One treatment group was set up so students had to use prescribed response

categories (arguments, evidence, explanation, and critique) for their postings. A second treatment group had students use response labels into message headings in addition to prescribed response categories. In the control group students did not use response categories or message labeling. In turn, messages were analyzed for relative frequency of arguments, supporting evidence, challenges to arguments, and overall level of interaction. The results suggested that labeling messages has lead to increased argumentation and explanation but reduced the overall interaction among students. A similar approach to message labeling was adopted by Langille et al. (2003) through the use of cognotes. Cognotes were notes used to label postings but more as a guiding framework for students before posting. Both approaches appeared to have lead to increased argumentative moves supported by evidence. Another somewhat similar approach to labeling was adopted by Nussbaum et al. (2002).

Nussbaum et al. (2002) conducted an experiment using note starters and elaborated cases to trigger more student argumentation in undergraduate Educational Psychology courses. A note starter is a phrase that students can choose before beginning to write a message ("on the opposite side" or "to me this means") and then continue writing. The elaborated cases pertained to educational psychology topics and consisted of two versions a question on an education topic and an elaborated case version. Participants were required to complete a personality survey that revealed three factors: assertiveness (extraversion), anxiety (neuroticism), and openness to ideas. Analysis of students' responses to group members indicated the following interaction of personality variables and note starters: 1) they were more helpful for students with low openness to ideas, 2) they were helpful to students low in assertiveness, and 3) they appeared to lead to less

disagreement in anxious students. Through this study, Nussbaum et al. (2002) examined a new element, that of personal characteristics of learners, which proved to interact with note starters in the argumentation process.

Another study by Nussbaum (2005) took a more direct approach to prompting disagreement and examined the effect of goal instruction and need for cognition on students' written argumentation in online Educational Psychology courses. The results showed that both goal instruction and need for cognition had a salient effect on argumentation. The goals to persuade and generate reasons had the strongest effect on students' argumentation by generating more claims. The exploration goal increased divergence mostly when combined with the reason sub goal and also generated some opposition. The qualitative analysis of the postings also indicated that goal instructions generated richer argumentation.

Bendixen et al. (2004) examined the quality of undergraduate students' on-line discussions and its relationship with personal epistemology (i.e., beliefs about knowledge and knowing). Two open-ended dilemmas were used as discussion subject for small groups of students enrolled in an Educational Psychology class. Postings were evaluated in terms of the number of claims made, supporting evidence given (solid or weak), and overall quality of the argument. Participants' personal epistemology was assessed using the Epistemic Beliefs Inventory (Schraw et al. 2002). Results revealed that belief in the certainty/simplicity of knowledge was a significant predictor of solid, more credible evidence given to support an argument. Previous research (Nussbaum et al., 2002, Nussbaum, 2005) has looked at personality variables and need for cognition and their influence on argumentative moves. Bendixen et al. (2004) has explored new personal

traits, epistemological beliefs or beliefs about knowledge, and their relationship to argumentation.

A study by Jeong (2004) examined the effects of response time and message content on the growth patterns of discussion threads in online asynchronous argumentation. Event sequence analysis was used to measure response times between threaded postings and responses containing arguments, evidence, critiques, evaluations, and other comments. Results revealed that critique responses and argumentative exchanges produced higher response rates and with a wait time significantly longer than those of other message types. The debate format and use of message labels may have produced sufficient argumentative exchanges to produce high response rates despite the long response times, which in turn helped sustain the growth of discussion threads. This study confirmed that argumentative moves produce more interaction by keeping the discussion growing.

Langille and Pelletier (2003) examined the use of cognotes and students' tendency to use higher order argumentation patterns in online discussions. Cognotes are defined as evaluation frameworks that students use to assess their own postings (MacKinnon, 2003). They provide students with a clear hierarchy of competencies they have to master and exhibit in discussions (higher order responses get higher numerical value assigned). For example, the response 'no attempt to support one's thinking' would receive 0 points while the response 'builds on one's point of view' would receive 8 points. Previous research conducted on the use of cognotes (MacKinnon & Aylward, 1999) used them as a grading tool as well. Students used them to guide their argumentation writing and also grade themselves. Langille et al. (2003) used the cognotes as a guiding framework only so students don't tend to use the cognotes just to get a better grade. The grade came from

an individual paper that was pretty much dependant on the writing of postings. Students worked in groups of 4-5 to discuss equity issues in a physical education course. Findings of the study revealed that the communication of expectations and accountability within the cognotes exercise seem to have made an impact on higher order argumentation. The cognotes approach is somewhat similar to Nussbaum et al. (2002) note starters and Jeong et al. (2004) response constraints to trigger argumentation.

All these approaches although proven to be very useful at getting more argumentative moves in online discussion forums, do not seem to lead to students analyzing multiple facets of the issue at hand towards a common ground or conclusion. This study will target production of arguments that explore both sides of a technology issues and are geared towards reaching a conclusion. During the first week of discussions the experimental group leader will specifically ask for at least three postings involving initial response, counter argument, and response to counter all backed up by evidence. The control group leader will ask for at least three postings as response to the dilemma but will not provide any scaffolding as of what the postings should contain. During the second week both groups members will be asked to react to the discussion of the previous week and come to a final resolution to the dilemma. Prerequisites for starting argumentation, as emphasized by previous research (Nussbaum et al., 2002, Bendixen et al., 2004, Langille et al., 2003); will be met through the use of an educational technology dilemma. Collaboration requirements are in accordance with cooperative learning practical and research suggestions (Johnson et al., 1998, Slavin, 1995) and will be met through arranging students in groups of 3 to 5, assigning a leader, and structuring individual accountability and positive interaction. The unique element that characterizes this study is

the scaffolding role of the group leader in triggering argumentation in accordance with constructivist and social-cognitive theories of learning as already discussed. Argumentation in open ended problem-solving is particularly productive when there is a focus on the problem (Erkens, 1997, Veerman & Treasure-Jones, 1999), new information is checked against existing knowledge, and multiple perspectives are examined (Veerman & Treasure-Jones, 1999). This study focuses the discussion on a pertinent educational technology issue of whether schools should incorporate new technologies in instruction or not and multiple perspectives are elicited through pre-determined scaffolding instructions.

Online Discussion Analysis Frameworks

Researchers have developed and used different analysis frameworks for evaluating the quality of online discussions. Spatariu, Hartley, and Bendixen (2004) reviewed and classified these research studies according to the general methodological approach utilized in analysis of online discussions. This classification reveals three general categories corresponding to the constructs being measured: argument structure analysis, interaction analysis, and content analysis. Several of the coding schemes described were not clearly delineated as they attempted to measure multiple constructs and thus could be included in any of the three categories. Already identified and additional methodological approaches will be described below. In this literature review, content analysis approaches are presented first. Second, interaction analysis frameworks will be presented. This study employs a coding scheme to measure interactivity based on one Schaffer et al. (2002) interaction analysis framework. Lastly, the focus will be particularly on argument

structure analysis coding schemes. The current study adopts such an approach to evaluating online argumentation in online postings. The argumentation framework developed by Bendixen et al. (2004) that relates to this study's coding scheme will be described in more detail in the methodology section.

Some researchers have taken a content-analysis approach for evaluating online discussions. It can be argued there are overlaps in between categorical frameworks. For example content analysis also includes interaction patterns (Henri, 1992) which is captured by interaction analysis frameworks and cognitive patterns which are also captured by argument analysis frameworks. Seven content analysis methodologies have been identified and discussed.

Henri (1992) advocates the identification of five dimensions when reviewing computer mediated communications. The five dimensions are (a) participation, (b) interaction, (c) social, (d) cognitive, and (e) metacognitive. Participation focuses on the amount of activity that occurs related to the content by counting the number of relevant messages. The social dimension refers to communications not related to the course content. Interactive messages make clear connections with other messages. Cognitive (knowledge and learning skills) and metacognitive (self-regulation) messages make each of the respective types of thinking observable.

A second methodology was developed by Hara, Bonk, and Angeli (2002). The analysis was based largely on Henri's (1992) cognitive and metacognitive dimensions. They analyzed discussions in an online course that involved an instructional method called the starter-wrapper technique. Five different dimensions analysis was employed: (a) student participation rates, (b) electronic interaction patterns, (c) social cues within

student postings, (d) cognitive and metacognitive aspects of students' postings, and (e) depth of processing ranging from surface to depth. Further, Henri's message interactivity criteria (explicit, implicit, and independent) and Howell-Richardson and Mellar's (1996) visual representation of message interaction (surface to depth) were combined to better capture student interactions. Hara et al. (2002) expanded the description of cognitive skills proposed by Henri to include elementary clarification, in-depth clarification, inference, judgment, and application of strategies. Also, metacognitive communication included personal awareness, task knowledge, and strategic knowledge.

A third methodology, based on Hara et al. (2002) five dimension content analysis framework, was developed by Peterson-Lewinson (2002) to analyze the discussions of students enrolled in a science methods course. The five dimensions were participative, social, interactive, cognitive, and metacognitive. The study investigated how the social and interactive dimensions of computer mediated communications influenced the level of cognitive processing demonstrated through social discourse. Interactions occurred in each student group following three discussion forums: Readings, Methods, and Practicum. Henri's indicators of in-depth processing were used to identify reflective thinking as a cognitive process skill.

A fourth content analysis framework was developed by Garrison, Anderson, and Archer (2000, 2001). The online discussion environment is viewed as a community of inquiry consisting of three elements: cognitive presence, social presence, and teaching presence. Cognitive presence refers to critical thinking and is defined as the extent to which learners are capable to construct meaning through sustained communication. Cognitive presence classifies online postings in four categories described by different

indicators: triggering event (problem recognition, sense of puzzlement), exploration (information exchange, discussion of ambiguities), integration (connecting ideas, coming up with solutions), and resolution (apply new ideas, assess solutions). Social presence refers to the ability of participants to present their personal characteristics. Social presence consists of three categories and a couple of different indicators: emotional expression (emotions, autobiographies), open communication (risk free expression, acknowledging, encouraging), and group cohesion (collaborating, helping, supporting). In their study Garrison, et al. (2001) utilized the community of inquiry framework. The transcript consisting of 24 postings showed evidence of critical thinking elements: *triggers*, *exploration*, *integration* and *resolution* (two-thirds of the postings). The results suggest that in a true community of inquiry, interaction progresses through a sequence culminating in resolution.

A fifth analysis framework was developed by Fahy, Crawford, & Ally (2001). Unlike Garrison et al. (2000), Fahy et al (2001) conducted transcript analysis work at the sentence level rather than message level. Each sentence was classified in five categories: questions, statements, reflections, scaffolding, and quotations/citations. Questions could be vertical (1A) which assumes a right answer exists (can be answered with the right source) horizontal (1B) which assumes there is more than one right answer., non referential (2A) which just informs but does not elicit arguments or referential (2B) direct answers or comments to other statements. Reflections (3) refer to statements expressing thoughts, judgments, or opinions that are personal. Scaffolding sentences (4) are those that intend to initiate or continue personal interaction. These categories also include greetings and salutations. Quotations (5A) refer to excerpts from other sources and

citations (5B) are attributions of quotations. As the analysis takes place at the sentence level and becomes more precise, this model has improved reliability, and better ability to detect and describe the nature of social interaction (Fahy, et al. 2001).

A sixth methodology, by Hawkes and Romiszowski (2001) was created to measure reflective outcomes and participant interaction in online discussions. This rubric contains seven levels of reflective thinking: no description of event (message unrelated to practice), events and experiences (described in simple terms generally not related to classroom activities), descriptions of events and experiences described in pedagogical terms, explanation of events or experiences (accompanied by rationale of tradition or personal preference), and explanation of an event or experience using cause/effect principle, explanation using cause/effect principle and also contextual factors, and explanation of events, experiences, or opinions that cites guiding principles and current context, while referencing moral/ethical issues. Participant interaction was measured using the following discourse variables: involvement strategies ('wh' clauses, indefinite pronouns, amplifiers) conversational cooperation, and sequential accountability. The study compared the discourse produced by twenty eight practicing teachers in an online environment with face to face in a problem based learning curriculum. Results show that the online collaboration can facilitate reflective discourse and, in fact, has significantly higher levels on the seven level reflective thinking scales than the face to face discussions. Although more reflective thought was involved in online discussions there was less interaction than in the face to face discussions.

Lastly, a distinct form of content analysis uses computer programs to code messages. McKlin, Harmon, Evans, and Jones (2002) report on the use of neural network software

automatically grouping asynchronous educational messages into cognitive categories. The methodology consisted of four steps. First, messages were converted into a database. Second, a tool was built to perform two kinds of word counts: self-defined (integration, suggestion, exploration, etc.) and General Inquirer (general categories of terms). Third, a neural network was trained to classify each message as falling into one of the following categories: triggering event, exploration, integration, resolution, or noncognitive. Fourth, for reliability purposes, human-coded messages were compared to those classified by the neural network. Most messages ended in the exploration category with very few integration messages. Findings suggest that neural networks can be used to classify messages into cognitive categories. This kind of analysis provides a more complete image of students' cognitive effort in an online learning environment. Thus it allows instructors to make instructional design changes in order to promote cognitive effort.

Other researchers have taken an interaction analysis methodological approach to assess the quality of online discussions. The difference between interaction analysis and argumentation analysis is the emphasis on the message as a part of a larger discussion. Needles to say interaction is an important component of a discussion but there are different kinds of interactions that take place online. Three interaction based methodologies have been identified and described.

Schaeffer et al. (2002) analyzed online debate activity in a policy analysis course. The purpose of the online debate forum was to promote cooperation, to encourage reflection on policy issues, and to progress students' ability to make convincing arguments. The coding category "type of exchange" was created to capture the nature of the student interactions in the discussions. The variable is based on Veerman et al.'s (1999)

"categories of information exchange." These included whether a post was related to a previous post, and if so, whether it was agreeing or disagreeing. It also included whether it introduced a new element or simply revisited old ideas. Exchange categories were also developed by Schaeffer et al. (2002). These categories included (a) counter, implicit or explicit opposition to an earlier point and introducing a new element; (b) challenge, same as counter without the introduction of a new element; (c) unrelated, no obvious reference to any other posting; (d) acceptance, implicit or explicit support of an earlier posting without introducing a new element; and (e) enhancement, implicit or explicit support of an earlier posting and introducing a new element.

Järvelä and Häkkinen (2002) describe an additional method for analyzing the level of interaction. This method is based on Selman's (1980) sociocognitive construct of perspective taking. This framework is difficult to classify since multiple perspective takings are analyzed in messages. Järvelä and Häkkinen described students postings in a Web-based discussion as reflecting a range of perspectives that progress from stage 0 (*egocentric*) through 1 (*subjective role taking*), 2 (*reciprocal role taking*), 3 (*mutual perspective*), and finally stage 4 (*a "societal-symbolic perspective"*). Järvelä and Häkkinen also include a classification that is less dependent upon perspective taking. These holistic categories described discussions as (a) high-level discussions, or shared and theory-based discussions; (b) progressive discussions, or generalizations and some joint knowledge building; and (c) low- level discussions involving mainly separate comments and opinions.

Social network analysis is another form of interaction analysis that is commonly found in the asynchronous learning literature. Nurmela, Lehtinen, & Palonen (1999) used

this type of analysis to evaluate the social level structures and processes in a computer supported collaborative learning environment. Students worked in pairs in an educational psychology course using the program WorkMates4. The program allowed students to exchange information through documents, comments, and questions in addition to inserting links to other documents and marking them as "for" or "against." WorkMates4 kept track of user activities. Three directions were analyzed: (a) identification of contributors in the computer-supported collaborative learning environment, (b) analysis of connections among them, and (c) analysis of the structure of documents created by contributors. Results indicate that reading was clearly the largest (85%) document action. Three other types of document actions were also identified: finished making a new document, finished editing a document, and added a comment, question, or link to a document.

This research study will analyze interaction patterns in undergraduate educational technology courses. The coding scheme is based on Schaeffer et al's (2002) type of exchange categories and it will be presented in the methodology section.

Many researchers have adopted an argumentation methodology to evaluate the quality of online discussions. Online discussions that engage the participants in debates or arguments are seen as productive in the learning process and understanding course content. Argument analysis helps in identifying a student's point of view and supplies information not stated in the message. Eight argument structure analysis approaches have been identified and described. Some of them are described by Inch and Warnick (2002) and identify argument typology, others evaluate levels of disagreement in online messages (Nussbaum et al., 2002, Nussbaum, 2005), and the rest of them evaluate other

argument structure features (Veerman et al., 1999, Aylward et al., 2000, and Jeong, 2004).

Inch and Warnick (2002) describe two methods for analyzing and describing argument structure. The first method is referred to as the general model. According to this model there are four types of arguments. These four arguments differ in terms of the degree of complexity in their structure. Complexity is quantified by examining the number of statements in each message and the relationship(s) among them. For example, arguments can be classified as Type I or simple if they consist of one premise and one claim (e.g., "You should study harder because you received low grades"), Type II if they consist of one claim and multiple premises, Type III if there are proven claims as evidence for unproven claims, and Type IV or complex if they consist of multiple premises and multiple claims linked in various ways. Messages are diagramed in order to better understand how premises and claims relate to each other. One challenge this model presents is differentiating between premises and claims. Inch et al. (2002) define premises as "the most readily verifiable and least arguable statements in the argument" (p. 298). Argument analysis in the general model consists of five steps: (1) determine the general meaning by reading the message once or twice, (2) number the statements in the argument by numbering complete thought units or ideas, (3) identify the argument's main claim, (4) construct a diagram of the argument, and (5) criticize the argument by evaluating evidence and reasoning (p. 309). When using the general model one can only emphasize premises that are explicitly stated. The drawback of this approach is that it does not capture unstated inferences and assumptions of an argument.

A second approach to argument analysis that Inch et al. (2002) describe utilizes the Toulmin (1969) model. This requires the analyst to identify and supply unstated inferences and the principles supporting them. Toulmin views arguments as field dependent; consequently, they should be looked upon as an organism which means different parts have their own functions and are related to a claim. This model identifies six argument parts with different functions: (1) data which function as grounds for a claim; data are the same as evidence, (2) a claim which functions as an expressed opinion or conclusion, (3) a warrant which functions as links between data and claims, (4) backing which functions as facts supporting a warrant, (5) a qualifier which is represented by adverbs such as probably and certainly, and modifies the claim and indicates the degree of strength attributed to the claim, (6) reservation which states the circumstances that undermine the argument (p. 311). This model also emphasizes the roles and functions of each statement rather than just showing how they relate to each other, as in the general model by Inch and Warnick (2002). The Toulmin model is more difficult to apply to arguments than the general model because of the attention that must be paid to the function that statements have.

A third framework related to the argument structure approach is used by Bendixen et al. (2003), who coded idea units in WebCT messages and rated them as positive evidence, negative evidence, and non-scored. Students had to find answers to dilemmas and support for evidence, which generated discussions. This method consists of the following steps: (1) read posting for meaning and number all statements, (2) combine and/or split statements into obvious idea units if necessary, (3) identify main claim(s), (4) rate remaining idea units as negative evidence (if it consists of beliefs, opinions, or

speculations), positive evidence (if it consists of established, supported facts and/or causal logical reasoning), or non-scored (if statements are redundant, unrelated, or incomprehensible). To assess the overall quality of each argument, each posting also receives a holistic score. A holistic score of 1 was attributed to a posting that consisted of isolated statements. A holistic score of 2 was attributed to a posting missing one of the following: clear argument, supporting evidence, or conclusion (stated or implied). A holistic score of 3 was attributed to a posting that had all of these components: clear argument, supporting evidence, and conclusion (stated or implied). This coding system was used to analyze the argument structure of students' responses to dilemmas in an educational psychology WebCT course. This simplified version of the general method was viewed as a valid measurement of the quality of the argument structure without the difficulties inherent in determining implied claims and premises.

A fourth argumentation framework is to code messages according to the level of disagreement that is exhibited in relation to the main posting. Nussbaum et al. (2002) developed a coding system to analyze the participation of students in an online discussion for an introductory educational psychology course. The coding system was based in part on a coding system used by Marttunen (1998) to analyze e-mail messages. The initial coding system rated messages from 1 to 4. The rating 1 represented a response that simply agreed with the previous posting and offered no new information. A 2 also represented agreement, but in addition offered some new information to the topic. A 3 was assigned to a posting that offered a qualified disagreement. For example, students would frequently respond with statements such as "I see what you are saying, but . . ." or "I agree with you, however . . ." and then follow up with a disagreement. A code of 4 was

then assigned to a posting that exhibited absolute disagreement. The Nussbaum et al. (2002) study investigated the relationships between personality variables such as anxiety and extraversion and students' postings to an online discussion forum. Thus, the chosen coding scheme allowed the authors to describe interactions based upon observed willingness of students to disagree with their peers. The coding scheme did not describe the discussion beyond disagreement. For example, the coding scheme did not identify any message characteristics related to content appropriateness or support for positions. Efforts to improve the levels of disagreement could attempt to better describe the message by including some measure of argument quality. This could include identification of supporting statements for positions taken in a message. Nussbaum (2005) and Bendixen et al. (2003) have taken further steps to building a coding scheme that captures more subtle aspects of arguments.

A fifth more elaborated framework, related to the previous one, was developed by Nussbaum (2005). In this framework an argument consists of a main claim and sub arguments. The sub arguments were coded as supporting (support the claim), opposing (do not support the claim), contingent (consider both sides of an issue), and divergent (supporting a claim different from the main claim already made). Claims are classified based on the type of argument they are in and also based on different levels (level one is an initial claim, level two evidence would support level one and level three would support level two).

A sixth methodology developed by Veerman et al. (1999) is a combination of argument analysis and content analysis. This methodology reflects a belief that quality online discussions are reflected in a dialogue that includes argumentative moves and

constructive activities. The postings are viewed here as individual statements rather than a holistic view of the dialogue. Veerman at al. (1999) analyzed discussions that occurred in three different online tools (synchronous: Netmeeting and Allaire Forum and asynchronous: Belvedere). Students participated in identical activities using the three different tools for posting messages. Three types of messages were classified in terms of information exchange: (a) focus (meaning and concepts), (b) argumentation (checks, challenges, and counters), and (c) constructive activities (addition, explanation, transformation, and evaluation). Belvedere discussions were found to be the most argumentative while Netmeeting discussions had fewer counterarguments. The Allaire Forum discussions contained the least amount of counterarguments. Most constructive activities occurred in asynchronous discussions. Very few constructive activities occurred in synchronous discussions.

A seventh coding method for argumentation, cognotes, was developed by MacKinnon and Aylward (2000). Cognotes are a series of icons that represent different argumentation styles. Microsoft Word macros are used to assign different icons to student discussions to provide feedback and also act as critical thinking prompts. Each cognote has a grade associated with it according to the level of cognitive engagement it represents. A coding icon was assigned for the following specific interaction: acknowledgement of opinions, question, comparison, contrast, evaluation, ideas to example (deduction, analogy), example to idea (induction, conclusion), clarification/elaboration, cause and effect, and off topic. The first coding study involving instructor coding with cognotes (Aylward & MacKinnon, 1999), involved three online successive discussion sessions on gender issues in science education. Results indicate that after the first discussion session, students

became involved in more substantive ways and displayed higher order thinking strategies. Another study by MacKinnon and Bellefontaine (2000) involved student coding in a teacher education course. Students were first trained in the use and meaning of cognotes. Three sessions of discussions occurred on a middle school case study. Results of this study indicate the use of cognotes by students seem to be beneficial to more substantive online discussions. A study already described in the previous section of this paper, Langille et al. (2003), used the cognotes as a guiding framework only and not as a grading tool. Students worked in groups of 4-5 to discuss equity issues in a physical education course. Findings of the study revealed that the communication of expectations and accountability within the cognotes exercise seem to have made an impact on higher order argumentation.

Lastly, a method for detecting both argumentation and interactions was developed by Jeong (2004) and it consists of four events: argument, evidence, criticism, evaluation. Students are asked to classify their own postings according to one of the four categories. Forum Manager, a program developed by the same researcher, takes all the postings from Blackboard to Excel and computes participation scores, counts response rates, and counts the threads. Another tool, Discussion Analysis Tool takes the downloaded discussion postings and the student labels and creates matrixes and diagrams that reveal the event sequence. The Discussion Analysis Tool reveals what kind and how often a position statement is followed by an argument, criticism, or evaluation. This procedure helps understand what types of interactions occur and what kind of postings trigger more critical thinking outcomes.

Summary of Research Findings

Group structure (Joung, 2004), roles within groups (Rose, 2004), mentoring and scaffolding (Peterson-Lewinson, 2002), discussion leaders (Heflich & Putney, 2001), and message triggers (Poscente & Fahy, 2003) all influence different aspects of online asynchronous discussions such as critical thinking, connectedness, or reflection. While research on these factors is rather limited, research concerned particularly with online argumentation is extremely limited. Martunnen (1998), Veerman et al. (1999), Andriessen, Bakers, and Shuters, (2003), and Andriessen and Coirier, (1999) consider rich argumentation to be the core of quality discussions and view it as a vehicle to solving problems and clarifying content. Argumentation is related to group dynamics (Jeong, 2004), message labeling (Jeong et al., 2003), note starters (Nussbaum et al., 2002), goal instructions (Nussbaum, 2005), and personal characteristics of learners (Bendixen et al. 2004; Nussbaum et al., 2002). Group structure and tasks have a powerful role in triggering online argumentation. Instructional design decisions are especially important when it comes to generating rich arguments as students are rather reluctant to disagree with each other for various reasons (Nussbaum et al., 2002; Jeong, 2004). Existing research on argumentation has revealed factors that can create argumentative moves but productive argumentation which encompasses various aspects of an issue and moves towards common ground or conclusion is still not generated. In this study the intervention designed to particularly target production of such rich arguments will provide additional valuable information concerning online argumentation.

Online discussions have been evaluated with different coding schemes. Content analysis frameworks looked at different dimensions of discussions such as social,

cognitive, and metacognitive. Interaction analysis frameworks have looked at how messages were connected to each other. This study employs an approach based on Bendixen et al. (2003) evaluation scheme to evaluate the quality of arguments. This study also employs a coding scheme to measure interactivity based on one Schaffer et al. (2002) interaction analysis framework. Argument structure frameworks looked at the construction of argumentative moves in discussions. The use of such evaluation schemes in this study will provide important additional information concerning the assessment of online argumentation and interactivity patterns.

The Current Study

This study investigates the influence of the discussion leader procedure with pre-determined argumentation instructions on the quality of arguments and interactivity in online discussions. Argumentation has an important role in students' learning and understanding of course content. Productive argumentation encompasses analysis of both sides of an issue and movement towards common ground and synthesis of information or conclusion. Thus, triggering and measuring rich argumentation, as an important learning factor, is suitable and valuable.

Purpose

The purpose of the study is two fold. The first purpose is to determine if the instructions received by students from the discussion leader will have a role in the quality of online argumentation. Previous research concluded that factors such as message labels (Jeong et al., 2003), note starters (Nussbaum et al., 2002), goals (Nussbaum, 2005), and personal characteristics (Bendixen et al, 2003, Nussbaum, 2005) had an effect on

argumentative moves in online settings. However, sound analysis of both sides of an issue and movement towards finding common ground or a conclusion has not been emphasized or evaluated. Moreover, the implementation of scaffolding instructions through a discussion leader has not been employed in online argumentative settings.

Secondly, this study investigates the role of the discussion leader procedure with argumentation instructions in the online interactivity patterns. Previous research concluded that factors like group structure (Rose, 2004, Joung, 2004) and message triggers (Poscente et al., 2003) have a positive effect on interactions in online environments. Research has also reported a low level of online interactivity when message labeling was employed (Jeong et al., 2003) or where discussions took place in pairs (Nurmela et al., 1999). A possible explanation can be the restrictive nature for postings in the labeling process and lack of sufficient perspectives in the use of pairs. Somewhat similar approaches, such as the starter wrapper technique (Peterson-Lewinson, 2002) and group mentor (Heflich et al., 2001), that have increased reflective thought and dialogue in online discussions will be applied to this study thus suggesting that the technique will have a positive impact on interactivity.

Research Questions and Hypotheses

This study will serve to address two research questions: First, will students participating in groups having discussion leaders with pre-determined instructions produce better online argumentation? Second, will students having discussion leaders with pre-determined argumentation instructions exhibit increased interactivity patterns?

The first hypothesis is that students participating in groups having discussion leaders with instructions will produce better online argumentation. As the potential of a

discussion leader with instruction intervention exists due to scaffolding among group members in an argumentative process, the first hypothesis extends current research on online argumentation requirements that involve instructor interventions (Jeong, 2004, Jeong at al., 2003, Nussbaum, 2005).

The second hypothesis is that students having discussion leaders with pre-determined argumentation instructions will exhibit increased interactivity patterns. The second hypothesis is congruent with current research on online interaction that involved group structure (Rose, 2004, Joung, 2004) and triggers (Poscente et al., 2003).

CHAPTER 3

METHODOLOGY

Participants and design are described first followed by instruments and materials used in this research study. Lastly, study procedures are presented.

Participants and Design

The participants in this study were teacher candidates enrolled in undergraduate educational technology courses at a large university in the southwestern United States. Volunteer participants received partial credit toward fulfillment of their course requirements. The number of participants was 50. Demographic data of participants was collected via an online questionnaire to include age, gender, class standing, and GPA.

The study was conducted over a two week period via the online WebCT discussion tool. The 50 participants were randomly assigned to groups of 3 to 5 participants each. These groups were randomly assigned to one of two conditions: (a) a discussion leader with pre-determined argumentation instructions group (experimental) or (b) a discussion leader with no argumentation instructions group (control). Students in the experimental group were presented with an educational technology dilemma to comment on via WebCT postings. Predetermined argumentation instructions were provided by the discussion leader to this group prior to commenting on the dilemma. In contrast, the control group was presented with the same educational technology dilemma to comment on also via online postings but did not receive any specific argumentation instructions

from the discussion leader. The second week both the experimental and control group were asked by the leader to give a reaction to the first week discussions and provide a final resolution to the dilemma.

As student sharing of instructions outside the class was anticipated to be a potential issue and thus steps were taken to insure the independence of subjects was maintained. Student autonomy was maintained by posting each group's technology dilemma and instructions on the discussion board after the face to face class meeting so that students could comment on the dilemma during a one-week period between class meetings. In addition, the online discussion groups were set to 'private' which only gave access to conversation to students belonging to their assigned group. These measures should have reduced history threats to internal validity as described by Shadish, Cook, and Campbell (2002).

Instruments and Materials

Three instruments were used in the study. The first one was a questionnaire designed to measure participants' thinking predispositions. The other two instruments were posting coding schemes. The first coding scheme evaluates students' discussions for quality arguments and the second one determines levels of interactivity.

Participants' thinking predispositions were measured using the Need for Cognition scale (Cacioppo, Petty, Feinstein, & Jarvis, 1984). This 18 item, 5 point Likert scale, type instrument measures the extent to which participants enjoy effortful thinking (see Appendix A). People high in need for cognition are more likely to form their beliefs by paying close attention to relevant arguments. People low in need for cognition are more

likely to rely on nonessential indicators. Students will be able to take this questionnaire at their convenience via WebCT quiz tool within a week prior to the intervention. A statement example is: "I would prefer complex to simple problems." The possible responses range from (1) if the statement is extremely uncharacteristic to (5) if the statement is extremely characteristic of the respondent. If the respondent is not sure (0) can be selected.

Two raters independently read and scored all students' online discussion postings using an argumentation coding scheme and an interactivity coding scheme. The raters met and discussed any coding discrepancies until complete agreement was reached. The argumentation coding scheme is based on a coding scheme developed by Bendixen et al. (2003) that is designed to capture the richness of argumentation (see Appendix B for an example). This method consists of the following steps:

1. Read the posting for meaning and number all statements
2. Combine and/or split statements into obvious idea units if necessary
3. Identify main claims
4. Rate remaining idea units as:

    Negative evidence (E-) if it consists of opinions or speculations

    Positive evidence (E+) if it consists of established facts or causal logical reasoning

    Non scored (N) if statements are redundant, unrelated, or incomprehensible

5. Assign a holistic score for the posting:

    1 for a posting consisting of isolated statements

2 for a posting consisting of a claim and no evidence or negative evidence

3 for a posting consisting of one claim and positive evidence

4 for a posting consisting of multiple claims supported by evidence on both sides of the issue or a posting consisting of one claim and positive evidence and indication of attempt to reach common ground

The interactivity coding scheme is based on a methodology developed by Schaeffer et al. (2002). This coding tool evaluates postings according to the level of relatedness and agreement of online discussion messages and it was used to evaluate interactivity in messages (see Appendix C for an example). This method consists of the following steps:

1. Read the message for meaning
2. Identify number and types of claims as A (acceptance) or C (counter)
3. Assign a score for the posting as follows:

    1 for unrelated posting with no clear reference to any other posting

    2 for acceptance posting

    3 for counter posting that introduces opposition to an earlier posting

    4 for complex posting that contains both acceptance and counter

The materials include an educational technology dilemma presented to the experimental and control groups, addressed pros and cons related to the learning process and the introduction of new technologies into the classroom. This debatable dilemma was selected from a collection of educational psychology controversial issues. The dilemma is "Should schools embrace computers and technology?" (Abbeduto, 2002, pg. 258-259).

Computers and related technologies have become intertwined with every facet of our daily lives. They can be found nearly every place of business, from Wall Street to the neighborhood auto shop. In the United States desktop computers can be found in millions of homes.

Computers are also becoming increasingly common place in schools. More than 6 million computers were in U.S. schools by the mid-1990s, and this number is likely to continue growing as government support for technology increases. Not only are computers increasing in frequency in schools, but so are the educational devices they power and the educational functions that they are now performing. Educational devices include CD-ROMS, digital cameras, laser disc players, overhead projector panels, and scanners. Educational functions include computer-assisted instruction, word processing, desktop publishing, e-mail, Internet searching, and distance education. Many of these devices and functions have been organized into networked systems for presenting the entire curriculum in a subject area to students across multiple classrooms and schools.

Many educators and policymakers have embraced computer-based technologies. In large measure, this is because these technologies appear to be consistent with constructivist theory, which has its origins in the work of psychologists Jean Piaget, Lev Vygotsky, and others and now holds sway amongst most educational researchers and practitioners. According to this theory, we construct new knowledge when the results of our physical and mental actions on the world challenge our current ways of knowing. This implies that schooling should provide students with opportunities to act on the material to be mastered and to "figure things out for themselves," rather than transmitting ready-made knowledge to them through an all-knowing teacher. Moreover, because

different students will come to the material to be learned with different "ways of knowing," they may require different experiences and different amounts of time to achieve mastery. Computer-based instruction is appealing because students are actively involved in the learning process, they can work at their own pace, and presumably they can receive lessons that are well suited to their current ways of knowing.

Critics, however, argue that much of the interest in these technologies reflects a rather naïve desire to use whatever is new with little attention to its appropriateness for the educational goal in question. As a result, critics argue, sophisticated technologies are often put to rather trivial uses, uses for which other, less-expensive approaches are available. The same phenomenon, they say, has been observed several times previously, when the new technologies of film and television burst onto the scene. Perhaps more important, critics suggest that there may be features of the current technologies that are antithetical to the goals that most educators hope to achieve. For instance, they suggest that activities such as surfing the internet may encourage a superficial, unsystematic approach to studying rather than one that is focused, goal directed, and self-reflective. Others argue that the technology makes learning an individual, isolated activity rather than the cultural activity that they believe best facilitates learning. Finally, some critics raise the possibility that because computer-mediated instruction depends critically on a student's ability to monitor his or her own progress, such technology may increase the gap between the more- and the less-capable students; that is, highly motivated students with good self-monitoring skills will flourish, while those who are less motivated or less self-reflective will flounder without the benefit of a human teacher to support them.

Procedure

Prior to participation in this study, each participant was required to complete an informed consent form in WebCT. Consent forms included specific information related to the purpose of the study, the participant's role, duration and time commitment, and participant protection. Following the completion of consent forms, participants were asked to take the need for cognition survey and complete the demographic profile information.

Participants were randomly assigned to small discussion groups of 3 to 5 members each. These discussion groups were randomly assigned to the experimental or control group. The dilemma and instructions were placed on the discussion board after the class period. Participants had a week to comment on the topic. At the end of the first week, the discussion leader posted the instructions for the second week. All discussions posted during the two week period were analyzed.

The following served as the argumentation instructions provided by the discussion leader in guiding the experimental group to elicit argumentation the first week.

- Read the technology dilemma carefully. You have to complete at least 3 posts for this week's discussion (initial, challenge, and response to challenge).
- Make the first posting. In this first posting you will adopt the side of the dilemma you most agree with (either the pro or the con presented). State your claim clearly and support it with evidence and/or reasoning.
- Read other group members postings. Respond to at least one of them. The response has to be a challenge to the posting you are responding to. The challenge

means adopting and supporting with evidence the opposite side of what is presented in the posting you are responding to.

- Make a third posting. This will be a response to one of the challenges addressed to you.

In contrast, the following served as the information given by the discussion leader to the control group taking a non-argumentative approach to elicit feedback from participants.

- Read the technology dilemma carefully. You have to complete at least 3 posts for this week's discussion.
- Make an initial posting as an answer to the dilemma.
- Respond to at least 2 other postings.

At the end of the first week a brief summary of the first week discussion and the following directions were posted to both groups.

- After discussing the dilemma of whether new technologies should be adopted by schools or not, a certain group direction has emerged. Read the summary carefully and respond to the following two questions. What is your reaction to the discussion topic as it evolved in the group? What is your final resolution to the dilemma? Respond to the two questions in two different posts. First, respond to the first question and then wait a day or two before posting your final resolution. That way you get to read other group members' reactions to the group direction.

All discussion postings generated by both groups over the two weeks were collected in an electronic format with the Compile tool in WebCT. Two coders independently analyzed messages using the argumentation and interactivity coding schemes. After

coding all messages meetings took place to discuss disagreements until 100% consensus was reached.

CHAPTER 4

RESULTS

A total number of 214 postings were generated over the two weeks of discussions. On average, each participant (N=44) posted 3 times the first week and 2 times the second week.

Messages were coded independently by two raters. Disagreements in coding were discussed until agreement was reached. After comparing the results, the following agreement percentages (see Table 1) and correlations (see Table 2) were obtained. On the argumentation scale 67.19% agreement at 0 point difference and 94.27% agreement at 0 and 1 point difference were reached. On the interactivity scale 80.99% agreement at 0 point difference and 95.07% agreement at 0 and 1 point difference were reached.

T-tests were performed on argument quality and interactivity measures for both weeks using the t-test SPSS routine (see Table 1). General linear model univariate SPSS routine was used to obtain more information than the t-tests provided such as partial eta squared and observed power. First, tests of between subjects effects were run with need for cognition as a covariate. The need for cognition covariate was found not to have a consistent effect, therefore was dropped for further statistical analysis. Then the same general model univariate tests were repeated without the covariate (see Table 2). The fixed factor was participants grouped either with or without scaffolding directions (experimental versus control) and outcome variables were argumentation and

interactivity for both weeks. Means and standard deviations on argumentation variable indicate subjects performed better both weeks in the experimental group (first week M= 3.0883, SD= .3617; second week M= 2.9348, SD= .8160; N=23) than in the control group (first week M= 2.8457, SD= .4643; second week M= 2.1933; SD= .7341; N=21). Means and standard deviations on interactivity indicate subjects performed better both weeks in the experimental group (first week M= 3.0361, SD= .5571; second week M= 2.9783, SD= 1.0604; N=23) than in the control group (first week M= 1.8729, SD= .3247; second week M= 1.8381, SD= .9410; N=21).

Figure 3. Means and Standard Deviations for Argumentation and Interactivity

Measure	Group	N	Mean	Std. Deviation
Argumentation Wk 1	treatment	23	3.0883	.36173
	control	21	2.8457	.46437
Argumentation Wk 2	treatment	23	2.9348	.81609
	control	21	2.1933	.73412
Interactivity Wk 1	treatment	23	3.0361	.55714
	control	21	1.8729	.32476
Interactivity Wk 2	treatment	23	2.9783	1.06043
	control	21	1.8381	.94100

Six cases in the data set were eliminated due to withdrawal of participants from the class. The final set of 44 subjects (6 males and 38 females) was screened for outliers deviating more than 3 standard deviations from the mean of the dependent variable.

Argument Quality

Argument quality statistical results are presented below. Both weeks of intervention are included.

Week 1

Results of t-tests (see Table 3) did not indicate a significant relationship between treatment intervention and argument quality the first week $t_{(42)} = 1.942, p = .059$. This is suggesting that, although the experimental mean was higher than the control (experimental M=3.0883, SD=.36173; control M=2.8457, SD=.46437), the first week both groups performed similarly on the argument quality measure.

Results of the univariate general linear model (see Table 4) showed the following results $F_{(1, 42)} = 3.772, p = .059, \eta^2 = .082$, observed power .475. This also indicated no significant relationship between treatment intervention and argument quality with $\eta^2 = .082$ which implies 8.2% of variance in the argument quality is accounted for by the treatment intervention.

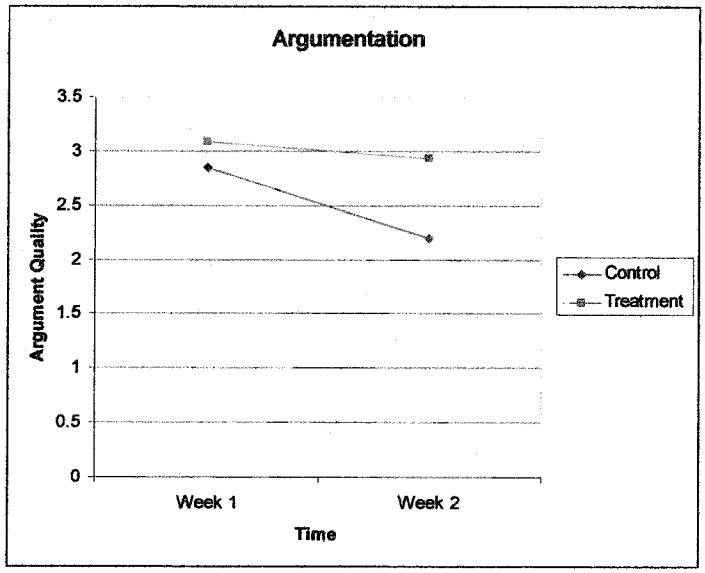
Week 2

Results of t-tests (see Table 3) indicated a statistically significant relationship between treatment intervention and argument quality the second week $t_{(42)} = 3.157, p <$

.003. This is indicating that in the second week the experimental group performed better on the argument quality measure.

Results of the univariate general linear model (see Table 4) showed the following results $F_{(1, 42)} = 9.967$, $p < .003$, $\eta^2 = .192$, observed power .870. This also indicated a significant relationship between treatment intervention and argument quality with $\eta^2 = .192$ which implies 19.2% of variance in the argument quality is accounted for by the treatment intervention.

Figure 4. Week 1 and week 2 scores on argumentation for the control and the treatment groups.



Interactivity

Message interactivity statistical results are presented below. Both weeks of intervention are included.

Week 1

Results of t-tests (see Table 3) indicated a significant relationship between treatment intervention and interactivity the first week $t_{(42)} = 8.354, p = .000$. The practical suggestion in this case is that in the first week the treatment group performed better on the interactivity measure.

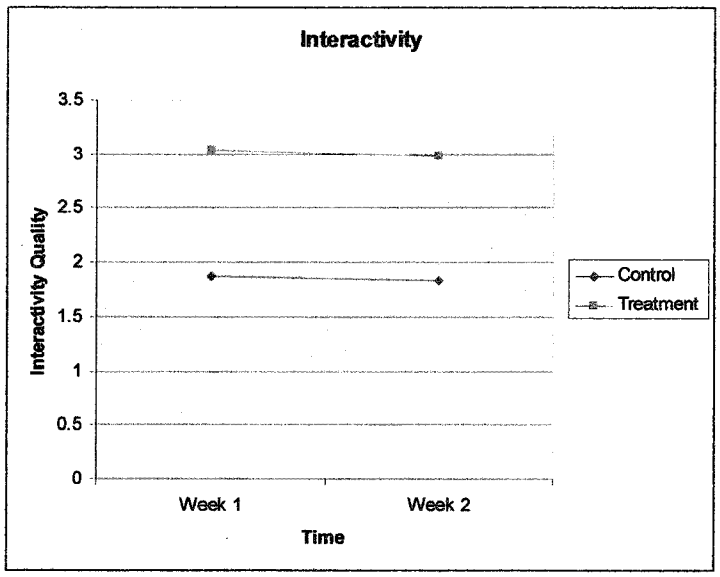
Results of the univariate general linear model (see Table 4) showed the following results $F_{(1, 42)} = 69.794, p = .000, \eta^2 = .624$, observed power 1.000. This also indicated a significant relationship between treatment intervention and interactivity with $\eta^2 = .624$ which implies 62.4% of variance in the interactivity is accounted for by the treatment intervention.

Week 2

Results of t-tests (see Table 3) indicated a significant relationship between treatment intervention and interactivity the second week $t_{(42)} = 3.758, p < .001$. The practical suggestion in this case is that in the second week the experimental group performed better on the interactivity measure.

Results of the univariate general linear model (see Table 4) showed the following results $F_{(1, 42)} = 14.119, p < .001, \eta^2 = .252$, observed power .956. This also indicated a significant interaction between treatment intervention and interactivity with $\eta^2 = .252$ which implies 25.2% of variance in the interactivity is accounted for by the treatment intervention.

Figure 5. Week 1 and week 2 scores on interactivity for the control and the treatment groups.



Summary of Findings

Findings supported the study hypothesis related to the influence of discussion leader instructions on the quality of arguments and interactivity. While the first week of discussions yielded higher means and close to significant statistics, the second week yielded both higher means and statistical significance of the treatment intervention on the argument quality measure. Both weeks of discussions generated statistically significant treatment intervention on the interactivity measure as hypothesized. The need for cognition covariate was found to have statistical significance on both argument quality and interactivity in the first week with a large and medium effect size respectively. The covariate was not found to have any significance neither on argument quality nor on interactivity in the second week. Due to inconsistency, the covariate was dropped from statistical analysis.

CHAPTER 5

DISCUSSION

The goal of the study was to determine the influence of discussion leader argumentation instructions on the argument quality and interactivity while controlling for need for cognition. The study was designed to answer two main research questions. First, will students participating in groups having discussion leaders with pre-determined instructions produce better online argumentation? Previous research concluded that factors such as message labels (Jeong et al., 2003), note starters (Nussbaum et al., 2002), goals (Nussbaum, 2005), and personal characteristics (Bendixen et al, 2003, Nussbaum, 2005) had an effect on argumentative moves in online settings. Second, will students having discussion leaders with pre-determined argumentation instructions exhibit increased interactivity patterns? Previous research concluded that factors such as group structure (Rose, 2004, Joung, 2004) and message triggers (Poscente et al., 2003) have a positive effect on interactions in online environments. However, sound analysis of both sides of an issue and movement towards finding common ground or a final resolution has not been emphasized or evaluated within online discussions. Moreover, this type of analysis has not been employed in small groups receiving scaffolding through specific argumentation instructions from a group leader.

The study presented two hypotheses. The first hypothesis is that students participating in groups receiving specific argumentation instructions from a leader will produce better

online argumentation. The first hypothesis extends current research on online argumentation requirements that involve instructor interventions (Jeong, 2004, Jeong at al., 2003, Nussbaum, 2005).

The second hypothesis is that students having discussion leaders with pre-determined argumentation instructions will exhibit increased interactivity patterns. The second hypothesis is congruent with current research on online interaction that involved group structure (Rose, 2004, Joung, 2004) and triggers (Poscente et al., 2003).

In addition to previous research, which indicated certain group structures and instructor prompts trigger more argumentation (Jeong, 2004, Jeong at al., 2003, Nussbaum, 2005, Rose, 2004), the current research extends the powerful influence of simple argumentation instructions on the small group discussions. This influence is manifested both at the quality of arguments and the degree of interactivity levels.

Theoretical Context and Explanation of Results

The study hypotheses are supported by constructivist, social cultural, and information processing theories of learning. Constructivist and information processing theories are represented the Piagetian (Piaget, 1969) and the Neo-Piagetian (Case, 1992) views of human development. Subjects in the current study are undergraduate education students who are typically capable of logical and abstract thinking which places them in the early formal operational stage of cognitive development. The type of intervention used in the experimental group, disagreement instructions, encourages a challenging discussion of the educational technology issue. These views are not always in agreement with students' existing beliefs on the issue thus creating antagonism, which can lead to cognitive

disequilibrium. Group discussions help resolve the divergent views and through assimilation and accommodation of information cognitive equilibrium may be reached. This study also draws on Vygotsky's (1978) socio-cultural theory of development as Piaget and Case pay less attention to language interaction and communication. This study draws on Vygotsky's socio cultural theory of development as speech is an important mechanism in cognitive development. Education students make sense of the technology dilemma through small group discussion. The discussion is mediated by a discussion leader who is providing scaffolding for accomplishing the task at hand (understanding and attempting to solve the dilemma). The scaffolding is in accordance with theoretical recommendations and consists of division of tasks (making an initial posting on one side of the issue then making a second posting challenging an existing one) and providing structure for how the task should be accomplished (giving a final resolution to the dilemma after exploring both sides of the issue through arguments, counterarguments, and responses to counterarguments).

Argumentation

The first hypothesis, that students participating in groups receiving specific argumentation instructions from a leader will produce better online argumentation, was supported by statistical analysis results only for the second week of discussions. The first week of discussions the discussion quality was not significant on the argument factor ($t_{(42)} = 1.942, p = .059$). A possible explanation for the results is that initially students in both treatment and control groups reacted in a somewhat similar way to the dilemma by producing good arguments (making a claim and supporting it with solid evidence) regardless of the instructions. Although, not statistically significant, the means were still

higher in the experimental group compared to the control group even the first week (experimental M=3.0883, SD=.36173; control M=2.8457, SD=.46437). The second week, the relationship between argumentation and treatment intervention was statistically significant. The quality of the arguments maintained over the second week only in the experimental group can be explained through the scaffolding presence with instructions for initial posting, counter, and response to counter, all backed by evidence or reasoning. Students who received specific instructions performing best the second week can be attributed to a transfer effect on argumentation over the two weeks. Without the scaffolding instructions the control group students considered the topic sufficiently explored and less worthy of additional discussion. The following examples of student reactions to the evolution of discussion in both groups within the second week support the lack of leader scaffolding in the control group.

Experimental group student responses week 2:

- After listening to what the other people in my group had to say I still agree with the cons. Through our conversation last week I was able to see all the pros. But through our conversation I was forced to see the other side. Without our discussion I may not have thought as much about the side I was opposing. I think that our conversation helped all of us gain a better understanding of the topic.
- It was great to think from both points of view! And being made aware of the cons against my supportive argument identified some wholes in my original thoughts. While I believe computers are helpful tools in the classroom, N's argument points out how easy it would be to become dependent on technology. My final thoughts about the issue are that computers are necessary...If used correctly; computers will increase higher levels of thinking.

Control group student responses week 2:

- As the topic progressed, I realized that our entire group basically had the same opinion. We all agreed that technology should be enforced in schools...When I was reading some of the comments posted I laughed because it was exactly what I said or thought. The whole group was in sync throughout the whole discussion, so there wasn't anything to argue or differences of opinion.
- Basically after reading everyone's responses, it seemed that everyone in the group had the same response, in which we all linked with each other. We all had about the same ideas about technology...It would have been better if we had some disagreement with

each others thoughts and ideas in that way we could see my other group members ideas that differs from each other.

Interactivity

The second hypothesis, that students receiving pre-determined argumentation instructions from the discussion leader will exhibit increased interactivity patterns, was strongly supported by statistical data results for both weeks. The interactivity patterns that make the discussion dynamic, specifically agreement and counter together and counter, were consistently more present in the experimental group. An explanation for this type of high interactivity is the presence of specific counter requirements in the pre-determined instructions. These instructions presented by the discussion leader specifically asked for at least one posting of opposition to a current group member posting and then a response to the challenge. The second week reactions to the first week discussions kept going along the same lines of counters or counter and agreement together. A significant relationship between treatment intervention and interactivity shows students in the experimental group performed best maintaining a high level of interactivity over both weeks. The following examples illustrate some of student's reactions in both the experimental and the control groups.

Experimental group

- It was very interesting to read fellow group member responses about technology in the classroom. Before reading the responses, I was under the impression that the majority was for technology being incorporated into the classroom; however, I now realize that the majority agrees that technology is only beneficial when used appropriately.
- I totally disagree with you. First off, computers are not going anywhere, if anything; society is becoming more dependent on them. As teachers we need to know this, understand this, and adapt to this.
- I really liked the fact that we interacted more than usual in the discussions. Usually we all post pretty much the same thing and then to respond, we all agree with each other. This is a better way of doing because we are actually thinking about what others have said and how to respond to their posts.

Control group

- After reading the postings of everyone in my group I believe the general consensus is pro-computer. We all understand that there are negative aspects of using technology, but the positives outweigh the negatives. Everybody in the group focused on the positive uses of computers in the classroom.
- I think that we all agreed because technology is something that we all utilize, and we believe that in order to reach our students (and be relevant to them) we must use technology.
- All of us seem to believe that there are no cons when it comes to teaching with technology

Limitations

The current research study used randomization to assign participants to either the experimental or control group. Practical constraints such as the availability of a large subject population made the sample unequal with respect to gender (N=44, F=38, M=6). Future research should attempt to involve samples with more gender equality.

In addition, the small sample size could be viewed as a limitation and may have impacted the non-significant result of the intervention in week 1 on argumentation. Overall, effect sizes were substantial for the intervention. In terms of argumentation, medium effect size the first week (ES= .082) and large effect size the second week (ES= .192) were obtained. On interactivity the first week (ES= .624) and second week (ES= .252) produced large effect sizes. According to Lipsey (1990) effect sizes play an important role in statistical power and treatment effectiveness research. These values suggested positive treatment effectiveness according to Olejnik and Algina (2000) .01 small, .06 medium, and .14 large effect size values.

Online argumentation over major educational issues constitutes a complex area of research. Understanding the various aspects of online argumentative discourse presupposes utilization of a variety of research methods. Although a couple of student

responses were presented as examples, the current research study did not include in the design a plan to employ qualitative methods to systematically evaluate the students' responses or previous argumentation experiences. Future studies could employ a mixed methods design to better decode the details of online arguments quality and interactivity dynamics.

Lastly, argument quality should be further analyzed with various argumentation instructions that provide a greater level of detail with respect to what a quality argument consists of. Particularly, the type of evidence furnished in support of the claim, may be further explained to the students prior to engaging in discussions or elicited during the discussion process through predetermined questions.

Implications

Three key implications emerge from the current research study, the type of influence simple argumentation instructions have on the argument quality, the type of influence the predetermined instructions have on the interactivity patterns, and the not so evident influence of personal characteristics of students such as need for cognition has on the quality of online discussions.

First, an important implication for education is that the results support the use of predetermined instructions in triggering rich argumentation within online discussion forums. The students who received the argumentation instructions produced better arguments than their peers with no instructions prior to posting. Although in the first week the argument mean difference was almost statistically significant, which makes sense if we consider both groups had initial reactions to the same dilemma that presented

detailed pro and con situations, in the second week responses the mean difference was higher and statistically significant. This can be attributed to the scaffolding provided by the discussion leader that contained specific directions for initial posting, counter, and response to counter all containing a claim backed by evidence or reasoning the first week. In the second week both groups were asked for a reaction to the first week's postings and a final resolution and only the argumentation patterns of the first weeks' experimental group carried over, while the control group's did not. The practical implication for teachers is of major importance for students' understanding of course content. Teachers eager to increase understanding of subject matter through online discussions can present content in a dilemma format and elicit greater participation through concrete argumentation instructions. Production of rich arguments and counterarguments targeting understanding of both sides of a dilemma is conducive to learning. Research shows the relatedness of constructing quality arguments to improving literacy skills (Pilkington & Walker, 2003), problem solving (Bruggen and Kirschner, 2003) and learning outcomes (Alexopoulu & Driver, 1996). In order to achieve quality discourse, students must be encouraged to share alternative perspectives, support their claims, and use counter argumentation (Erkens, 1997, Veerman & Treasure-Jones, 1999, Stein & Miller, 1993; Coirier et al., 1999; Golder & Pouit, 1999).

Second, another important implication for education is that the results support the use of pre-determined argumentation instructions in generating rich interactivity patterns within online discussion forums. The students who received the instructions exhibited better interactivity patterns such as disagreement and agreement/disagreement messages than their peers who did not receive the instructions. Teachers willing to increase student

participation in online forums should make use of such instructions. The instructions are simple but powerful in engaging students' discourse. Instructional design decisions are especially important when it comes to generating rich arguments as students are rather reluctant to disagree with each other for various reasons (Nussbaum et al., 2002, Jeong, 2004).

Lastly, the role of need for cognition in the quality of online argumentation seemed to be inconsistent and it was dropped from statistical analysis. It is possible these or other learner characteristics may play a role in the quality of online arguments therefore future research should take a closer look at learner characteristics.

The importance of the study is reflected by the guiding role simple pre-determined argumentation instructions can play in the quality of online discussions. The understanding of online argument quality and interactivity dynamics and the role they play in students' understanding of content is vital for the successful use of online discussion forums. Elucidating the details of effective online discourse is a continuous endeavor that entails more than just engaging students in poor structured discussions with the expectation of positive outcomes. Argument structure and interactivity are important determinants of quality online discussions that merit further exploration to help improve instructional decisions.

Future research

Based on the results of this study some broader future research recommendations can be made. Aspects of online argumentation and interactivity manifested in synchronous dialogue and audio-video conferencing should be further examined. The rapid advanced of online delivery systems (e.g., Horizon Wimba) that allow for interaction to occur in a

live virtual classroom might make the use of asynchronous online discussions obsolete. New communication mediums need to be explored for their tremendous potential of making quality real time audio-video classroom discourse possible. This research would provide valuable instructional insights to educators who use such technologies either in distance education courses or in addition to their face to face courses.

Future research should also explore other aspects of online discussions besides the ones that directly concern this study. Online discourse has a tremendous potential for helping reach desired learning outcomes at knowledge, skills, and attitudes level. Discussions can be used by instructors to determine and fill current gaps at various levels of student learning. Research in this area can help understand and improve the use of online discussions in meeting learning outcomes.

APPENDIX A

NEED FOR COGNITION SCALE

Instructions: For each of the statements below, please indicate to what extent the statement is characteristic of you. If the statement is extremely **uncharacteristic** of you (not at all like you), please circle (1) next to the question. If the statement is extremely **characteristic** of you (very much like you), please circle the (5) next to the question. Of course, a statement may be neither extremely uncharacteristic nor extremely characteristic of you; if so, please use the number in the middle of the scale that describes the best fit.

1. I would prefer complex to simple problems.
a. Extremely uncharacteristic
b. Characteristic
c. Uncertain
d. Somewhat characteristic
e. Extremely characteristic

2. I like to have the responsibility of handling a situation that requires a lot of thinking.
a. Extremely uncharacteristic
b. Characteristic
c. Uncertain
d. Somewhat characteristic
e. Extremely characteristic

3. Thinking is not my idea of fun.
a. Extremely uncharacteristic
b. Characteristic
c. Uncertain
d. Somewhat characteristic
e. Extremely characteristic

4. I would rather do something that requires little thought than something that is sure to challenge my thinking abilities.
a. Extremely uncharacteristic
b. Characteristic
c. Uncertain
d. Somewhat characteristic
e. Extremely characteristic

5. I try to anticipate and avoid situations where there is a likely chance I will have to think in depth about something.
a. Extremely uncharacteristic
b. Characteristic
c. Uncertain

d. Somewhat characteristic
e. Extremely characteristic

6. I find satisfaction in deliberating hard and for long hours.
a. Extremely uncharacteristic
b. Characteristic
c. Uncertain
d. Somewhat characteristic
e. Extremely characteristic

7. I only think as hard as I have to.
a. Extremely uncharacteristic
b. Characteristic
c. Uncertain
d. Somewhat characteristic
e. Extremely characteristic

8. I prefer to think about small, daily projects to long-term ones.
a. Extremely uncharacteristic
b. Characteristic
c. Uncertain
d. Somewhat characteristic
e. Extremely characteristic

9. I like tasks that require little thought once I've learned them.
a. Extremely uncharacteristic
b. Characteristic
c. Uncertain
d. Somewhat characteristic
e. Extremely characteristic

10. The idea of relying on thought to make my way to the top appeals to me.
a. Extremely uncharacteristic
b. Characteristic
c. Uncertain
d. Somewhat characteristic
e. Extremely characteristic

11. I really enjoy a task that involves coming up with new solutions to problems.
a. Extremely uncharacteristic
b. Characteristic
c. Uncertain
d. Somewhat characteristic
e. Extremely characteristic

12. Learning new ways to think doesn't excite me very much.
a. Extremely uncharacteristic
b. Characteristic
c. Uncertain
d. Somewhat characteristic
e. Extremely characteristic

13. I prefer my life to be filled with puzzles that I must solve.
a. Extremely uncharacteristic
b. Characteristic
c. Uncertain
d. Somewhat characteristic
e. Extremely characteristic

14. The notion of thinking abstractly is appealing to me.
a. Extremely uncharacteristic
b. Characteristic
c. Uncertain
d. Somewhat characteristic
e. Extremely characteristic

15. I would prefer a task that is intellectual, difficult, and important to one that is somewhat important but does not require much thought.
a. Extremely uncharacteristic
b. Characteristic
c. Uncertain
d. Somewhat characteristic
e. Extremely characteristic

16. I feel relief rather than satisfaction after completing a task that required a lot of mental effort.
a. Extremely uncharacteristic
b. Characteristic
c. Uncertain
d. Somewhat characteristic
e. Extremely characteristic

17. It's enough for me that something gets the job done; I don't care how or why it works.
a. Extremely uncharacteristic
b. Characteristic
c. Uncertain
d. Somewhat characteristic
e. Extremely characteristic

18. I usually end up deliberating about issues even when they do not affect me personally.
a. Extremely uncharacteristic
b. Characteristic
c. Uncertain
d. Somewhat characteristic
e. Extremely characteristic

NFC scoring
Positive: items 1,2,6,10,11,13,14,15,18
Negative [Recode]: 3,4,5,7,8,9,12,16,17

APPENDIX B

CODING SCHEMES EXAMPLES

Coding scheme argument analysis

I agree with your views on "Digital Tools for Digital Kids." **1|** Technology is extremely prevalent in our society. **2|** Students are growing up in this new digital era. **3|** Computer programs are fun yet can now be used as learning tools. **4|** If teachers could make learning fun for students that will last them throughout their education career. **5|** We need to make the curriculum based on the students needs, and that is through computers. **6|**

Argumentation Coding Example

Message #	# of Sentences	Idea Units #	Scoring	Holistic Score
64	1	1	NS	3
	2	2	E+	
	3	3	E+	
	4	4	E+	
	5	5	E+	
	6	6	C	

Coding scheme interactivity analysis

I agree with your views on "Digital Tools for Digital Kids." **1|** Technology is extremely prevalent in our society. **2|** Students are growing up in this new digital era. **3|** Computer programs are fun yet can now be used as learning tools. **4|** If teachers could make learning fun for students that will last them throughout their education career. **5|** We need to make the curriculum based on the students needs, and that is through computers. **6|**

Interactivity Coding Example

Message #	# of Claims	Type of Claim	Overall Score
64	1	A	2

APPENDIX C

TABLES

Table 1
Inter Rater Reliability Percentages

Coding Schemes	Points difference (4 point scale)	N	% Agreement	Total N
Argumentation	0	129	67.19	192
	1	52	27.08	
	2	11	5.73	
Interactivity	0	115	80.99	142
	1	20	14.08	
	2	5	3.52	
	3	2	1.41	

Table 2
Inter Rater Reliability Correlations

Argumentation		Rater 1	Rater 2
Rater 1	Pearson Correlation	1	.651(**)
	Sig. (2-tailed)		.000
	N	192	192
Rater 2	Pearson Correlation	.651(**)	1
	Sig. (2-tailed)	.000	
	N	192	192
Interactivity		Rater 1	Rater 2
Rater 1	Pearson Correlation	1	.816(**)
	Sig. (2-tailed)		.000
	N	142	142
Rater 2	Pearson Correlation	.816(**)	1
	Sig. (2-tailed)	.000	
	N	142	142

** Correlation is significant at the 0.01 level (2-tailed).

Table 3

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for equality of means			
		F	Sig.	t	df	Sig. (2 tailed)	Mean Difference
Argumentation Week 1	Equal variances assumed	.582	.450	1.942	42	.059	.2425
	Equal variances not assumed			1.920	37.76	.062	.2425
Argumentation Week 2	Equal variances assumed	1.517	.225	3.157	42	.003	.7414
	Equal variances not assumed			3.173	41.99	.003	.7414
Interactivity Week 1	Equal variances assumed	2.780	.103	8.354	42	.000	1.163
	Equal variances not assumed			8.548	35.94	.000	1.163
Interactivity Week 2	Equal variances assumed	.585	.449	3.758	42	.001	1.140
	Equal variances not assumed			3.778	41.97	.000	1.140

Table 4

Summary of Significant Relationships Experimental versus Control Groups

Variable	Week 1	Week 2
Argumentation	$F_{(1, 42)} = 3.772$	$F_{(1, 42)} = 9.967$
	$p = .059$, $\eta^2 = .082$	$p < .003$, $\eta^2 = .192$
Observed Power	.475	.870
Interactivity	$F_{(1, 42)} = 69.794$	$F_{(1, 42)} = 14.119$
	$p = .000$, $\eta^2 = .624$	$p < .001$, $\eta^2 = .252$
Observed Power	1.000	.956

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Dissertation Title: The Influence of the Discussion Leader Procedure on the Quality of Arguments in Online Discussions

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