# THE EFFECTS OF PROMPTS-BASED ARGUMENTATION SCAFFOLDS ON PEER-LED INTERACTIVE ARGUMENTATION

---

A Dissertation

presented to

the Faculty of the Graduate School

at the University of Missouri-Columbia

---

In Partial Fulfillment

of the Requirements for the Degree

Doctor of Philosophy

---

by

BOSUNG KIM

Dr. David H. Jonassen, Dissertation Supervisor

December 2009

The undersigned, appointed by the Dean of the Graduate School, have examined the dissertation entitled

THE EFFECTS OF PROMPTS-BASED ARGUMENTATION SCAFFOLDS ON PEER-LED INTERACTIVE ARGUMENTATION

Presented by Bosung Kim

A candidate for the degree of Doctor of Philosophy

And hereby certify that, in their opinion, it is worthy of acceptance.

Professor David. H. Jonassen (Chair)

Professor David A. Bergin

Professor James M. Laffey

Professor Rose M. Marra

Professor Jessica Summers

To my husband, Gyung-ho and my daughter, Jane.

# ACKNOWLEDGEMENTS

Working on this dissertation has been a wonderful and often challenging experience for me. Looking back on my journey, I found that many people have helped me complete this journey in different ways. I would like to take this opportunity to acknowledge with sincere thanks the following people, who made this dissertation possible and helped me stay positive through these years.

My deepest gratitude, first and foremost, goes to my dissertation chair, Dr. David H. Jonassen for his inspiring advice and constructive criticism. His untiring support and endless patience also helped me get through this difficult journey. I would also like to thank my other dissertation committee members, Dr. Rose M. Marra, Dr. James M. Laffey, Dr. Jessica Summers, and Dr. David A. Bergin for their insightful comments and encouragement. I am also grateful to Dr. Rose Marra for her guidance during the course of my graduate studies and her stimulating advice in the early development of the assessment tools used in this dissertation. Without their professional guidance, support, and insight, this dissertation would not have been possible.

A special thanks goes to Dr. Laura Wedman, who opened her online classroom to my research and was very supportive during the whole process. All research participants are also gratefully acknowledged. I would also like to extend my gratitude to Krista Galyen who took the time to narrate video clips used in this research; Young Hoan Cho who spent endless time coding data with me and inspired me with great suggestions; and Jason Rhodes, who kindly corrected my spelling and grammar. I would also like to express my gratitude to my friends for being there for me when I need you the most.

Finally, my heartfelt gratitude goes to my parents for having such strong belief in me. Most importantly, none of this would have ever been possible without the love and support of my husband, Gyung-ho, and the charming smile of my daughter, Jane.

# TABLE OF CONTENT

# LIST OF ILLUSTRATIONS

Figures Page

# LIST OF TABLES

THE EFFECTS OF PROMPTS-BASED ARGUMENTATION SCAFFOLDS ON PEER-LED INTERACTIVE ARGUMENTATION

Bosung Kim

Dr. David H. Jonassen, Dissertation Supervisor

# ABSTRACT

The main focus of this study was to determine whether prompts-based argumentation scaffolds (PAS) would result in improvement of students' argumentation in a peer-led argumentation context. The study also examined the effects of PAS on students' reasoning performance and their feelings of group community.

Thirty-two participants were randomly assigned to one of three conditions: a) no prompts, b) cognitive prompts, and c) socio-cognitive prompts. As designed, the socio-cognitive prompts resulted in a significantly greater amount of socio-emotionally enhanced strategy use. With regard to argument behaviors, students in all three conditions made a considerable number of opposing arguments, which could be attributed to the task design of the study. More important, the socio-cognitive prompts condition resulted in a statistically significant greater number of substantial agreeing arguments. As expected, students in the scaffolded conditions performed better in terms of overall argumentation than students in the control condition. This difference, however, was not statistically significant. Contrary to expectation, students in the socio-cognitive prompts condition did not successfully justify their positions within the framework of others' views in the individual reasoning performance test. Lastly, the socio-cognitive prompts did not result in significantly stronger feelings of group community, although students in this condition reported slightly stronger feelings of group community than their counterparts.

# CHAPTER I

# INTRODUCTION

The critical importance of argumentation skills is universally acknowledged, as people are regularly required to engage in some sort of argumentation as part of their everyday lives. The development of such skills has therefore been a topic of educational research for a long time. In recent years, following a realization of the importance of social interaction to learning (e.g. Lave & Wenger, 1991; Piaget, 1985; Slavin, 1995; Vygotsky, 1978), there has been a great emphasis on the importance of having learners engage in argumentation with peers both for the purpose of arguing to learn as well as for learning to argue (e.g. Kuhn, Shaw, & Felton, 1997).

It is often presupposed that having students discuss a concept or a problem with peers enables them to articulate their opinions, explore multiple perspectives, and resolve conflicts among different views by means of argumentation, and thus leads to the expansion of their understanding of the topic at hand. Recently, a number of computer-supported collaborative learning (CSCL) environments have been developed to facilitate interactive argumentation in order to augment the benefits of such argumentation for learning (e.g. Andriessen, Baker, & Suthers, 2003b). Those environments have mostly focused on supporting the cognitive dimension of argumentation either by sequencing activities, constraining communication, or providing visual and written aids (e.g. Baker, 2003; Bell & Linn, 2000; Cho & Jonassen, 2002; de Vries, Lund, & Baker, 2002; Nussbaum, Winsor, Aqui, & Poliquin, 2007; Oh & Jonassen, 2007; Suthers, 2003; Suthers & Hundhausen, 2003; Weinberger, Ertl, Fischer, & Mandl, 2005). They were

successful in improving several aspects of argumentation. There is, however, substantial evidence that learners may not engage in co-constructive critical discussions even with strong instructional supports. For example, students in CSCL environments for argumentation rarely challenged arguments made by others and rarely responded to challenges (e.g. Baker, 2003; Cho & Jonassen, 2002; Jeong & Joung, 2007; Oh & Jonassen, 2007). Even worse, Jeong and Joung (2007) reported that constraining message types with labels discouraged students from engaging in challenging and counter-challenging activities, and shifted their attention to generating more arguments and extending arguments with more explanations and evidence. This low-level engagement in challenging and counter-challenging activities can be problematic in interactive argumentation because counterarguments provide "people grounds for examining their own views" (Leitão, 2000, p. 336) and engage them in deeper levels of cognitive processing (Nussbaum & Schraw, 2007). It is thus obvious that when people do not challenge one another's ideas and do not respond to others' challenges, the quality of argumentation will be degraded and conflicting ideas will not be discussed in depth. In addition, complex knowledge construction that integrates multiple sides of an issue will not occur if students' argumentation is limited to supporting their own claims with evidence without serious consideration of others' challenges. According to Keefer, Zeitz, and Resnick (2000), participants in an "issue-driven critical dialogue" (p. 73) were more open to others' opinions, voluntarily conceded their prior positions upon strong arguments made by others, and willingly elaborated others' arguments. Therefore, for successful knowledge (re)construction via argumentation to occur, participants need to engage in substantial argumentation beyond simply defending their own positions. In

order to resolve conflicts, they must engage in persuasive argument backed by evidence to challenge others' perspectives, or find ways to accommodate divergent views. Such discussion is also similar to Mercer's (1996) notion of exploratory talk. Students in exploratory dialogue were found to perform better in building a complex argument by together integrating different sides of an issue and considering multiple factors involved in the issue (Nussbaum, 2005). In summary, research clearly demonstrates that there is a difference in the quality of peer-led discussions (Chinn, O'Donnell, & Jinks, 2000; Keefer, et al., 2000; Nussbaum, 2005).

Another important dimension of interactive argumentation that has thus far been neglected is the socio-emotional dimension. Studies focusing on social argumentation show that peers' argument behaviors in dealing with conflicts are linked to their socio-emotional behaviors. For example, several studies have reported that supportive behaviors (e.g. acknowledging remarks, the use of closing signature, challenging remarks which take the form of 'I agree…but', etc.) have been observed in co-constructive discussions, whereas disturbing behavior (e.g., sarcastic remarks, verbal sparring, impatience, etc.) have appeared in adversarial discussions (Hogan, Nastasi, & Pressley, 2000; Jeong, 2006; Keefer, et al., 2000). These studies shed light on the importance of a supportive atmosphere in stimulating co-constructive, critical discourse. Therefore, there is a pressing need to find a way to build and maintain a supportive atmosphere for argumentation, so that participants feel comfortable and encouraged to deal with conflicts and to build their own ideas upon the ideas of others.

According to Garrison, Anderson, and Archer (2000), successful online learning occurs when cognitive and social presence are well-balanced and supported throughout

the learning processes. *Cognitive presence* exists when people "construct meaning through sustained communication" (p. 89) (Garrison, et al., 2000). Such communication is nurtured when people support one another socially and emotionally through communication (*social presence*) (Garrison, et al., 2000). When this happens, "the tone of messages is questioning but engaging, expressive but responsive, skeptical but respectful, and challenging but supportive" (Garrison, et al., 2000, p. 96). Such engaging, responsive, respectful, and supportive communication (hereafter socio-emotionally enhanced communication) contributes to building a safe, warm, and trustful learning environment, in which people are more likely to share their tentative ideas, to critically challenge other members' ideas, and to see the value of others' critiques rather than taking them as personal attacks (Rourke, 2000). Such socio-emotionally enhanced communication during the processes of knowledge construction can also be nurtured by carefully structuring and facilitating both cognitive and social learning processes (*teaching presence*) (Garrison, et al., 2000). So far, however, most CSCL environments have focused on supporting communication on the cognitive plane only, assuming that the desired social interaction will automatically occur (Kreijns, Kirschner, & Jochems, 2003). Unfortunately, the lack of nonverbal cues (e.g. facial expressions and gesture) in text-based communication makes it harder for online participants to engage in socio-emotional interactions (Gunawardena, 1995). In this case, the challenge for the effective design of CSCL environments for argumentation becomes how to support socio-emotional communication in ways which nurture a supportive atmosphere for co-constructive, critical argumentation.

Studies on conversational language and social presence inform techniques for breaking the ice among online discussants and nurturing a supportive and respective learning atmosphere. For example, Jeong (2006) found that messages including certain types of conversational language (e.g. acknowledging a partner's contribution, inviting others' opinions, referencing others by name, etc.) elicited a greater number of responses from other online discussants than messages without such conversational language. According to social presence researchers, such conversational expressions are indicators of the existence of social presence, which, they argue, can be cultivated (e.g. Garrison, et al., 2000; Gunawardena, 1995; Gunawardena & Zittle, 1997; Rourke, 2000).

## Background of the Research

### *Argument and Argumentation*

The term *argument*$_1$ has been widely used to refer to a special "kind of utterance or a sort of communicative act" (O'Keefe, 1982, p. 3). For example, we call it an argument when a person proposes both a claim and reasons for supporting the claim. In everyday life, *argument*$_2$ has also been used to refer to "a particular kind of interaction" where people exchange opinions (O'Keefe, 1982, p. 4). The use of *argument*$_1$ in the former case views an argument as a product and the use of *argument*$_2$ in the latter case views an argument as an interactive process. How then does *argumentation* differ from *argument*? According to Inch, Warnick, and Endres (2006), *argumentation* is "the process of making arguments intended to justify beliefs, attitudes, and values so as to influence others" (p. 8) and thus it is a chain of individual *arguments*$_1$.

Due to the complex use of terms in the field of argument(ation), we need to pay special attention to what phenomena are studied and discussed when reviewing argument(ation) theory and argument(ation) research. Traditionally, a normative approach to argument(ation) studies has concerned what constitutes a sound or persuasive argument (argument as a product) or a what are the steps or strategies for the making of a more critical argument (argument as an interactive process) (O'Keefe, 1982). A descriptive approach to argument(ation) studies, on the other hand, has focused on describing the nature of an argument as a product or an interactive process and exploring how it works in everyday life (O'Keefe, 1982).

It is only relatively recently that interest has surged in the interactive aspects of argumentation, in particular with relation to the social construction of knowledge and its effects on individuals' reasoning (e.g. Keefer, et al., 2000; Leitão, 2000; Nussbaum, 2005; Nussbaum, et al., 2007). The underlying premises of this approach are twofold: a) argumentation is fundamentally a social activity of reasoning, and b) how people engage in interactive argumentation affects what they learn.

Socio-cognitive and socio-cultural perspectives on learning provide a theoretical framework for understanding the relationship between argumentation and learning. For instance, from the perspective of Piagetians, argumentation is an effective means of engaging learners in cognitive conflicts. Resolving conflicts through argumentation might allow them to improve or reconstruct their initial ideas and deepen their understanding on a topic. Therefore, the design goal for interaction becomes making disagreements visible (Baker, 2003; Koschmann, 2003). On the other hand, from Vygotskian perspectives, argumentation is an effective means of helping learners reach their potential development

level. Each learner will serve as an advanced learner to one another by asking critical questions, challenging views, and giving valuable explanations. Therefore, the design goal for interaction becomes supporting advanced argumentative behaviors. From socio-cultural perspectives, argumentation itself is a learning process of social construction of knowledge that meets "socially determined standards of cogency (Goldman, 1999; Vorobej, 2006) and evidence (Toulmin, 1958)" (as cited in Nussbaum, et al., 2007, p. 480).

Not all peer-led discussions take the form of argumentation. Also, not all peer-led argumentations aim for accommodating divergent viewpoints or expanding understanding of a controversial topic (see Keefer, et al., 2000). Among various types of peer-led discussion, this paper particularly focuses on a specific discussion context, in which two or more discussants exchange divergent viewpoints on a controversial issue so as to influence others and to expand understanding of the issue by means of argumentation. Perceiving "argumentation as a social practice involving the negotiation of divergence" (Leitão, 2000, p. 336), this paper is particularly interested in the process of social argumentation in peer-led discussions—how individuals' socio-emotional behaviors are linked to their argument behaviors for negotiating divergence.

### *Issues in Peer-led Discussions*

In general, research shows a variety of positive effects of peer-led argumentation on learning (e.g. Alexopoulou & Driver, 1996; Anderson, et al., 2001; Burnett, 1993; Chinn, et al., 2000; Heller, Keith, & Anderson, 1992; Kuhn, et al., 1997; Nussbaum & Sinatra, 2003; Reznitskaya, et al., 2001; Schwarz, Neuman, & Biezuner, 2000; Teichert

& Stacy, 2002; Wegerif, Mercer, & Dawes, 1999; Zohar & Nemet, 2002). However, participating in argumentative activities has not always resulted in desired learning outcomes, because peer-led discussions are not always processed in a productive way. For example, Keefer, Zeitz, and Resnick (2000) found that fourth-graders engaging in verbal sparring and using tricky arguments failed to accommodate divergent views. Similar findings were also found in the preliminary study conducted by Steinkuehler (2001), who analyzed a discussion of five preservice teachers. Their discussion sometimes turned into eristic. When this happened, participants spent more effort defending their own positions than furthering ideas (Steinkuehler, 2001). Therefore, it can be concluded that engaging students in peer-led discussions does not always guarantee the occurrence of fruitful interactive argumentation (Veerman & Treasure-Jones, 1999). Without proper guidance, learning will often suffer from lack of productive argumentation.

Those undesirable situations can be attributed to several factors. First, people may lack argumentation skills (Felton & Kuhn, 2001; Kuhn, 1991; Stegmann, Weinberger, & Fischer, 2007). In particular, people rarely deal with counterarguments and rebuttals. Second, individual differences (e.g. argumentativeness, epistemological beliefs, etc.) play a role in individuals' disposition toward argumentation (e.g. Infante & Rancer, 1982; Nussbaum, 2002; Nussbaum & Bendixen, 2003). Third, people may be reluctant to disagree with one another or strongly advocate a particular position due to social or other reasons: a) having a fear of losing face and feeling afraid of challenging dominant persons (Nussbaum & Jacobson, 2004; Veerman, 2003), b) misinterpreting disagreement as a hostile act (Nussbaum, et al., 2007; Rourke & Kanuka, 2007), c) having competitive

schema on the operation of group interaction (Alexopoulou & Driver, 1996), and d) feeling time pressure (Baker, 1999). Fourth, certain social and contextual factors may affect individuals' subsequent behavior and their disposition to argue. For example, complementary and supportive behaviors (e.g. acknowledging other members' contributions, connecting ideas, etc.) contribute to building a safe, warm, and trustful atmosphere for the co-construction of knowledge during peer-led argumentation, whereas unfavorable behaviors seem to have a detrimental effect on fostering such an atmosphere and lead to an adversarial style of argumentation (e.g. Hogan, et al., 2000; Resnick, Salmon, Zeitz, Wathen, & Holowchak, 1993; Steinkuehler, 2001).

When the goal of peer-led discussions is to enhance understanding of multiple perspectives of an issue and achieve a better (re)construction of individuals' perspectives, co-constructive, critical argumentation is clearly more productive than adversarial argumentation. The critical question then becomes what can be done to encourage students to deal with conflicts in more productive ways and to build their ideas upon those of their peers. First of all, the topic of discussion should entail divergent views. If there are no disagreeing opinions, there will be no need for argumentation. Counterargument is a critical component of promoting good argumentation (e.g. Andriessen, Baker, & Suthers, 2003a; Erkens, Andriessen, & Peters, 2003; Järvelä & Häkkinen, 2003; Leitão, 2000; Nussbaum, Hartley, Sinatra, Reynolds, & Bendixen, 2004; Nussbaum & Kardash, 2005; Nussbaum & Schraw, 2007; Nussbaum, et al., 2007; Oshima & Oshima, 2002; van Eemeren, Grootendorst, & Henkemans, 1996) because counterarguments provide grounds for examining one's opinions (Leitão, 2000; Nussbaum & Kardash, 2005). For this reason, many scholars argue for making

disagreement visible (Baker, 2003; Koschmann, 2003) and requiring students to explore alternative ideas (Nussbaum, et al., 2007). Moreover, a supportive atmosphere is of necessity for co-constructive argumentation because it affects an individual's willingness to deal with conflicts and to improve their ideas based on others' challenges (e.g. Alexopoulou & Driver, 1996; Hogan, et al., 2000; Nussbaum, et al., 2007; Steinkuehler, 2001).

### *Computer-Supported Collaborative Argumentation (CSCA)*

Several intervention studies on interactive argumentation inform ways of promoting critical argumentation with the help of technologies. One way is via scaffolding. Scaffolding is a useful instructional approach that is used to provide students support, in the form of temporary frameworks, which allows them to perform beyond their capacities (Jonassen, 1999). Since Scardamalia and colleagues (Scardamalia & Bereiter, 1991, 1992, 1993, 1993-1994, 1996; Scardamalia, Bereiter, & Lamon, 1994; Scardamalia, Bereiter, McLean, Swallow, & et al., 1989; Scardamalia, Bereiter, McLean, Swallow, & Woodruff, 1987; Scardamalia, Bereiter, & Steinback, 1984) first used note starters to support students' knowledge building activities as part of Computer-Supported Intentional Learning Environment (CSILE), many CSCL environments (e.g., Belvedere, CONNECT Environment, FLE3, CSCL Environment with Epistemic and Social Scripts, Knowledge Integration Environment, Online Argumentation Vee Diagram Environment, etc.) have been developed in an attempt to facilitate interactive argumentation among students using a variety of methods (e.g., scripting the process of a task, providing a

representational tool, guiding the interaction with note starters, visualizing cognitive conflicts, etc.).

In general, empirical studies on CSCL environments for argumentation suggest positive effects of these interventions on interactive argumentation and individual learning; it is, however, inconclusive whether or not current instructional strategies are sufficient to guarantee quality argumentative interaction toward social construction of knowledge and to lead to (re)construction of individuals' knowledge. For example, there is considerable evidence that students in CSCA environments are still reluctant to confront conflicts. For example, students using Belvedere rarely generated backings, rebuttals, or warrants (Cho & Jonassen, 2002). Similarly, students in the CONNECT environment rarely discussed identified conceptual differences between their opinions before they were required to write a common text (de Vries, et al., 2002). Recently, Oh and Jonassen (2007) investigated the effects of constraint-based argumentation scaffolds on students' argument behaviors and individual ill-structured problem-solving performance. They found that students in the constraint-based discussion condition generated more evidence messages than students in the threaded discussion condition but performed no better in generating verification and rebuttal notes. One important thing to note here is that an increase in some argumentative activities comes at the cost of a decrease in others. For example, when students excessively focus on using evidence to extend their own arguments, they may not have enough time or effort left to challenge others' opinions or to seriously consider how others' challenges bear on their own arguments.

To this date, most CSCL environments have primarily focused on providing cognitive support, assuming that the desired social interaction will automatically occur (An, Kim, & Kim, 2008; Kreijns, et al., 2003; Wegerif, 1998). Unfortunately, individuals are not likely to share their tentative ideas or critically argue against arguments made by others unless they have trust in their group members and feel belong to the group (An, et al., 2008; Kreijns, et al., 2003; Rourke, 2000).

In addition, a co-constructive discussion is not likely to occur in the absence of a supportive atmosphere. Thus, support must be provided for both the cognitive and social dimensions of interaction in order to effectively facilitate productive argumentation.

### *Socio-Emotionally Enhanced Conversation*

Appropriate use of socio-emotional conversational language promotes fruitful argumentation by contributing to building a supportive and respectful learning environment. Computer-mediated communication is often characterized as being impersonal and lacking non-verbal cues. To compensate for the lack of non-verbal cues in written messages and to project themselves as personal, online participants often use emoticons and parenthetical metalinguistic cues (e.g., hmmm, yuk, etc.) (Gunawardena, 1995; Gunawardena & Zittle, 1997). Additionally, some people may use more supportive voices to prevent their messages from being misunderstood by others. Studies on conversational language continuously show that friendly, encouraging, and personalized voices are more effective in continuing communication (e.g. Fahy, 2003; Jeong, 2006; Savicki, Kelley, & Ammon, 2002). For example, Jeong (2006) found that online messages including more personal, supportive, or respectful conversational language

(e.g., asking questions, inviting replies, acknowledging others' contributions, referencing others by name, using closing signatures, greeting fellow participants, presenting challenges in polite forms such as, 'I agree, but') elicited a greater number of responses (e.g., more challenging replies to arguments and more explanation replies to challenging messages) in an asynchronous argumentation context.

It is not yet certain whether these conversational strategies will be appropriated by users and result in the social construction of knowledge as well as its individual internalization. It is also possible that people may feel reluctant to strongly criticize an argument when the tone in which it is made is friendly, personal, and polite. However, findings from interactive argumentation studies clearly indicate that social construction of knowledge does not easily occur and arguing with others is quite difficult for some students, particularly online, without any instructional support (Steinkuehler, 2002). In addition, there is considerable evidence that students' argument(ation) behaviors are linked to their social behaviors (e.g. Hogan, et al., 2000; Keefer, et al., 2000; Steinkuehler, 2001).

## Purpose of the Study

The present study aims to scaffold peer argumentative interaction using prompts in such a way as to induce students to generate more socio-emotionally enhanced task-oriented messages and to investigate whether they actually do so. If students could be educated to generate more socio-emotionally enhanced task-oriented messages, those messages might contribute to building a supportive environment for productive argumentation where students demonstrate their willingness to explore various

perspectives by unfolding their own ideas, critiquing ideas produced by others, sincerely responding to others' challenges, engaging with all the relevant perspectives, and, critically, building their own arguments within the framework of others' views. It is expected that students in a socio-emotionally enhanced argumentative environment will feel connected to and trust their discussion partners, and that they will feel supported by them ("connectedness"). In addition, they will feel safe in sharing ideas and gain a sense of satisfaction from the construction of knowledge based upon their interaction with this partner ("learning"). It is, however, also possible that people may not feel comfortable arguing against arguments which put forward with polite and friendly language. Polite and friendly manners in argumentation then prevent meaningful disagreement from happening. Currently, there is not enough empirical evidence to fully understand the precise role socio-emotional behaviors play in a peer-led argumentative context.

Thus, in sum, the purposes of this study are to assess the effects of prompts-based argumentation scaffolds on argumentation in terms of students' argument behaviors and socio-emotionally enhanced behaviors, students' reasoning performance represented by the degree to which they succeed in building an argument within the framework of others' views, and their feelings about their own discussion partner and learning experience. For these purposes, three experimental conditions—two treatment conditions and one control condition—were established. Students in the control condition received no prompts while participants were composing messages. Students in the first treatment condition received cognitive prompts that are task-oriented. Students in the second treatment condition received socio-cognitive prompts, which added socio-emotional cues to the cognitive prompts.

In order to answer the research questions, students' online discussions were assessed in several ways. First, students' argument behaviors and socio-emotionally enhanced behaviors observed during discussions were categorized and evaluated. It was expected that the socio-cognitive prompts would result in an increase of socio-emotionally enhanced behaviors. More important, it was expected that prompts-based argumentation scaffolds would have some effect on students' engagement in certain argument behaviors. Cognitive prompts may result in a more competitive style of argumentation, in which students are more eager to prove their points of view; socio-cognitive prompts may result in more co-constructive style of argumentation, in which students successfully accommodate multiple sides of an issue. Further, it was investigated whether prompts-based argumentation scaffolds affected students' reasoning performance and their feelings about their dyads in terms of connectedness and learning (sense of group community). It was expected that students scaffolded by socio-cognitive prompts would feel a strong sense of group community and justify their opinions within alternatives because of the mediating effect of socio-emotionally enhanced argumentation.

## Research Questions

The following research questions are examined in this study:

RQ1. How does the use of prompts-based argumentation scaffolds affect students' socio-emotional behaviors while they engage in online dyadic argumentation about a controversial issue?

RQ2. How does the use of prompts-based argumentation scaffolds affect students' argument behaviors while they engage in online dyadic argumentation about a controversial issue?

RQ3. Does the use of prompts-based argumentation scaffolds affect the overall quality of students' argumentation performance while they engage in online dyadic argumentation on a controversial issue?

RQ4. Does the use of prompts-based argumentation scaffolds affect students' reasoning performance represented by the degree to which they succeed in building an argument within the framework of opposing views?

RQ5. Does the use of prompts-based argumentation scaffolds affect students' feelings of group community?

## Research Hypotheses

Based on theoretical assumptions and empirical findings in previous studies concerning the role of socio-emotionally enhanced conversational language in peer-led discussions and the effects of prompts on subsequent behaviors in online argumentation, the following hypotheses are developed.

RH1.

RH1-1. Students scaffolded by socio-cognitive prompts will use more socio-emotionally enhanced strategies while they engage in online dyadic argumentation about a controversial issue than students without any supportive prompts.

RH1-2. Students scaffolded by socio-cognitive prompts will use more socio-emotionally enhanced strategies while they engage in online dyadic argumentation about a controversial issue than students scaffolded by cognitive prompts.

RH2. There will be differences of argument behaviors across conditions (i.e. the control condition, the cognitive prompts condition, and the socio-cognitive prompts condition).

RH3.

RH3-1. The overall quality of argumentation performance of students in the scaffolded discussion condition (the cognitive prompts condition and socio-cognitive prompts condition) will be better than that of students in the unscaffolded discussion condition (the control condition).

RH3-2. There will be no statistical difference in the overall quality of argumentation performance between the cognitive prompts condition and the socio-cognitive prompts condition.

RH4. Students scaffolded by socio-cognitive prompts will score higher in the post-reasoning performance test than their counterparts (i.e., the control condition and the cognitive prompts condition) after controlling for the effect of the pre-reasoning performance scores.

RH5. Students scaffolded by socio-cognitive prompts will report a higher level of group community than their counterparts (i.e., the control condition and the cognitive prompts condition).

# CHAPTER II

# LITERATURE REVIEW

This chapter begins with a review and discussion of major theoretical and analytical models of argument(ation). It is then followed by the development of a conceptual framework for the use of interactive argumentation for learning, including definitions of interactive argumentation. After that, major studies concerning interactive argumentation are reviewed and conditions for productive argumentation toward successful social construction of knowledge are discussed. Several well-known computer-supported learning environments for interactive argumentation are also introduced and analyzed, demonstrating a crucial gap between current theoretical assumptions and empirical findings. Finally, based on a review of studies on social presence in CSCL and written conversational language in argumentation, various means to support both cognitive and social dimensions of interactive argumentation are suggested.

## What is Meant by Argument and Argumentation?

Theories of argumentation trace their roots back to Aristotle's notions of apodictic (or demonstrative), dialectical, and rhetorical arguments. He distinguished arguments according to their purposes (van Eemeren, et al., 1996). van Eemeren et al. (1996) shortly summarize Aristotle's three main forms of arguments as follows:

> *Arguments designed to achieve absolutely certain and reliable knowledge, he calls apodictic or demonstrative; arguments calculated to lead to generally acceptable opinions, or points of view, are dialectical; and*

> *arguments that are primarily intended to convince a particular audience of the correctness of a standpoint, are called rhetorical arguments. (p. 32)*

More recently, Toulmin (1958) and Perelman (1969) set the stage for contemporary studies of argument(ation) by emphasizing the importance of studying argumentation in ordinary language and argumentation in practice. Since then, many argument(ation) models have been established to describe or analyze ordinary argument(ation), or to develop effective argument(ation) techniques. In particular, contemporary argumentation models such as pragma-dialectics (van Eemeren & Grootendorst, 1992) and argumentation schemes for presumptive reasoning (Walton, 1996) provide useful insight into understanding ordinary argumentation.

The meaning of argument(ation), as used in ordinary language, is often quite ambiguous. In practice, the word argument(ation) has not only been used to refer to a special "kind of utterance or a sort of communicative act" (p. 3), in which argument is conceived as a kind of product, but has also been used to refer to "a particular kind of interaction" (p. 4), in which people exchange opinions (O'Keefe, 1982). The definition put forward by van Eemeren et al. (1996) embodies this "process-product ambiguity" (p. 5):

> *Argumentation is a verbal and social activity of reason aimed at increasing (or decreasing) the acceptability of a controversial standpoint for the listener or reader, by putting forward a constellation of propositions intended to justify (or refute) the standpoint before a rational judge (p. 5).*

Their definition of argumentation also draws attention to the fact that argumentation is a social activity. Understanding the role of argumentation in the social construction of knowledge calls for special attention to the dialogical and dialectical

perspectives on argumentation, and requires practical approaches rooted in experimentation and observation (Leitão, 2001). Major models for understanding the critical connections between argumentation and knowledge construction are reviewed in the following section.

## *Major Argumentation Models*

### *New rhetoric.*

The "new rhetoric" model was first introduced by Perelman in 1949 and further developed by Perelman and Olbrechts-Tyteca over the next ten years (van Eemeren & Grootendorst, 1992). Like classical rhetoric, new rhetoric views the goal of argumentation as the persuasion of the audience[1]:

> *Arguers unfold their argumentation in order to sway the audience, or to convince them of something. Rhetorically speaking, the soundness of argumentation depends on its success with the audience for whom it is intended. (van Eemeren, et al., 1996, p. 96).*

For this reason, the new rhetoric concentrated on establishing argumentation techniques (argumentation schemes) that effectively increase the likelihood of the approval of an argument from an audience, or what they referred to as "the mind's adherence" (Perelman & Olbrechts-Tyteca, 1969, p. 4).

[1] According to Perelman and Olbrechts-Tyteca (1969), the audience is "the ensemble of those whom the speaker wishes to influence by his argumentation" (p. 19).

*The uses of argument.*

In 1958, Stephen Toulmin published his famous book, "The Uses of Argument", in which he introduced the layout of an argument. He made the critical point that formal logic is not applicable to the understanding of everyday argumentation. On the basis of legal reasoning processes, he developed the layout of an argument designed to represent rational processes. Although he did not explicitly link his works to the rhetorical tradition, his model has been widely adopted as an analytical tool for the evaluation of rhetorical arguments.

Toulmin (1958) argued that the basic layout of an argument constitutes a claim (C), data (D), and warrant (W), and that the layout of an argument gets more complicated with the addition of additional elements such as backing (B), qualifiers (Q), and rebuttal (R). When faced with a challenge to a claim, an arguer justifies his or her claim by linking (W) a fact (D) to the claim (C), and extends the reasoning by adding field-dependent assurances (i.e., the nature of the assurances are dependent on the audience) (B) to the warrant (W), some explicit reference (Q) to the degree of force from data (D) to claim (C), and finally allows for conditions of exception (R). In plain English, the arguer responds by first linking a fact (previously mentioned or not) to the claim, makes assurances as to the veracity and relevance of the fact presented which are tailored to the audience being addressed, makes a specific claim as to the weight that the fact just provided should be accorded in evaluating the claim, and then makes allowances for exceptions. According to Toulmin (1958), the general procedural pattern of argumentation is the same regardless of field (field-invariant), but the criteria determining the right or wrong use of modal qualifiers are field-dependent (van Eemeren &

Grootendorst, 1992). For example, modal qualifiers such as 'can', 'cannot', 'possible', and 'impossible' have "a field-invariant force and field-dependent standards" (Toulmin, 1958, p. 38).

Against proponents of the efficacy of formal logic for the evaluation of argument structure, he rejected the existence of universal norms for the evaluation of argumentation, and contended that the validity of argumentation depends upon the nature of the problem at hand (van Eemeren & Grootendorst, 1992). Hence, he did not provide any evaluation criteria and left them to experts in the infinite number of fields to which an argument could be addressed.

Although his model has been very influential in the field of argument(ation) studies, the actual application of Toulmin's model in practice, in particular interactive argumentation, seems to be somewhat problematic for several reasons. First, it is hard even for researchers to differentiate between data and warrants and between warrants and backings (Simosi, 2003). Second, Toulmin's model was originally developed to illustrate the structure of an argument and thus is not appropriate for use in analyzing naturally occurring interactive argumentation (O'Keefe, 1982). Although Toulmin's model is quite useful in identifying the essential components of the speakers' arguments and their relationships, it certainly does not help to reveal how the arguments are challenged, further elaborated or restructured during interactive argumentation. It may be too much to say that Toulmin's model failed to depict interactive argumentation. Rather, it may be fair to say that Toulmin's model as well as Perelman's new rhetoric was originally developed for "isolated arguments," and neglected "the pragmatic aspects of the verbal

and nonverbal context of the speech even in which they occur" (van Eemeren & Grootendorst, 2004, p. 4).

In sum, Toulmin's model is useful in identifying the essential components of an argument and displaying how those components are related to each other. However, it did not consider how an argument is developed, challenged, further elaborated, or compromised in the attempts to close the gap between different opinions in the course of a discussion.

### *Pragma-dialectics.*

Pragma-dialectics, developed by Frans van Eemeren, Rob Grootendorst and colleagues (van Eemeren & Grootendorst, 1992; van Eemeren, et al., 1996), regarded argumentation as a means of resolving differences of opinions during a critical discussion. Criticizing the limitations of the purely theoretical approach, with its foundation in modern logic, and the purely observational approach used by contemporary linguistics in studying everyday argumentation, they tried to close the gap between theories and practices by systematically combining both normative and descriptive aspects of argumentation (van Eemeren & Grootendorst, 1992; van Eemeren, et al., 1996).

According to van Eemeren and colleagues (van Eemeren & Grootendorst, 1992; van Eemeren, et al., 1996), there are four basic principles for the study of argumentation: 1) externalization, 2) socialization, 3) functionalization, and 4) dialectification. That is, the externalized commitments which people bring to the task of joint problem solving (*externalization*) should be the focus of the study of argumentation, which should be

studied in social contexts (*socialization*). Further, the study of argumentation should be attentive to the various functional roles of each argumentative move made in the resolution of disagreements (*functionalization*). Lastly, they emphasized the importance of recognizing the dialectical nature of the process of resolving disagreements in critical discussions (*dialectification*).

Their proposed ideal model for critical discussions has four essential stages: 1) confrontation stage, 2) opening stage, 3) argumentation stage, and 4) concluding stage (van Eemeren & Grootendorst, 1992, 1999; van Eemeren, et al., 1996). In the *confrontation stage*, people present their differing standpoints. If there is no realization of differing views, there is no argumentation. In the *opening stage*, people accept their obligation and roles and establish a common ground for fruitful discussion. In the *argumentation stage*, people advance argumentation by both defending and challenging the opposing standpoints. In the *concluding stage*, participants in argumentation determine who has emerged the victor. If there is no agreement on the outcome of the discussion, it is understoodthat "the critical discussion has not led to a resolution of the difference of opinion" (van Eemeren, et al., 1996, p. 282).

In contrast to formal dialectics, pragma-dialectics has concerned itself with ordinary discussions and has focused on providing dialectical rules for a critical discussion (van Eemeren & Grootendorst, 1999). According to pragma-dialectics, arguers should follow a certain procedure in order to resolve conflicts effectively.

In general, the pragma-dialectic argumentation model provides great insight into how opposing sides of a controversial issue resolve a conflict via argumentation. However, it does not take into account the possibility that the purpose of discussion may

not be winning or persuading one's supposed "opponent," but rather the expansion of knowledge and understanding of the issue under discussion. A discussion may end with the victory of one position over the other position, but also possible is the social construction of knowledge that integrates both sides of views on a controversial issue. Additionally, and particularly in educational contexts, people may not act strictly as a proponent or opponent of any of the positions or viewpoints under discussion.

### *Walton's notion of presumptive reasoning.*

Walton (1996) argued that certain arguments, while fallacious if judged by the rules of formal logic, can still be employed persuasively. Such arguments are prevalent in everyday discourse and thus should not be ignored (Walton, 1996). Examples of presumptive arguments include arguments from signs or consequences and the appeal to expert opinion during argumentation (Walton, 1996). He provided the following argument as an example of presumptive arguments.

> John's hat is on the peg. Therefore, he has not left the house.
>
> (Walton 1992, p. 52)

This argumentation is based on unexpressed warrant; "John normally wears his hat (removing it from the peg) when he leaves the house" (Walton, 1992, p. 52). The presumptive inference in the above example is based on the knowledge of John's usual habits (Walton, 1992). The conclusion ("he has not left the house") is drawn from the sign ("John's hat is on the peg").

In arguments based on presumption, the reasoning is tentative and open to challenge (Walton, 1996) because the presumption used for arguments is "something you move ahead for practical purposes, even though the evidence to support it may be insufficient or inconclusive" (Walton, 2001, p. 155 as cited in Ebenezer & Puvirajah, 2005). The conclusion in the above case ("he has not left the house") is not conclusive, but rather tentative. In presumptive arguments, the burden of proof is shifted to the other party in a dialogue (Walton, 1996). Thus, presumptive arguments call for further argumentation and are open to revision upon the arrival of new stronger evidence in the process of argumentation.

> *In assertions, the burden of proof is on the proponent (assertor) to prove or provide evidence if challenged by a respondent in dialogue. With presumptions, this dialectical arrangement is reversed according to our analysis, given in chapter two. A proponent can put forward a presumption "for the sake of argument" for purely practical reasons, without offering evidence to back it up. It is then up to the respondent to rebut the presumption by bringing forward evidence against it. If the respondent does not, the presumption holds, provisionally, at least until some subsequent point in the dialogue where someone brings forward evidence to refute it. With presumption, then, the burden of (dis)proof lies on the respondent, not on the proponent. (Walton, 1996, p. xii)*

Walton (1996) perceived argumentation as a goal-directed and interactive dialogue, in which two participants are reasoning together to advance arguments by proving or by disproving presumptions. He classified critical discussions into two types according to the role of proponents and respondents: simple critical discussions versus compound critical discussions. In a simple critical discussion, a proponent needs to prove his or her argument and a respondent needs to raise critical questions (Walton, 1996). In a compound critical discussion, both proponent and respondent are required to prove their own argument (Walton, 1996). According to Walton (1996), "proper evaluation of

presumptive reasoning requires a flexible tolerance, a readiness to acknowledge and correct errors and biases, and finally, an appreciation of the finer shades of meaning and shifts of presumption in argumentation" (p. 45).

In his famous book, "Argumentation Schemes for Presumptive Reasoning", Walton (1996) identified twenty-five presumptive argumentation schemes and provided a matching set of critical questions that should be asked by respondents. Critical questions for an argument from consequences, for example, might be "How strong is the likelihood that these cited consequences will (may, must, etc.) occur?," "If A is brought about, will (or might) these consequences occur, and what evidence supports this claim?," and "Are there other consequences of the opposite value that should be taken into account?" (pp. 76-77). Although his argumentation schemes are not exhaustive, they do provide useful insight into how everyday argumentation uses presumption for the practical effect they have in advancing an argument, and the types of questions asked to evaluate each kind of presumptive reasoning.

### *Rhetorical Perspectives versus Dialectical Perspectives on Argument(ation)*

The study of argumentation can be classified according to the perspective on argument(ation) taken by each theory: a) logical (e.g., Walton's presumptive reasoning), b) rhetorical (e.g., Perelman's new rhetoric) and c) dialectical (e.g., van Eemeren's pragma-dialectics). Researchers who adopt a particular rhetorical perspective have been primarily interested in dialogue between an arguer and an audience, and have considered an argument as acceptable and successful if it gains approval from the target audience (van Eemeren & Grootendorst, 1992). Thus, most rhetorical argumentation models have

concentrated on investigating "the structure and content of arguments produced by a single individual," (Chinn & Anderson, 1998, p. 316) and on developing argumentation techniques which are effective in persuading or convincing a target audience. For example, Willard (1983) argued that the epistemic background of an audience was crucial in determining the types of arguments likely to be effective in persuading them, and matched a variety of argument types with the epistemic backgrounds most likely to find them persuasive.

On the other hand, researchers who perceive argumentation as dialectical have treated argumentation as almost identical to debate, and thus emphasize winners and losers (Chinn & Anderson, 1998). To these theorists, argument(ation) is a dialogue between a proponent and an opponent of a controversial issue played according to the rules of a dialogue game. From the dialectical perspective, successful argumentation does not solely depend on approval from the audience, but is also determined by whether an argumentative procedure is valid for resolving the difference (van Eemeren & Grootendorst, 1992). Therefore, most dialectical argumentation models have focused on providing rules for the role of interlocutors or argumentative moves that can effectively contribute to resolving conflicts. However, little attention has been given to the social relations that influence the processes of argumentation.

Recently, the pragma-dialectical approach to argumentation has systematically integrated rhetorical considerations into a dialectical analysis of argumentative discourse (van Eemeren & Houtlosser, 2003, 2006). van Eemeren and Houtlosser (2003, 2006) argue that participants in an argument may simultaneously pursue both rhetorical and dialectical aims at each stage of discussion. They make the case that an arguer can

diminish any potential tensions between two aims by making use of "strategic maneuvering".

> *Strategic maneuvering may take place at several levels of an argumentative move. The basic aspects of strategic maneuvering are, in our view, making an expedient selection from the topical potential available at a certain discussion stage, adapting one's contribution optimally to the specific expectations and demands of the audience, and using the most effective presentational devices. When the choices that are made at the various levels go together in a concerted succession of moves, this amounts to conducting a full-fledged argumentative strategy. What the best way of strategic maneuvering is, will in the last resort always depend on the limits set by the dialectical situation and the audience that is to be persuaded in the context concerned.(van Eemeren & Houtlosser, 2003, p. 392)*

## *Analysis of Argument(ation)*

Toulmin's model (1958) has been widely used as an analytical tool in the study of argumentation. This model attempts to document and explain the functional relationships of the elements of which an argument consists. According to Toulmin (1958), an argument in any field progresses from establishing a link (a *warrant*) between facts (*data*) and one's conclusion (*claim*), to justifying (*backing)* the link, and specifying the conditions for the claim using *qualifiers* and *rebuttals*. From this perspective, the strength of an argument depends on the presence or absence of these elements (Sampson & Clark, 2006). Recently, Toulmin's model has been used to analyze peer-led argumentation (Cho & Jonassen, 2002; Oh & Jonassen, 2007).

Although Toulmin's model has been effectively used in assessing the structure of arguments, there have been concerns about using this model in practice. First, even researchers have found it difficult to make distinctions between warrants and backing. Moreover, some elements of arguments, such as warrants, often remain implicit in

practice (Driver, Newton, & Osborne, 2000). Second, while Toulmin's model was originally developed to illustrate the structure of an argument$_1$ it has also been used to analyze the efficacy of an argument$_2$ (O'Keefe, 1982). Using Toulmin's model for analyzing interactive argumentation, however, can be problematic because it does not take into balanced consideration both sides of a controversial issue (e.g. Leitão, 2001; van Eemeren, Grootendorst, & Kruiger, 1987). In addition, when participants in an argument revise their original statements to integrate multiple perspectives of an issue in the course of discussion, it cannot be easily coded with Toulmin's model. Third, Toulmin's model does not provide any criteria for judging the quality of an argument, as he left this to experts in the relevant field. Fourth, Toulmin's model presents an argument in a decontextualized way (Driver, et al., 2000). In his scheme, there is no consideration of the context in which argumentation is made or the linguistic and situational factors likely to influence it (Driver, et al., 2000).

According to Blair and Johnson (1987), a good dialectical argument should satisfy the following criteria: 1) "acceptability", 2) "relevance", and 3) "sufficiency". The first criterion concerns the acceptability of the premises in an argument by the interlocutors. The second and third criteria concern the relationship between the premises and the conclusion of an argument: are the premises relevant to and providing sufficient support for the conclusion?

Later, Kuhn (1991), who proposed a definition of thinking as a form of "formulating and weighing the arguments for and against a course of action, a point of view, or a solution to a problem" (p. 2), provided five skills essential for the formulation of a persuasive argument. These skills are named as the following abilities: 1) to

generate causal theories to support claims, 2) to offer evidence to support theories, 3) to generate alternative theories, 4) to envision conditions that would undermine the theories they hold, and 5) to rebut alternative theories. According to her, an argument can be considered a strong argument if it has all these components. Recently, Munneke, Andriessen, Kanselaar, and Kirschner (2007) analyzed the breadth and depth of interactive argumentation based on Kuhn's skills of argument.

To date, no systematic tools of analysis have been developed to analyze argumentation which take into account both the cognitive and social dimensions of argumentation. However, several studies of peer-led discussions show that argumentation should be understood by approaches which explicitly recognize the significance of each of these crucial domains (e.g. Alexopoulou & Driver, 1996; Hogan, et al., 2000; Jeong, 2006; Keefer, et al., 2000; Steinkuehler, 2001).

## Interactive Argumentation

It is only relatively recently that interest has surged in the interactive aspects of argumentation, in particular with relation to the social construction of knowledge (e.g. Keefer, et al., 2000; Nussbaum, 2005; Nussbaum, et al., 2007). The underlying premises of this approach are twofold: a) argumentation is fundamentally a social activity, and b) the way in which people engage in argumentation affects what they learn. Further, several studies on interactive argumentation have shed light on the importance of social relations in understanding the development of argumentation (e.g. Alexopoulou & Driver, 1996; Hogan, et al., 2000; Keefer, et al., 2000; Steinkuehler, 2001).

To avoid any misunderstanding, hereafter an 'argument' will be used to mean a meaningful expression and a reasoned utterance and 'argumentation' will be used to indicate a chain of arguments, a dialogue (Andriessen, Baker, et al., 2003a).

## *Theoretical Perspectives on the Use of Interactive Argumentation for Promoting Individual Reasoning*

Both socio-cognitive and socio-cultural perspectives support the claim that students' reasoning can be promoted from engaging in peer-led argumentation. Piagetians hold that cognitive conflicts generated during social interaction with peers stimulate cognitive development (Bell, Grossen, & Perret-Clermont, 1985; Johnson & Johnson, 2004; Koschmann, 2003). That is, people learn from one another because "cognitive conflicts will arise, inadequate reasoning will be exposed, disequilibrium will occur, and higher-quality understandings will emerge" (Slavin, 1996, p. 49) during discussions. By resolving conflicts through argumentation, students might be able to improve or reconstruct their initial ideas and to deepen their understanding on a topic. Therefore, the design goal for interaction becomes making disagreements visible (Baker, 2003; Koschmann, 2003).

Vygotsky (1981) also supports the use of interactive argumentation for individual learning. He contends that "the higher functions of child thought first appear in the collective life of children in the form of argumentation and only then develop into reflection for the individual child" (Vygotsky, 1981, p. 157). In his view, argumentative interaction with peers promotes learning because within their peer group, children are likely to "be operating within one another's proximal zones of development, modeling in

the collaborative group behaviors more advanced than those they could perform as individuals" (Slavin, 1996, p. 48). Discussions stimulate people to articulate their own thinking, expose them to alternative perspectives, and create situations in which participants need to deal with conflicting opinions (Reznitskaya, et al., 2001). In this view, each individual serves as an advanced learner to the others, asking critical questions, challenging competing viewpoints, and providing valuable explanations. Through this interactive process, participants in argumentation might collectively engage in advanced behaviors which some, if not all, members of the group might have been incapable of performing alone, which become internalized to be used later without any support, a process which Vygotsky calls "Zone of Proximal Development" (Kuhn, et al., 1997). Cognitive and social competencies performed by advanced peers may also be appropriated by other participants as well (Reznitskaya, et al., 2001). In this view, therefore, the design goal for argumentative interaction is to scaffold advanced collaborative and argumentative behaviors which can be appropriated by learners so that they can use them in different contexts without external support.

From socio-cultural perspectives, argumentation itself is a learning process of social construction of knowledge that meets "socially determined standards of cogency (Goldman, 1999; Vorobej, 2006) and evidence (Toulmin, 1958)" (as cited in Nussbaum, et al., 2007, p. 480).

### *Definitions of Interactive Argumentation*

Chinn and Anderson (1998) use the term *interactive argumentation* to refer to "discussions in which participants present reasons and evidence for different positions"

(p.317). Baker (2003) describes argumentation as "a cooperative exploration of a dialogical space" (p. 49) and operationally defines argumentation as "a process that is oriented towards deciding what statement(s) should be jointly accepted, or not, by linking those statements to others [called (counter-)arguments], and thereby transforming the degrees of acceptability of the statements under discussion (theses)" (Baker, Andriessen, Lund, Amelsvoort, & Quignard, 2007, p. 317). Nussbaum, Winsor, Aqui, and Poliquin (Nussbaum, et al., 2007) define collaborative argumentation "as students working together to construct and critique arguments" (p. 480).

All these views share the idea that argumentation is the backbone of the social construction of knowledge. Leitão (2000) argues that the process of resolving the conflict among differing views leads to the transformation and reconstruction of knowledge. Similarly, Veerman (2003) contends that argumentation is "an important mechanism for fruitful discussions and the production of constructive activities" (p. 118).

Since argumentative activities and situations are surprisingly complex and varied (Andriessen, Baker, et al., 2003a), there is a need to specify what is meant by interactive argumentation in this study. The present study regards interactive argumentation as follows:

> *Interactive argumentation is a special form of discussion. It begins with a mutual awareness of the existence of conflicting ideas among participants and their willingness to resolve the conflict. Interactive argumentation enables participants to deepen their understanding of divergent viewpoints through the process of supporting, challenging, elaborating, and evaluating various arguments, and may lead them to find a solution that all parties accept.*

### *Research on Interactive Argumentation*

In general, research shows a variety of positive effects of peer-led argumentation on individual learning: a) fostering conceptual understanding (e.g. Teichert & Stacy, 2002; Zohar & Nemet, 2002), b) improving individual problem-solving abilities (e.g. Burnett, 1993; Heller, et al., 1992), c) enhancing argumentation strategies (e.g. Anderson, et al., 2001; Zohar & Nemet, 2002), d) improving individual reasoning abilities (e.g. Alexopoulou & Driver, 1996; Kuhn, et al., 1997; Reznitskaya, et al., 2001; Wegerif, et al., 1999), e) fostering conceptual change (e.g. Nussbaum & Sinatra, 2003; Schwarz, et al., 2000), and f) increasing the ability to write one's own conclusion (e.g. Chinn, et al., 2000). For example, Reznitskaya et al. (2001) found that fourth and fifth grade students who participated in oral discussions with the support of a teacher included more relevant arguments, counterarguments, and rebuttals in their persuasive essays. Similar results were found with other age groups. Kuhn, Shaw, and Felton (1997) reported that participation in a series of peer-led dyadic discussions led both early adolescents and young adults to be aware of the coexistence of multiple views and to build a complex argument by incorporating alternatives.

However, there is also considerable evidence that peer-led discussions do not always result in desired learning outcomes because those discussions may lack in quality (e.g. Chan, 2001; Chinn, et al., 2000; Keefer, et al., 2000). For example, Keefer, Zeitz, and Resnick (2000) found that students engaging in verbal sparring and using tricky arguments made a vigorous effort to prove their points of view and failed to expand their understanding of the topic. Similar findings were also found in the preliminary study conducted by Steinkuehler (2001). In her study, five preservice teachers sometimes

focused exclusively on the process of defending one's own positions, an approach which failed to advance ideas or stimulate new thinking about the topics under discussion (Steinkuehler, 2001).

In fact, quality of argumentation has been shown to have a profound impact on the quality of the learning process itself. Chinn, O'Donnell, and Jink (2000) evaluated the quality of a peer-led discussion on the basis of its relative complexity, and demonstrated the positive relationship between the complexity of discussions and individual learning. Specifically, they quantified the quality of discussions by assigning a score from 0 to 6 depending on the relative complexity of each discussion. In their view, a discussion is more complex if it is extended with more reasons, rebuttals, and counterarguments. Using a series of partial correlations between various measures of the quality of peer-led discussion and students' post-discussion conclusion scores, they demonstrated that "students learn more when they engage in complex argumentation, adding to and rebutting reasons and evidence given by others" (Chinn, et al., 2000, p. 93). Furthermore, several studies showed that the quality of argumentation is not only related to the complexity of argumentation, but also to its content. For example, Keefer et al. (2000) found that 'position-driven eristic discussions' (similar to adversarial discussions) were often complex and exhibited plenty of skillful arguments and challenges, but typically did not lead to the expansion of students' understanding of the topic. They concluded that 'issue-driven critical discussions' (similar to co-constructive critical discussions) were the most productive form of discussion for expanding students' understanding of a topic, and defined such discussions as a type of dialogue where "the participants are more willing to produce and concede to arguments that do not align with positions they

previously defended" (Keefer et al., 2000, p. 71). In issue-driven critical discussions, students voluntarily conceded in the face of persuasive arguments made by others, willingly extended others' persuasive arguments, and quickly recognized when they needed to look for external support (Keefer, et al., 2000). Similar findings were also found in other studies focusing on social argumentation (e.g. Alexopoulou & Driver, 1996; Steinkuehler, 2001).

Why, then, do people tend not to engage in quality argumentation? First, people may lack the proper skills. For example, only a few subjects in Kuhn's study (1991) were able to generate coherent theories, alternative theories, counterarguments, and rebuttals. In another study, Felton and Kuhn (2001) found that young adolescents, during a debate with peers on capital punishment, were less able to use effective strategies to deal with counterarguments than some adults, who effectively weakened their partner's argument by requesting interpretation and clarifications, and then offering critiques of these. In addition, young adolescents often failed to rebut others' challenges effectively in order to defend their positions. In a recent study by Stegmann et al. (2007), even college-level students often failed to support their claims with adequate grounds and to construct counterarguments on their own. Further, some people may not know how to socially negotiate meanings via argumentation. For example, Steinkuehler (2002) observed that two online participants engaged in discussion using different conversational styles. One collaborator in a dyad clearly attempted to build and maintain rapport and a shared interpersonal space by using a dialogic language style, which included acknowledging the partner's contributions, referencing shared experience, and inviting the partner's viewpoints, whereas the other student maintained a social distance by using a more

contentious conversational style, characterized by referencing "I" versus "You" rather than "we", and by ignoring or rejecting the partner's viewpoints or contributions.

Second, people may not like to engage in an argumentative discourse. Studies on individual differences show that certain characteristics of individuals affect their tendency to argue. For example, assertiveness, epistemological beliefs, need for cognition, and openness to ideas have been shown to affect students' disposition to argue (e.g. Infante & Rancer, 1982; Nussbaum, 2002; Nussbaum & Bendixen, 2003). Nussbaum and Jacobson (2004) concluded that shy students may need social support and a feeling of safety before actively participating in argumentation.

Third, people may be reluctant to disagree with one another or adopt and advocate a position due to social or other reasons. For example, a study by Andriessen et al. (2003) found that participation in argumentation was rare for many students, and that these students expressed indifference as to the content of argumentative discussion in the classroom. One plausible explanation they provided for this finding is that students might pretend to agree most of time in order to avoid conflict. Finding similar behavior, Baker (1999) offered the interpretation that agreement on a solution to a problem between a pair of students did not necessarily indicate the resolution of conflict through a process of argumentation, but rather that students often accepted the solution arrived at merely for the sake of the assignment.

Students may have fear of losing face during argumentation or feel afraid of challenging dominant persons (Nussbaum & Jacobson, 2004). Disagreement may be misinterpreted as a hostile act (Nussbaum, et al., 2007). For example, through in-depth interviews with adult learners, Rourke and Kanuka (2007) found that some online

participants interpreted "differing opinions as win-lose competitions, not as opportunities for higher-order learning" (p. 118) and perceived "critiques as personal attacks (p. 105)." According to Alexopoulou and Driver (1996), an individual's schema as to how group interaction operates affects their subsequent behavior. Students who view group interaction as more collaborative than competitive are typically more open about their views and more willing to negotiate meaning.

Fourth, certain social and contextual factors may affect individuals' subsequent behavior or even their disposition to argue. Keefer et al. (2000) found that in the case of eristic argumentation, students often put more effort in defending their own arguments without seriously considering the challenges of others. On the other hand, in the case of issue-driven argumentation, students both voluntarily conceded their previous positions when presented with stronger arguments made by others and willingly elaborated upon others' arguments. Similar findings were also found in the preliminary study conducted by Steinkuehler (2001). In a study involving preservice teachers underdoing teacher training, he found that several behaviors were detrimental to the process of argumentation for the purpose of furthering or modifying one's ideas. These behaviors were: 1) lack of acknowledgement of other members' contributions, 2) the use of tricky questions or arguments, 3) negative reaction to the inconsistency of other members' claims, and 4) wording implying authority.

## *Conditions for Productive Argumentation for the Social Construction of Knowledge*

In light of the myriad examples of behaviors which lead to argumentation which might be described as "conflict without learning," what kind of interactive argumentation can be identified as being productive? The answer to this question is not easy. When we view argumentation as a means of promoting students' understanding of divergent views on a controversial issue and further encouraging students to integrate divergent views, co-constructive critical argumentation can be described as productive, in contrast with competitive argumentation. In competitive argumentation[2], advancing one's own argument is what matters, rather than exploring multiple perspectives towards the co-construction of knowledge (Nussbaum, et al., 2007). In co-constructive argumentation, on the other hand, what is valued is the exploration of diverse opinions and the building of one's own argument by way of the support of others (e.g. Keefer, et al., 2000; Nussbaum, 2005). Several studies have found that competitive argumentation often turns adversarial. In the context of adversarial argumentation, students often used tricky arguments for the purpose of "demolishing" the other party, and were solely interested in advancing their own argument to the exclusion of furthering ideas (e.g. Keefer, et al., 2000; Steinkuehler, 2001). Rather than making a concession to the opposing side, students in a debate were more likely to restate or slightly revise their original arguments (Nussbaum, 2005). In contrast, students in co-constructive, critical argumentation

[2] Competitive argumentation is different from adversarial argumentation, in which people engage in disturbing behaviors to win an argument (e.g. sarcastic remarks, verbal sparring, impatience, etc.)

contexts seriously considered others' challenges and conceded their previous positions when faced with a stronger argument made by the other party (Keefer, et al., 2000).

The question then becomes when and how such co-constructive, critical argumentation occurs. First of all, argumentation begins with divergent opinions. Therefore, the topic of discussion should be controversial enough to engender diverse perspectives among students. If there are no conflicting views, there will be no need for argumentation. Baker (2003) argues that the driving force behind collaborative sense-making is *interpersonal and interactive pressure.* That is, the necessity of dealing with conflicts contributes to the co-elaboration of knowledge and understanding. When participants notice disagreement on an issue, they are likely to engage in argumentative dialogue in order to persuade others by extending a line of reasoning to support their own positions or challenge the other party's positions. Many scholars have advocated counterargument as a critical component of promoting good argumentation (e.g. Andriessen, Baker, et al., 2003a; Erkens, et al., 2003; Järvelä & Häkkinen, 2003; Nussbaum, et al., 2004; Nussbaum & Schraw, 2007; Nussbaum, et al., 2007; Oshima & Oshima, 2002; van Eemeren, et al., 1996) because counterarguments provide grounds for examining one's opinions (Leitão, 2000; Nussbaum & Kardash, 2005). Framing one's argument within alternative viewpoints enhances the persuasiveness of one's argument (Kuhn, et al., 1997; O'Keefe, 1999). For these reasons, many scholars argue for making disagreement visible (Baker, 2003; Koschmann, 2003) or explicitly requiring students to explore alternative ideas (Nussbaum, et al., 2007). For example, Nussbaum et al. (2007) found that students more actively integrated diverse views and changed their initial views

when they were required to engage both sides of an issue and develop an integrated conclusion.

If participants ignore alternative opinions, however, or are not willing to explore them for any of the reasons previously mentioned (Alexopoulou & Driver, 1996; Chan, 2001; Nussbaum & Bendixen, 2003; Nussbaum & Jacobson, 2004; Rourke & Kanuka, 2007; e.g. Steinkuehler, 2002), no productive argumentation will occur. Alexopoulou and Driver (1996) support this view by asserting that in pursuit of the goal of fruitful discussion, students' willingness to argue is even more significant than equal participation. Erkens, Andriessen, and Peters (2003) found that students' willingness to disagree was positively related to their collaborative performance in solving a puzzle. Indeed, productive argumentation requires students not just to present one's own arguments, but to elaborate, critique, and connect diverse ideas as part of a process of conflict resolution (Chinn, 2006; Hoadley, 2000; Nussbaum, et al., 2007). Moreover, the quality of these activities does not depend solely on students' willingness to deal with conflicts, but also on the way in which they deal with them. For example, if a person simply ignores a challenge made by the other party or responds to the challenge with another pointless counter-challenge, there will be no progress in the furthering of ideas (e.g. Keefer, et al., 2000; Steinkuehler, 2001).

What, then, are the conditions which foster student openness to diverse opinions and a willingness both make criticisms and find connections between ideas? Co-constructive critical argumentation necessitates a supportive atmosphere, which includes crucial elements such as acknowledging contributions and engaging with one another's ideas. For example, Jeong (2006) found that online messages including socio-emotionally

supportive language (e.g. name referencing, signatures, questions, and I-agree-buts) elicited more responses from peers. He interpreted this finding by suggesting that messages equipped with socio-emotionally supportive language might convey to interlocutors the impression that the author of the message was more open to opposing opinions, and encourage them to respond to the challenges made to their argument. Additionally, Hogan et al. (2000) found that unfavorable behaviors such as sarcasm, joking, and failure to acknowledge others' contributions were prevalent in unproductive group discussions. Similarly, Keefer et al. (2000) and Steinkuehler (2001) found verbal sparring and tricky arguments to be characteristic of eristic (adversarial) discussions.

## Computer-Supported Collaborative Argumentation

Many scholars have made the case for the potential of computer-mediated communication (CMC) for learning, and have urged the design of computer-supported collaborative environments conducive to fostering fruitful peer argumentation. For example, Veerman (2003) has argued for the potential of computer-mediated communication (CMC) for interactive argumentation, saying that "text-based and time-delayed communication can be beneficial to keep track and keep an overview of complex questions or problems under discussion. Text-based discussion is by necessity explicit and articulated" (p. 119). Baker (2003) further argues that computer-supported collaborative argumentation (CSCA) environments "can play an important role in such learning to the extent that they enable task sequences and interpersonal communication media to be structured in ways that favour the co-elaboration of knowledge" (p. 47).

It is thus not surprising that many CSCL environments have been developed in an attempt to facilitate interactive peer argumentation. Scardamalia and colleagues (Scardamalia & Bereiter, 1991, 1992, 1993, 1993-1994, 1996; Scardamalia, et al., 1994; Scardamalia, et al., 1987; Scardamalia, et al., 1984) are among the leaders in this effort. They developed the Computer-Supported Intentional Learning Environment (CSILE) software program. The main feature of CSILE is the use of note starters to support students' knowledge-building activities. Examples of note starters for fifth and sixth graders include "One thing I didn't understand is…" and "I'd find it helpful if I knew…" (Scardamalia & Bereiter, 1991). The main purpose of these note starters was to guide children to generate constructive comments.

Since then, many CSCL environments have been developed to support argumentative interaction among students in various ways (e.g. scripting the process of a task, providing representational tools, guiding the interaction with note starters, visualizing cognitive conflicts, etc.). The following section provides description of the most well-known CSCA environments.

## *Examples of Computer-Supported Collaborative Learning Environments for Promoting the Quality of Interactive Argumentation*

### *Belvedere.*

Belvedere[3], originally developed by the Learning and Resource Development Center at the University of Pittsburgh, and further developed by the Laboratory for Interactive Learning Technologies, is a networked environment. Belvedere supports

[3] For the Belvedere interface, see http://lilt.ics.hawaii.edu/lilt/software/belvedere/.

participants in the process of collaborative inquiry on scientific problems by enabling them to construct an inquiry diagram (evidence map) using shapes and links. For example, learners can build an inquiry diagram by typing statements into a text box, by clicking on the proper shape button ('Data', 'Hypothesis') to add them to the window, and then by linking them using link buttons ('+ : Add For Link', '- : Add Against Link', '? : Add Non-Link'). In addition, Belvedere 4.1 provides multiple representational views by converting the inquiry diagrams into graphs (simple model and concept map) and a table (matrix).

Imagine, for example, that you are a science teacher. You want students to learn critical inquiry skills for solving scientific problems such as the reasons for the decline in frog population. For this, you can ask students, individually or in a group, to construct an inquiry diagram using the Belvedere software, in which they can relate their hypotheses to the data they gathered for the problem.

The rationale for using a constraint-based representational guidance like Belvedere for collaborative inquiry is that Belvedere supports the process of a collaborative inquiry by forcing users to stay focused on a task by helping them articulate and reflect on one's ideas during the process of creating a graph with others. In particular, Belvedere constrains the nature of students' collaborative inquiry by pre-classifying actions involved in the collaborative inquiry and by requiring them to determine their contribution to the collaborative inquiry beforehand (Cho & Jonassen, 2002). For example, let's assume that a user wants to add a statement, 'the temperature increased last year', to a graph. To do that, the user should determine the nature of the statement and its

relationship to other statements already displayed in the graph before adding it to the graph.

Cho and Jonassen (2002) studied the effects of argumentation scaffolds using Belvedere on argumentation building and problem solving. The Belvedere software they used provided four shapes ('hypothesis,' 'data,' 'principles,' and 'unspecified') and three links ('for,' 'against,' and 'and') for constraining argumentation (Cho & Jonassen, 2002). They demonstrated that college students using Belvedere generated more claims, and provided more grounds in supporting those claims, than students using a typical bulletin board system when solving problems. But the scaffolds using Belvedere did not promote students' use of backing, rebuttals, and warrants. They argued that this was because claims and grounds are the primary elements in argument construction, while warrants, backings, and rebuttals are secondary. That is, students focused more on primary elements when constructing solutions to problems (Cho & Jonassen, 2002).

### *CONNECT.*

CONNECT (Baker, Quignard, Lund, & Séjourné, 2003; de Vries, et al., 2002) is a CSCL environment designed for promoting argumentative communication, specifically on "the conceptual foundations of problem solving" (Baker, 2003). It involves three sequential tasks: 1) individual preparations (Phase 0), 2) a discussion of individual interpretations using CONNECT (Phase 1) and 3) a joint construction of text using CONNECT (Phase 2). An important element of the CONNECT environment is that dyads for Phase 1 were created in ways which maximize the chances for students to have differing conceptual models (de Vries, et al., 2002).

CONNECT[4] is like a window which has two separate panes. The upper pane is used for text-based synchronous communication, and the bottom pane is used for a task. Communication interface consists of eight pre-defined communication buttons ("Yes", "No", "Ok?", "I don't agree", "I'll do it", "You do it", "Hello?", "Are we done?"). A user can open a chat box by clicking on the text balloon, and send typed messages by clicking on any one of the pre-defined communication buttons (de Vries, et al., 2002). The task interface for Phase 1 consists of individual student texts, choice buttons for expressing opinions on each text, and instructional labels (de Vries, et al., 2002). One can express his or her opinions on both one's owns and one's partner's sentences by clicking one of the pre-defined opinion buttons ("Yes", "No", "?"), and then one of four instructional labels ("discuss", "verify", "to be seen", "explain") will be displayed next to each sentence indicating what needs to be done (de Vries, et al., 2002). The task interface for Phase 2 consists of sentences generated by each student and a common text area. Students can jointly write texts by copying and pasting sentences into the common text area and by directly changing text in the common text area.

In the study by de Vries et al. (2002), high school students were introduced to the particle model of sound and were required to explain a new two-tambourine situation (Phase 0). Their initial interpretation of the two-tambourine situation was displayed as a list of seven sentences on the bottom panel of the CONNECT display. Students were required to judge each text by choosing one of the choice buttons (i.e. Yes, No, ?), and to co-construct mutual understanding of the two-tambourine situation by examining each text (Phase 1). Then, they jointly constructed text to explain the tambourine situation

[4] For the CONNECT interface, refer to the Figure 2 (p. 54) in Baker (2003) or Figure 3 (p. 75) in de Vries, et al., 2002).

based on their previous discussion (Phase 2). On the basis of qualitative and quantitative analyses of discussions of six dyads, de Vries, Lund, and Baker (2002) reported that five out of six dyads noticed the conceptual differences between their opinions but rarely expressed disagreements during Phase 1. Only some discussed the differences when they wrote a common text in Phase 2 (de Vries, et al., 2002). de Vries et al. attributed the lack of epistemic dialogue to the great conditions for such dialogue. Epistemic discourse requires students' conceptions to be sufficiently elaborated, so that they are willing to ask for or give an explanation, and to engage in argumentation (de Vries, et al., 2002). They argue that it does not make to expect students to simultaneously develop and defend an idea or position. Another explanation given by them is that students might avoid disagreeing with each other intentionally in order to avoid a social conflict. Lastly, they suspected, students might not have "sufficient understanding of, and practice in, argumentation and explanation" (p. 99).

### *Constraint-based discussion boards.*

In contrast to generic threaded discussion boards (e.g., bulletin board systems) which organize a discussion around topics and subtopics, constraint-based discussion boards scaffold a discussion by pre-structuring it (Jonassen & Remidez, 2002). A core assumption of constraint-based discussion is that processes of argumentation can be facilitated by predefined message types and constrained relationships between those message types (Jonassen & Remidez, 2002). Examples of constraint-discussion boards are Shadow netWorkspace (Jonassen & Remidez, 2002) and FLE3 (Oh & Jonassen, 2007).

To date, there is only limited research on the effects of the use of constraint-based discussion boards on discussions and individual learning. Recently, Oh and Jonassen (2007) investigated the effects of constraint-based argumentation scaffolds on ill-structured problem solving and argumentation building, while pre-service teachers solved ill-structured diagnosis-solution problems together. The authors defined diagnosis-solution problems as being ill-structured, having "vaguely defined or unclear goals and unstated constraints" (Oh & Jonassen, 2007, p. 1). Due to such characteristics of ill-structured problems, students in Oh and Jonassen's study were required "to build problem space, generate multiple hypotheses, and represent personal arguments to justify their solutions" (Oh & Jonassen, 2007, p. 12). Constraint-based argumentation scaffolding[5] was embedded into FLE3, an online conferencing system. Oh and Jonassen (2007) designed FLE3 to support an online problem solving activity with pre-defined message types and note starters. Student interaction was constrained by six message types: hypothesize cause, solution generation, verification, rebuttal, evidence, and elaboration. Examples of note starters include "The problem is caused by" for the hypothesis message type and "My experience is…" for the evidence message type. They found that students under constraint-based argumentation scaffolding conditions posted more evidence messages than students operating free of scaffolding constraints. However, students under scaffolding conditions performed no better in generating verification and rebuttal messages than their counterparts.

[5] For the constraint-based argumentation scaffolding tool interface embedded in FLE3, refer to the Figure 2, 3 (p. 7), and 4 (p. 8) in Oh and Jonassen (2007).

*CSCL environment with epistemic and social scripts.*

Recently, Weinberger and his colleagues (2005) developed two separate prompt-based collaboration scripts: one specifies how learners approach the analysis of a given case (epistemic scripts) and the other specifies how they interact with one another while engaging in collaborative argumentation (social scripts). These scripts are available in learners' input boxes, pre-structuring their input messages. The epistemic scripts aimed at facilitating learners' application of theoretical concepts to the given problem cases (Weinberger et al., 2005). Epistemic scripts, specifically, were designed to support learners to identify relevant and irrelevant case information for the application of a theory to a case, and to guide their application of the theory to the case. The scripts also supported them in predicting the consequences of the case. Examples of epistemic scripts include "case information, which can be explained with the attribution theory" (p. 14) and "does a success or a failure precede this attribution?" (p. 14) (Weinberger et al., 2005). Social scripts, on the other hand, were designed to foster the elaboration and critical negotiation of meanings (Weinberger et al., 2005). Examples of social scripts include "these aspects are not yet clear to me" (p. 14) for the constructive critic role and "regarding the desire for clarity" (p. 14) for the case analyst role (Weinberger et al., 2005). For example, the prompts for the case analyst role (e.g., "Regarding our difference of opinions") were automatically inserted into the analyst's messages when the analyst replied to his or her learning partner's messages. Using two by two randomized factorial design (factors: epistemic and social scripts), Weinberger et al. (2005) examined the effects of prompts-based collaboration scripts on the individual acquisition of knowledge. They found a positive connection between use of social scripts and the individual

acquisition of knowledge, but negative connection between use of epistemic scripts and the individual acquisition of knowledge. Contrary to expectation, learners seem to use epistemic scripts as a checklist, which may limit processes of their reflective thinking.

### *KIE (knowledge integration environment).*

Knowledge Integration Environment (Bell & Linn, 2000) is a scaffolded computer-supported curriculum that supports students' knowledge integration via collaborative inquiry and classroom debate. In the study by Bell and Linn (2000), prior to engaging in classroom debate, student pairs developed arguments for two conflicting theoretical positions about the nature of light by connecting individual pieces of evidence to either position with the help of SenseMaker and Mildred. SenseMaker[6] allowed a group of students to visually construct their arguments by grouping and framing evidence into claims and supported them in communicating their differing ideas as they build their arguments (Bell & Linn, 2000). Mildred[7] provided students with note starters and hints. Note starters scaffolded their explanations with evidence, and hints encouraged students to provide more detailed explanations of their evidence-based arguments.

Using the pre- and post-test method, Bell and Linn (2000) found that almost half the students who participated in KIE acquired a more robust understanding of the processes of light propagation. By analyzing the types of arguments students generated using SenseMaker and Mildred, they showed that students using the KIE integrated knowledge in more meaningful ways. For example, many students supported their

[6] For the SenseMaker software interface, refer to Figure 1 (p. 799) in Bell and Linn (2000).
[7] For the Mildred guidance and note-taking component interface, refer to Figure 2 (p. 801) in Bell and Linn (2000).

explanation of new evidence with warrants. Over 70% of explanations included single (47.6%) or multiple warrants (22.9%). In addition, students using the KIE included more unique and conceptual ideas in constructing their arguments (Bell & Linn, 2000).

### *Online AVD (argumentation vee diagram) environment.*

To promote students' balanced consideration of arguments and counterarguments regarding controversial issues, Nussbaum and colleagues (Nussbaum & Schraw, 2007; Nussbaum, et al., 2007) developed the *Argumentation Vee Diagram*[8]. AVD is a table-based template. A question for discussion is given at the top of the AVD. Two empty columns, right below the question, are assigned to arguments and counterarguments, respectively. According to them, the 'V' shaped arrows at the bottom of the columns force students to integrate arguments and counterarguments. To scaffold students to effectively evaluate the relative strength of arguments, specific questions are given for guidance at the bottom of the AVD.

Nussbaum et al. (2007) implemented the AVD for use in a distance course. To maximize the effect of the AVD on collaborative argumentation, activities were specified and sequenced into three steps. First, students filled out the AVDs individually as a preparation for the group discussion. Next, three to five students participated in group discussion using threaded discussion boards. Lastly, students developed the group AVD using *wiki* technology on the basis of their group discussions; they took on specific roles as composer, elaborator, and integrator and rotated these roles. They found that students who followed the AVD procedure integrated more arguments and counterarguments than

[8] For the Argumentation Vee Diagram, refer to Figure 1 (p. 484) in Nussbaum et al. (2007).

students who did not (Nussbaum, et al., 2007). In particular, the AVD group made significantly more compromises for *arguments-counterargument integration* than the control group ($z = 2.33$, $p < .05$, $\beta = 0.29$) (Nussbaum, et al., 2007). Using a multilevel logistic model, Nussbaum et al. (2007) showed the positive connection between compromises and opinion change. Of students who compromised arguments and counterarguments, 27.5% changed their opinion during a discussion, whereas 8.3% of those who did not (Nussbaum, et al., 2007). This result indicates a correlation between integration of arguments-counterarguments, in particular compromises, and opinion change (Nussbaum, et al., 2007).

### *Summary.*

Most studies focusing on CSCA technologies for interactive argumentation have suggested positive effects of CSCA technologies on interactive argumentation and individual learning to a certain extent. For example, both Cho and Jonassen (2002) and Oh and Jonassen (2007) found that students gathered a greater amount of evidence in support of their arguments, when their argumentation was scaffolded by technologies. However, there is also considerable evidence that students in CSCA environments were still reluctant to disagree with others' opinions (e.g. Cho & Jonassen, 2002; de Vries, et al., 2002; Oh & Jonassen, 2007).

So far, most CSCA studies have focused exclusively on the provision of cognitive support (Kreijns, et al., 2003; Wegerif, 1998) either by providing representational tools, by constraining cognitive aspects of conversation, or by supporting cognition with prompts. According to Kreijns et al. (2003), current educational interventions for CSCL

often tend to restrict interaction to the cognitive plane ("tightly related to the collaborative execution of learning tasks") (p. 341), utterly ignoring interactions on the social plane of online interaction. As they argue, instructional support for the social dimension of online interaction is very limited in the current design of the CSCA environment. For example, even though representational tools provide cognitive guidance for argumentation beyond the affordance of plain text (Suthers & Hundhausen, 2003) and serve as a shared group knowledge and product, those tools hardly support the social dimension of interactive argumentation because they do not scaffold how people interact with one another while engaging in interactive argumentation. Also, current constraint-based discussion boards have not been designed in ways to support interpersonal interaction.

### *The Role of the Social Dimension in Computer-Supported Collaborative Learning*

The social dimension of interaction is important because it effectively determines whether people willingly engage in collaborative argumentative interaction. According to Kreijns et al. (2003), this dimension relates to "processes that have to do with getting to know each other, committing to social relationships, developing trust and belonging, and building a sense of on-line community" (p. 342). Stacey (2002) ascertains that "in eight years of researching and teaching online, the social dimension of online interaction provides the basis of establishing an environment of trust and motivation for effective learning" (p. 138). Similarly, Garrison et al. (2000) contend that social presence is of necessity because it nurtures a trustful and comfortable environment for collaboration.

Rouke (2000) supports the above arguments by saying that students may not willingly critique their peers' ideas and may take others' critiques as a personal offense unless they feel close to them, and sense warmth, belonging, and mutual trust. Wegerif (1998) also argues for the crucial role of the social dimension by arguing that these kinds of feeling towards their fellows underlie collaborative learning. Considering the importance of social experiences in influencing how people behave and what they learn, CSCA should be designed in ways that facilitate both cognitive and social dimensions of argumentation.

## Strategies for Nurturing a Supportive Environment

Studies on computer-mediated communication have shown that online participants use several conversational strategies to reduce interpersonal distance and sustain and increase interaction, and that the effective use of these strategies can result in greatly enhanced learning opportunities.

### *Studies on Social Presence in CSCL*

Research on social presence provides a way to promote social interaction and eventually cognitive performance. According to social presence researchers (Gunawardena, 1995; Gunawardena & Zittle, 1997; Kreijns, Kirschner, Jochems, & Buuren, 2004; Rourke, Anderson, Garrison, & Archer, 1999; Stacey, 2002; Tu & McIsaac, 2002, p. 94), the social presence tends to be low in online discussion due to the lack of social cues in text-based communication over the Internet, and this certainly has a detrimental effect on building a warm and trustful environment. Here, social presence

refers to the ability of participants "to project themselves socially and emotionally" (Garrison, et al., 2000, p. 94) and "the degree to which a person is perceived as "real" in mediated communication" (Gunawardena & Zittle, 1997, p. 8). In asynchronous learning networks, social presence is constructed through accumulated interactive messages over time. By way of a literature review on social presence, Gunawardena and Zittle (Gunawardena, 1995; Gunawardena & Zittle, 1997) conclude that online participants develop an ability to use emoticons and parenthetical metalinguistic cues (e.g., hummm, yuk) in order to compensate for the lack of non-verbal cues in written messages and to express their feelings. This indicates that social presence is incompatible with the nature of the medium itself, but can in fact be cultivated.

Gunawardena (1995) proposes several moderation strategies aiming at cultivating social presence in order to facilitate the social construction of knowledge. For example, online participants should have the chance to engage in social chit-chat. Additionally, a moderator could facilitate student interaction by providing protocols for instruction in the use of the system, and etiquette for CMC discussions, by recognizing all contributions, and by summarizing communications.

According to Garrison and her colleagues (Garrison, et al., 2000), social presence can be determined by the following three indicators: a) emotional expression, b) open communication, and c) group cohesion. Two examples of the emotional expression category include use of humor and self-disclosure. The use of humor tends to convey goodwill and to decrease social distance among members, and self-disclosure by way of sharing feelings, attitudes, and interests allows participants to form individuated impressions of others. Cutler provides evidence which suggests that trust and a sense of

belonging are more likely to be established when online participants disclose themselves (cited in Garrison, et al., 2000). As for the open communication category, mutual awareness and recognition of each other's contributions were provided as examples. Mutual awareness is created by replying to, quoting, and commenting on others' messages, all of which illustrate respect for others' contributions. Recognition indicates supportive behaviors such as explicit encouragement, agreement, and compliments on others' contributions. The third category, group cohesion, is an indicator of building and sustaining a sense of group commitment. Examples of this indicator are helping and supporting behaviors.

### *Studies on Conversational Language in Interactive Argumentation*

Studies on conversational language in computer-mediated communication show that online participants differ in their communication styles, and that the use of certain types of conversational language increases interpersonal interaction.

Through an analysis of 13 senior graduate students' communication styles using Transcript Analysis Tools, Fahy (2002) observed that the communication style of women was more in favor of interaction than that of men. In particular, women's online postings were friendlier, more encouraging, and personalized than men's postings, whereas the postings of men appeared to be less supportive. Fahy attributes the lack of responses to men's postings to this difference in communication style. In the follow-up study, Fahy (2003) found that online groups differed in the presence of supporting and connected behaviors. According to Fahy, supportive and connected behaviors include inviting and questioning, referencing statements, acknowledging, agreeing, expressions of

appreciation and apology, the use of etiquette-related devices (e.g. closings and signatures), and personalizing the discussion by use of greetings, emoticons, and humor.

Jeong's (2006) study supports previous findings (e.g. Fahy, 2002; Savicki, et al., 2002) on the positive effects of the use of such socio-emotional language on continuing communication. Specifically, he found that online messages including more socio-emotional language elicited more responses (e.g., more challenging replies to arguments and explanations in greater detail in response to challenging messages) in an asynchronous argumentation context. Posting an argument with a closing signature might make interlocutors perceive the author of the argument to be more personable, and thus motivate them to respond to it with a challenging argument (Jeong, 2006). Similarly, socio-emotional language (e.g., name referencing, signatures, questions, and I-agree-buts) in challenging messages might make interlocutors think that the author of the message is more open to opposing opinions and encourage them to respond to the challenges.

Similarly, Steinkuehler (2002) observed different conversational styles during argumentation. One student in a dyad clearly attempted to build and maintain rapport and a shared interpersonal space through the use of a dialogic language style, by acknowledging their partner's contributions, referencing shared experience, and inviting a partner's viewpoints, whereas the other student maintained social distance by using a more contentious conversational style, characterized by referencing "I" versus "You" as opposed to "we", and by ignoring or rejecting a partner's viewpoints or contributions. In another study, Steinkuehler (2001) observed the emergence of three different types of discussions (explanatory discussion, critical discussion, and eristic discussion) while a group of five pre-service teachers engaged in solving an instructional redesign problem

together. He identified three complementary activities that enabled students to converge on a discussion: 1) questioning, critiquing, and challenging previous claims and statements, 2) reasoning with one another until they reach sufficient explanation, and 3) jointly bridging the gaps found in the discussion. What these three complementary activities have in common is that they all involve connected discourse for the aim of gaining an understanding of an idea. He also identified four activities as detrimental to social construction of knowledge. Those detrimental activities include 1) lack of acknowledgement of other members' contributions, 2) the use of tricky questions or arguments, 3) negative reaction to perceived contradictory aspects of other members' arguments, and 4) wording implying authority. These findings are aligned with what Hogan et al. (2000) observed in their study of teacher- and peer-led discourses. They observed that the discourse was more sophisticated when participants "acknowledged, built, and elaborated on others' ideas" (p. 426).

It is not yet certain whether these argumentation strategies using conversational language will be appropriated by users, and whether this appropriation will affect the style of argumentation and individual understanding. Findings from social argumentation studies clearly indicate that co-constructive knowledge does not easily occur and the development and use of connected and supportive voice could be quite difficult for students, particularly in online environments, without any instructional support (Steinkuehler, 2002). Well-designed scaffolding strategies will help students manage socio-cognitive conflicts in a better way and thus result in desired learning outcomes.

## Prompts for Scaffolding Socio-Emotionally Enhanced Task-Oriented Interaction

Previous studies shed light on the importance of enhancing the quality of argumentation and nurturing a supportive learning environment in which students have no fear of expressing differences of opinion and are more willing to explore various perspectives. I am particularly interested in ways to enhance socio-emotionally supportive interaction, which is known to affect students' willingness to confront cognitive conflicts and to elicit more responses and thus may lead to fruitful argumentation for learning.

One promising way to promote connected critical argumentation in CSCL environments is to prompt students to do so. Prompts can take any form such as question-stems or note starters. To promote the quality of peer interaction, King and Rosenshine (King, 1989, 1990, 1991, 1992, 1994, 1997; King & Rosenshine, 1993) implemented the questioning strategy as a form of prompts with various age groups, and found that the use of the question-stems positively mediated learning in various learning contexts. Question-stems are a list of task-specific questions, from which students select and fill in the blanks (King, 1999). The purpose of question-stems is to guide students to generate critical thinking questions for eliciting more elaborated explanations from a partner (King, 1990). She argues that the types of questions posed affect discourse patterns. In her review paper, King (1999) discusses different discourse patterns for knowledge construction, problem solving, and peer tutoring, respectively, and provides lists of prompts for each discourse pattern. Examples of question-stems that are designed to stimulate discussions for shared knowledge construction are "What are the strengths and weakness of…?,"

"Why is … important?," and "what would happen if…?" (King, 1994). This questioning strategy was implemented in two separate studies (King, 1994; King & Rosenshine, 1993). In those studies, students were first trained to formulate explanations, and practiced doing so. They were then trained to generate critical questions with the help of the list of incomplete question stems. For problem solving, strategic questions were provided to guide students' cognitive and metacognitive activity while they are solving a problem (King, 1999). In order to help students solve a problem strategically, sets of questions were designed for each phase of a problem solving process (King, 1999). Examples of questions for guiding problem solving are "What is the problem?," "What is our goal now?," "What worked?," and so on (King, 1991). Later, King (1997) developed the ASK to THINK-TELL WHY model, in which peer tutors are required to ask tutees given questions in sequence in order to facilitate learning by helping tutees assess and consolidate their prior knowledge, construct new knowledge, and monitor their thinking processes (King, 1999). There are five different types of questions: review questions (e.g. "What does … mean?"), thinking questions (e.g., "What is the difference between … and …?"), probing questions (e.g., "Tell me more about …"), hint questions (e.g., "Have you thought about …?"), and metacognitive or monitoring questions (e.g., "What led you to that belief?") (King, 1999).

The results of a series of studies (King, 1989, 1990, 1991, 1992, 1994, 1997; King & Rosenshine, 1993) corroborate the conclusion that the guided questioning strategy promotes the quality of peer interaction and leads to heightened individual learning. For example, King (1990) found that college students generated significantly more critical thinking questions and explanations when they were guided by the question stems. In

another study with fifth graders, King (1991) found that students who had been trained in and practiced the reciprocal questioning and asking strategy, using the list of 11 strategic questions as a guide, outperformed students in both unguided and control conditions on both a novel stimulus design problem and a written problem-solving test. In particular, students under guided conditions generated more strategic questions and explanations while solving the novel problem than students in other conditions.

A number of CSCA environments have used prompts to guide task-oriented interactions and have found the positive effects of prompting strategies on learning. For example, Oh and Jonassen (2007) guided students' message inputs using note starters as a form of prompts (e.g., "What is the cause…?," "My experience is…," etc.). Another example can be found in Weinberger et al.'s study (2005). They used questions (e.g., "Does a success or failure precede this attribution?") as a form of epistemic prompt to facilitate students' approach to the learning task. They also used note starters (e.g., "Regarding the desire for clarity") as a form of social prompt to promote critical negotiation and elaboration.

To date, however, there has been no attempt to scaffold students to generate socio-emotionally enhanced task-oriented messages using prompts. This current study proposes prompts as an effective means to scaffold students to generate socio-emotionally enhanced task-oriented messages.

# CHAPTER III

# METHODOLOGY

## Research Design

### *Overview of Research Design*

A between-group experimental design was used to examine the effects of different levels of prompts in scaffolding argumentation on peer-led online argumentation building, the reasoning performance of individual students, and their feelings of group community. This method was selected because it is a means to determine whether independent variables caused changes in dependent variables when there were two or more groups to study (Creswell, 2005).

In this study the independent (treatment) variable was the different levels of prompts students received while they discussed a controversial topic in a dyad through role-playing. The three treatment conditions were: a) no prompts condition (a control condition), b) cognitive prompts condition (a comparison condition), and c) socio-cognitive prompts condition (an experimental condition). The details of the argumentation environments of the three conditions are discussed in the Treatment section of this chapter.

Prior to and immediately following the treatment, students submitted an opinion essay as an individual writing assignment. Students' feelings of group community were surveyed immediately following the dyadic discussion. Table 3.1 illustrates the research design.

Table 3.1

*Research Design*

| | | | | |
|---|---|---|---|---|
| **Control** | | | | |
| No prompts | $O_1$ | $X_1$ | $O_2$ | $O_3$ |
| **Treatment** | | | | |
| Cognitive prompts | $O_1$ | $X_2$ | $O_2$ | $O_3$ |
| Socio-cognitive prompts | $O_1$ | $X_3$ | $O_2$ | $O_3$ |

*Note.*
$O_1$: individual students' opinion essay on a controversial topic prior to the treatment (pretest)
$X_1$: dyadic discussion without any support of prompts
$X_2$: dyadic discussion with the support of cognitive prompts
$X_3$: dyadic discussion with the support of socio-cognitive prompts
$O_2$: individual students' opinion essay on the same controversial topic right after the treatment (posttest)
$O_3$: a questionnaire that measures individual students' feelings of group community

## *Threats to Validity*

The threat of a testing effect to internal validity was minimal in the study because the pretest and the posttest concerned their own reasoning (justification of their position) on a controversial issue. There was no right or wrong answer for this task. What mattered in the pretest and posttest was how well students justified their selected position.

In order to minimize the threat of selection bias to internal validity, participants were randomly assigned to different conditions in the experiment in order to equally distribute personal variables (extraneous variables) among conditions. However, random assignment does not guarantee full control of the personal characteristics of participants in the experiment. As such, personable variables potentially influential to outcome measures, such as argumentativeness and level of reasoning, were also obtained before the treatments to control them statistically (see Personal Profile Survey section, below).

## Context of the Study and Participants

The subjects of the current study were distance students enrolled in a fall, 2008 master's-level course at a state university located in the midwestern United States in the fall of 2008. The course, titled Technology to Enhance Learning (TEL), was an eight-week online course, which targeted new and experienced teachers across states. Blackboard, a classroom management system, was used as a platform for course materials distribution, course discussions, and assignment submissions.

An overarching goal of the TEL class was to help new and experienced teachers integrate technology into their own curriculums to facilitate meaningful learning (e.g. higher-order thinking, problem solving, etc.) for their own students. To achieve this goal, the instructor provided the course participants with opportunities to use several well-known educational technologies (e.g. concept maps) and to plan, develop, and self-assess a short technology-integrated lesson. Each week, the course participants were required to read a document called "the roadmap of the week," which provided an overview of learning goals, as well as weekly readings, to be discussed with peers, and responded to in writing.

There were two reasons for choosing the TEL class for this study. First, the TEL class was conducted entirely online. Students enrolled in the course from countries around the world. As a consequence, the communication mode of this course was by way of asynchronous, computer-mediated text. As prerequisites, students were required to have an adequate level of technical skills, including familiarity with asynchronous discussion boards. This study required students to engage in online argumentation.

Therefore, the success of the study depended on students coming to the class already equipped with basic online communication skills.

The other reason is that TEL aimed to expose teachers to educational technologies. The treatments of this study were computer-supported prompts which were designed to scaffold online argumentation in such a way as to induce students to generate more task-oriented and socio-emotionally enhanced messages. Computer-supported prompts can provide a good example of technology used for educational purposes.

Initially, forty-eight students out of a total of fifty-three enrolled in the TEL class voluntarily consented to participate in the study. Random assignment was used to equate the groups by equally distributing personal factors among the groups (Creswell, 2005). First, I randomly assigned the forty-eight students a number between one and forty-eight. Odd-numbered students were assigned the role of proponent in arguing the controversial issue, "Should the school monitor K-12 teachers' internet use in school?" (hereafter *Internet monitoring*), and even-numbered students were assigned to take the opposing view. Then, students were grouped into dyads in numbered pairs (students #1 and #2 are paired together, followed by #3 and #4, etc.). As a last step, each dyad was randomly assigned to one of three conditions (no prompts, cognitive prompts, and socio-cognitive prompts). Eight dyads were removed from the study because either one or both of the students in the dyad did not complete the work on time or completed the work incorrectly. Therefore, the final sample was thirty-two students. Demographic information and important characteristics of the final sample are described in the Participant Profiles section of Chapter 4.

## Data Sources, Instruments, and Analysis

### *Overview of Data Sources, Instruments, and Analysis*

To investigate the effects of prompts-based scaffolds on argument behaviors and performance, socio-emotionally enhanced behaviors, reasoning performance, and feelings of group community, data were collected from five different sources: a) participants' responses to the personal profile survey, b) participants' opinion essays prior to dyadic discussions, c) participants' messages posted to the online discussion boards, d) participants' opinion essays immediately following dyadic discussions, and e) participants' responses to the group community survey. Table 3.2 summarizes data sources and analysis methods for each research question.

Table 3.2

*Research Question, Data Source, Instruments and Data Analysis*

| Research Question | Data Source / Instruments / Data Analysis |
|---|---|
| **RQ1**<br>How does the use of prompts-based argumentation scaffolds affect students' socio-emotional behaviors while they engage in online dyadic argumentation about a controversial issue? | Source: Students' messages posted on online discussion boards<br><br>Instruments: Coding scheme for socio-emotionally enhanced behaviors (Table 3.3) & socio-emotionally enhanced behavior density (Figure 4.1)<br><br>Data Analysis: Multivariate planned comparisons<br>(Table 4.7) |
| **RQ2**<br>How does the use of prompts-based argumentation scaffolds affect students' argument behaviors while they engage in online dyadic argumentation about a controversial issue? | Source: Students' messages posted on online discussion boards<br><br>Instrument: Coding scheme for argument behaviors (Table 3.4), quality index of argument performance for each argument behavior (Table 4.13), & personal profile survey (Appendix D) |

| | |
|---|---|
| | Data Analysis: MANOVA, post-hoc univariate *F* tests (Table 4.11), & stepdown analysis (Table 4.12) |
| **RQ3**<br>Does the use of prompts-based argumentation scaffolds affect the overall quality of students' argumentation performance while they engage in online dyadic argumentation about a controversial issue? | Source: Students' messages posted on online discussion boards<br><br>Instrument: Rubric for argumentation performance (Appendix E) & personal profile survey (Appendix D)<br><br>Data Analysis: Planned Comparisons (Table 4.16, 4.17, & 4.18) |
| **RQ4**<br>Does the use of prompts-based argumentation scaffolds affect students' reasoning performance represented by the degree to which they succeed in building an argument within the framework of opposing views? | Source: Students' opinion essays submitted prior to and immediately after a dyadic discussion<br><br>Instrument: Rubric for opinion essays (Appendix F)<br><br>Data Analysis: ANCOVA (Table 4.20) |
| **RQ5**<br>Does the use of prompts-based argumentation scaffolds affect students' feelings of group community? | Source: Students' feelings of group community<br><br>Instrument: Group community scale survey (Appendix H)<br><br>Data Analysis: ANOVA (Table 4.22) |

## *Personal Profile Survey*

An online questionnaire, the personal profile survey (Appendix D), was developed to collect potentially influential personal variables prior to the dyadic discussion. The survey, consisting of thirty two items, was divided into three sections: a) twenty items to measure respondents' level of argumentativeness, b) five items to measure respondents' prior attitudes with regard to *internet monitoring* and their topic-specific perception, and c) six items for gathering demographic information such as gender, age, native language, academic status, occupation, academic program, and the number of online courses taken, including the current course. Responses to the personal

profile survey were used to assess the individual differences of participants considered most likely to impact measurement of outcomes.

### *Argumentativeness.*

To measure an individual's tendency to either approach or avoid argumentative situations, the 20-item Argumentativeness Scale developed by Infante and Rancer (1982) was used with a 7-point Likert-type scale ranging from 'never or almost never true' to 'always or almost always true'. Questions from 1 to 20 in Appendix D are the items used for these variables. Infante and Rancer's argumentativeness scale yielded two separate scores for tendency to approach or avoid argumentative situations. The sum of 10 question items (2, 4, 7, 9, 11, 13, 15, 17, 18, 20) represented the tendency to approach argumentative situations ($ARG_{ap}$) and the sum of the other 10 items (1, 3, 5, 6, 8, 10, 12, 14, 16, 19) represented the tendency to avoid ($ARG_{av}$). High scores indicate a strong tendency.

Infante and Rancer (1982) reported a decent internal consistency and validity of the scale. Cronbach's alpha coefficients of the tendency to approach argumentative situations and the tendency to avoid were .91 and .86, respectively, indicating a good internal consistency of the scale. The results of one-week apart test-retest reliability tests for $ARG_{ap}$ ($r = .87$) and $ARG_{av}$ ($r = .86$) indicated that the scale was quite stable. The validity of the scale was tested using bivariate correlations between self-reported scores and peer-evaluated scores. The correlations for $ARG_{ap}$ and $ARG_{av}$ were $r = .54$ ($p < .001$) and $r = .42$ ($p < .02$) respectively (for a more detailed description of the process of validating the scale's validity, see Infante and Rancer (1982)). To determine the internal

consistency of the scale for the data set in this current study, Cronbach's alpha coefficients were computed. For this data set, the alpha coefficients of the tendency to approach or avoid argumentative situations were .89 and .84, respectively.

### *Prior attitudes and topic-specific perception.*

Participants' prior attitudes and topic-specific perceptions were measured with 7-point Likert scales ranging from 'strongly disagree' to 'strongly agree.' Questions from 21 to 25 in the profile survey are the items used for these variables. Specifically, participants were asked to indicate their opinion on *Internet monitoring* and the level of certainty of their opinion before they participated in the dyadic discussion. Items for topic-specific perceptions were designed to measure respondents' self-reported knowledge of, interest in, and beliefs regarding the importance of *Internet monitoring* prior to the study. Four items except the item for importance were adapted from the work of Golanics and Nussbaum (2008) and Alexander, Buehl, and Sperl (2001).

## *Online Postings*

Online messages posted by students were a primary data source in this study. The names of the discussion boards were not included in the discussion transcripts. Also, pseudonyms were assigned to dyads and participants prior to coding so that coders would be blind to condition, which ensure the reliability of coding.

Using two coding schemes, online messages posted by students during the dyadic discussion phase were coded to quantify students' socio-emotionally enhanced behaviors

(Table 3.3) and argument behaviors (Table 3.4). Classified argument behaviors were then assessed using a rubric (Appendix E) to obtain argumentation performance scores.

### *Socio-emotionally enhanced behaviors.*

Among many instruments for assessing the patterns of online interaction, the social presence coding scheme (Rourke, et al., 1999) and the list of supportive behaviors (Fahy, 2001, 2002, 2003; Jeong, 2006) specifically focus on assessing socio-emotional behaviors observed in online interaction. Based on three categories of social presence (e.g., emotional expression, open communication, and group cohesion) outlined by Garrison et al. (2000) and literature on "media capacity, teacher presence, and group interaction," Rourke et al. (1999) developed a social presence coding scheme to quantitatively describe the level of social presence in asynchronous text-based computer conferencing. The coding scheme consists of 12 indicators across three categories: affective, interactive, and cohesive. Low frequencies of social presence indicators are signals of a cold and impersonal social environment and vice versa (Rourke, et al., 1999). Specifically, the category of affective responses includes three communicative indicators: a) expression of emotions, b) use of humor, and c) self-disclosure. The interactive response category includes six indicators: a) continuing a thread, b) quoting from others' messages, c) referring explicitly to others' messages, d) asking questions, e) complimenting, expressing appreciation, and f) expressing agreement. The last category, cohesive responses, include three communicative indicators: a) vocatives, b) addresses or refers to the group using inclusive pronouns, and c) phatics, salutations. Using the method of Holsti (1969), it was found that the aggregate inter-rater reliability of this

tripart coding scheme was quite high (.95 and .91) but the coding of *humor* and *expression of emotions* failed to achieve acceptable level of reliability (.24 for *humor* and .46 for *expression of emotions*) (Rourke, et al., 1999). Rourke, et al. thus recommended excluding these categories from the analysis. It is sometimes hard to judge whether humor has a positive or negative effect on the promotion of a supportive atmosphere because it can be misunderstood by others, particularly in text-based communication.

Twelve of the social presence indicators in the social presence coding scheme overlap with thirteen supportive indicators derived from the Transcript Analysis Tool developed by Fahy (Fahy, 2001, 2002, 2003). Supportive indicators include: 1) horizontal questions, 2) referential statements, 3) acknowledgements, 4) agreements, 5) apologies, 6) closings, 7) emoticons, 8) humor, 9) invitations, 10) rhetorical questions, 11) salutations, 12) signatures, and 13) thanks. Jeong (2006) combined horizontal questions and rhetorical questions for his study and reported a Cohen Kappa coefficient of .86, indicating high inter-rater reliability.

For the current study, to assess the socio-emotionally enhanced behaviors generated by each individual during a dyadic discussion, a coding scheme for socio-emotionally enhanced behaviors was developed based on a social presence scheme (Rourke, et al., 1999) as well as supportive indicators (Fahy, 2001, 2002, 2003). The modified coding scheme (Table 3.3) of the current study specifically focused on behaviors that are likely to contribute to creating warm, friendly, and respectful environments where participants tend to feel more willing to engage in discussion.

Table 3.3

*Coding Scheme for Socio-Emotionally Enhanced Behaviors*

| Behavior Category | Indicators | Definition | Example |
|---|---|---|---|
| Affective | Thanks/Apologies [TA] | Expressing appreciation or making apologies; responding to appreciation and apologies. | "Thanks for all of your replies!" "Sorry that you had to wait for me." "No problem for the delay!" |
| | Self-Disclosure [SD] | Disclosing personal episodes outside of the topic; expressing vulnerability | "I just got married…" "It is hard for me to argue against you because …" |
| | Emoticons [EM] | Using emoticons to express emotions | ":)" |
| | Sympathy* [SY] | Expressing the understanding others' feelings | "I can see how difficult it was for you to…" |
| Supportive | Referring explicitly to others' messages [RE] | Referencing to contents of others' posts directly | "In your message, you talked about the privacy issue …" |
| | Acknowledging / Complimenting [AC] | Complimenting and acknowledging contents of others' message | "I really like your interpretation of the reading" "You made a good point about …" "Thank you for your valuable insights on …" |
| | Expressing agreement [EA] | Expressing agreement | "I was thinking the same thing. You really hit the nail on the head" |
| | Challenging/disagreeing politely* [CP] | Politely challenging an argument made by others | "I agree with your point on … but …" "You made a good point on … However, …" |

| | | | |
|---|---|---|---|
| | Making polite requests* [MP] | Making a polite request | "I like your idea…,but could you give me more explanation …?" "Could you please explain …?" "Let me know …" |
| | Responding to requests politely* [RP] | Politely responding to the request made by others | "Let me respond to your question …" |
| Cohesive | Addressing group members by name [AN] | Addressing group members by name | "Amy, what do you think?" |
| | Using inclusive wording when addressing the group [GR] | Addressing the group as we, us, our, or group. | "Let's focus on …" "We came to a consensus on …" |
| | Greeting [GT] | Greeting before starting the message | "Hi Tom" |
| | Closing signature [CS] | Ending the message with a closing signature | "Thanks, Amy" |

*Note.* Eight indicators in the coding scheme are adapted from the model and template for assessment of social presence developed by Rouke, Anderson, Garrison, and Archer (1999), and the supportive indicators developed by Fahy (Fahy, 2001, 2002, 2003). Four indicators, marked with an asterisk (*) are new indicators created by the researcher for the current study.

The coding scheme for socio-emotionally enhanced behaviors is composed of three behavior categories: a) affective, b) supportive, and c) cohesive. The affective category has four behavior indicators, including 'thank you/apology [TA]', 'self-disclosure [SD]', 'emoticon [EM]', and 'sympathy [SY]'. The supportive category consists of six behavior indicators, including 'referring explicitly to others' messages [RE]', 'acknowledging/complimenting [AC]', 'expressing pure agreement [EA]',

‘challenging/disagreeing politely [CP]’, ‘making polite requests [MP]’, and ‘responding to requests politely [RP]’. The cohesive category is composed of four indicators, including ‘addressing group members by name [AN]’, ‘using inclusive wording when addressing the group [GR]’, ‘greeting [GT]’, and ‘closing signature [CS]’. Among 14 indicators, 8 indicators (TA, SD, EM, RE, AC, EA, AN, GR, GT, and CS) were adapted from the previous studies of Rourke et al. and Fahy with a slight modification of the descriptions for indicators. ‘Sympathy [SY]’ is a new indicator that emerged during the trial period of the coding analysis. This indicator was used to code when students expressed understanding of others’ feelings. CP, MP, and RP are also new indicators that were created according to the socio-cognitive prompts. These three indicators, in particular, are the codes for politeness strategies used by students.

‘Meaning unit,’ which conveys a single function, was chosen as a unit of analysis for the socio-emotionally enhanced behaviors in this study. According to Henri (1992), using meaning units for content analysis is appropriate because “for content analysts, the essential factor is not form but meaning” (p. 134). A sentence may contain a single socio-emotionally enhanced behavior, and a student sometimes could have used two or more sentences just to share personal episodes. A sentence, for the former case, was divided into several sections (meaning units), and several sentences, for the latter case, were combined as one meaning unit.

### *Argument behaviors.*

Some coding schemes for argument behaviors have been developed based on the basic concepts in Toulmin’s model (1958). For example, Cho and Jonassen (2002)

classified students' argumentative messages into one of five categories (claims, grounds, warrants, backings, and rebuttals) which were created based on the basic concepts in the Toulmin model. Recently, Oh and Jonassen (Oh, 2005; Oh & Jonassen, 2007) developed a coding scheme for argument structure by combining two argument components—evidence and rebuttal—from Toulmin's model (1958), and two argument acts—agreement (named 'verification' in Oh and Jonassen's study) and elaboration—from the conversational argument coding scheme (Meyers, Brashers, & Hanner, 2000).

Instead of using the Toulmin's model as an analytical tool, Munneke et al. (2007) developed a map of interactive argumentation to analyze the breadth and depth of debate on the basis of argument skills identified by Kuhn (1991). In the map of interactive argumentation, debate begins with a claim. The debate becomes broader with theories in support of or in opposition to a claim (supportive theory and alternative theory) and becomes deeper through the elaboration of theories with evidence. The theory being supported is challenged with counterarguments and alternative theories, which are in turn challenged by way of rebuttals (Munneke, et al., 2007).

Resnick et al. (1993) was particularly interested in identifying features of peer-led discussions in relation to how people reason cooperatively in a social context. They identified five essential features—premise, conclusion, challenge, answer to challenge, and concession. Later, Keefer et al. (2000) found that the presence of voluntary concession was the key to determining whether or not a group of students had actually engaged in critical discussion. The aforementioned analytical tools for argumentation provide valuable insight into the argument behaviors of students in a group. Grounded on the work of Kuhn (1991), Resnick et al. (1993), and Oh and Jonassen (Oh, 2005; Oh &

Jonassen, 2007), I developed a coding scheme to capture important argument behaviors observed during interactive argumentation where two arguers exchange their opinions on a controversial issue. The purpose of this coding scheme was to identify how two arguers deal with contrasting viewpoints on a controversial issue and resolve conflicts in a social context.

The coding scheme consists of seven argument behaviors: 1) proposing a supportive theory (ST), 2) proposing an opposing theory (OT), 3) challenging (CH), 4) counter-challenging (CC), 5) integrating (IN), 6) elaborating (EL), and 7) agreeing (AG). The coding scheme for argument behaviors is presented in Table 3.4. Four categories (ST, OT, CH, CC) were modified from Kuhn's original work (1991) and two categories (EL, AG) were adapted from the conversational argument coding scheme. IN was a new category developed to capture argument behavior that integrates both sides of a controversial issue.

Table 3.4

*Coding Scheme for Argument Behaviors*

| **Behavior Category** | **Description** |
|---|---|
| Proposing a supportive theory [ST] | Proposing an initial argument in support of *monitoring K-12 teachers' internet use in school* |
| Proposing an opposing theory [OT] | Proposing an initial argument in opposition to *monitoring K-12 teachers' internet use in school* |
| Challenging [CH] | Providing a counterargument that attempts to falsify or undermine the primary line of reasoning. |

| | |
|---|---|
| Counter-challenging [CC] | Providing a rebuttal that rebuts a counterargument (an opposite line of reasoning). |
| Integrating [IN] | Integrating primary and opposing lines of reasoning, suggesting a creative solution, or illustrating exceptions or conditions based on the examination of both primary and opposing lines of reasoning. |
| Elaborating [EL] | Elaborating one's preceding argument with reasons or evidence (e.g. personal beliefs, experience, expert opinions, research findings, etc.) or asking a question seeking additional information on a preceding statement. |
| Agreeing [AG] | Expressing agreement with the preceding argument. |

A single online posting, in general, was regarded as functioning as one argument behavior. There were, however, some cases in which a single posting contained more than one argumentation or some postings which were simply an extension of previous argumentation. It was, therefore, problematic to take a posting as a unit of analysis. For these reasons, 'meaning unit' was chosen as a unit of analysis for the socio-emotionally enhanced behaviors in this study. When a student's message conveys more than one argumentative function, it was divided into several meaning units. When two or more messages are used to construct a single argumentation, they were combined as one meaning unit.

### *Argumentation performance.*

To assess overall argumentation performance, each argument behavior was assessed based on a rubric (Appendix E), which was developed by the researcher. The rubric was developed according to the following guidelines: a) defining the essential

argument behaviors of interest (Table 3.4), b) defining the rating scale for each argument behavior category, c) defining the meanings of each scale for its respective argument behavior category (Jonassen, 2004).

Each argument behavior was assigned a score from 0 to 2 according to its quality of argumentation. Arguments that did not achieve their purpose were assigned a score of 0. For example, if a counterargument fails to falsify or undermine the primary argument, it received a score of 0. A score of 1 was generally given when arguments provided some but not sufficient reasoning/evidence or achieved its purpose to some extent. A score of 2 was given when arguments successfully achieved their purposes and were accompanied by substantial reasons/evidence. The summed scores of all argument behaviors were used to represent the overall quality of argumentation performance.

### *Coding procedure.*

Two coders participated in coding and assessing online postings. First, the primary coder (the author of the current study) divided messages into meaning units. Among meaning units for argument behaviors, some meaning units were pre-coded as 'OFF' by the primary coder when they were not related to any argument behaviors.

The two coders then independently coded meaning units by classifying meaning units designated as socio-emotionally enhanced behaviors into one of fourteen categories from Table 3.3 and by classifying meaning units designated as argument behaviors into one of the seven argument behavior categories from Table 3.4. At this point, the two coders also independently assessed the quality of argument behaviors using the rubric for argumentation performance (Appendix E).

As a last step, the coding results were compared. Any coding disagreements, including disagreements about the proper division of meaning units, were resolved at this stage through communication between the two coders.

### *Intercoder reliability.*

In order to check the degree of agreement among the two coders, Cohen's Kappa (κ) (Cohen, 1960) and Kappa Coefficient with Omission Calculation ($\kappa_{woc}$) (Simon, 2006) were calculated. Cohen's κ is the most frequently used statistical measure of inter-rater reliability for nominal data and removes chance agreement from consideration (Cohen, 1960). The Cohen's kappa coefficient is calculated as follows:

$$\kappa = (P_o - P_c) / (1 - P_c)$$

Where $P_o$ is "the proportion of units in which the judges agreed" and $P_c$ is "the proportion of units for which agreement is expected by chance" (Cohen, 1960, p. 39)

Recently, Simon (2006) criticized Cohen's kappa for not taking "omission mistakes" into account. That is, there are cases in which coder A does not assign any code to a coding unit whereas coder B assigns a code to the unit. The omission mistakes cause an overestimation of intercoder agreement (Simon, 2006). To resolve this problem, Simon created a column called "Not coded" in the contingency table and included the probability of randomly choosing "Not coded" in the $P_c$ calculation. Therefore, $\kappa_{woc}$ does use the same calculation rule as the original Cohen kappa.

For socio-emotionally enhanced behaviors, the Cohen's kappa coefficient was .99 and kappa coefficients with omission calculation were .93. For argument behaviors, Cohen's kappa coefficient was .86 and kappa coefficients with omission calculation were

.83. All reliability coefficients for socio-emotionally enhanced behaviors and argument behaviors were above .70 and thus considered acceptable. For argumentation performance, Cohen's kappa coefficients for ST, OT, CH, CC, IN, EL, and AG were .30, .82, .76, .80, .77, .49, and .38; kappa coefficients with omission calculation were .30, .82, .72, .75, .64, .38, and .34. Reliability coefficients for argumentation performance score ST, EL, and AG were below .50, which are below acceptable inter-coder reliability.

### *Assessment of Reasoning Performance*

Grounded in the standard models proposed by Inch and Warnick (2002) (Nussbaum & Schraw, 2007), Nussbaum and Kardash (2005) developed a coding scheme to analyze argumentation in opinion essays. Their coding scheme consisted of five argumentation categories, including final claim, primary claim, counterclaim, rebuttal, and supporting reason or example. The coding categories were similar to those developed by Kuhn (1991) and by Ferrett, MacArthur, and Dowdy (2000) (Nussbaum & Kardash, 2005; Nussbaum & Schraw, 2007). Later, Nussbaum and Schraw (2007) added one more argumentation category, *reservations*, "defined as brief qualifications serving as rebuttals to short or implicit counterarguments" (p. 70) which were taken from the Toulmin model. They also assessed the degree of integration of arguments and counterarguments in each essay. A well-balanced essay with an integrative closing paragraph received the highest score, whereas a one-sided essay or an essay that had no final conclusion received the lowest score.

In the current study, students were required to submit an opinion essay on the question, "should the school monitor K-12 teachers' internet use in school?" before and

after the dyadic discussion. What follows is an excerpt of the instructions for the pre- and post-opinion essay (for the entire set of instructions, refer to Appendix B):

> The Pre-Opinion Essay Assignment asks you to write an essay expressing your opinion by making arguments on the following question, ***"Should the school monitor K-12 teachers' internet use in school?"***
>
> Arguments are stands you take on an issue, supported by reasons and evidence. You may include alternative points of view and counterarguments (and supporting reasons) and consider both arguments and counterarguments when developing your final conclusion.

> ***After having examined the issue of internet monitoring, please write an essay that describes your current opinion*** on the following question, "Should the school monitor K-12 teachers' internet use in school?"
>
> Arguments are stands you take on an issue, supported by reasons and evidence. You may include alternative points of view and counterarguments (and supporting reasons) and consider both arguments and counterarguments when developing your final conclusion.

As shown in the instructions, students were required to take a stand on an issue and support their claim with reasons and evidence. In addition, they were encouraged to structure their arguments such that they both acknowledged and countered opposing points of view. According to Kuhn (1991), the ability to generate an alternative claim, to envision conditions that would undermine one's own claim, and rebut an opposite line of reasoning are critical argument skills. To assess students' ability to frame their own argument within alternative theories, two rubrics for opinion essays (Appendix F) were developed based on Kuhn's work (1991), with the argumentation coding categories developed by Nussbaum and Kardash (2005), and the integration scoring rubric developed by Nussbaum and Schraw (2007). The assessment of opinion essays was done in two steps. First, argument components in an individual opinion essay were identified

and evaluated based on the first rubric (step 1: assessing the quality of argument components in opinion essay). Then, the level of the essay, in terms of developing an argument which engaged and countered opposing views, was determined according to the results of the first part of the assessment and criteria of the second rubric (step 2: assessing the level of argument development within the framework of opposing views).

The first rubric consists of six argumentation categories: 1) final claim, 2) supporting argument, 3) counterargument, 4) rebuttal, 5) integration, and 6) weighing. A student's position or stance on the essay topic, *internet monitoring*, was identified as the *final claim*. An argument supporting the final claim with or without reasons and evidence was identified as a *supporting argument*. An argument refuting the supporting argument or giving an opposing reason to the final claim was identified as a *counterargument*. A response to a counterargument was identified as one of three response categories (i.e. rebuttal, integration, or weighing). When a response refuted a counterargument, it was identified as a *rebuttal*; when it integrated counterargument into their supporting argument by presenting solutions or by allowing some exceptions or conditions, it was identified as *integration*; when it weighed the benefit and/or drawbacks of a supporting argument and a counterargument, it was identified as *weighing*.

When an essay developed both sides of an issue in a balanced manner, and included a well-argued response to the opposing views contributing to the final conclusion, the essay received full scores of 5. An essay received scores from 1 to 4 depending on the quality of counterarguments and responses to the counterarguments. When an essay developed only one point of view, it received a zero score. Inter-rater

reliability for reasoning performance on the first step was .94, and the coefficient for the second step was .89.

### *Students' Feelings of Group Community*

The measure of students' perception of the social climate of their group experience was developed based on the classroom community scale (CCS) that was originally developed to measure the sense of community of university students who are taking online courses (Rovai, 2002). The Cronbach's coefficient alpha and the split-half coefficient for the full CCS were .93 and .91, indicating an excellent reliability (Rovai, 2002). Reliability estimates of each subscale (connectedness and learning) ranged from .80 to .92, indicating a good reliability.

The revised group community scale can be found in Appendix H. The group community scale consists of two sub-constructs: connectedness and learning. Examples of the connectedness construct are "I felt that my discussion partner cared about me" and "I trusted my discussion partner during the discussion." As for the learning constructs, examples are "I felt that I was encouraged to ask questions during the discussion," and "I felt reluctant to speak openly during the discussion." Cronbach's coefficient alpha for the full-group community scale used in the current study was .92, indicating an excellent reliability. The alpha coefficients for subscales, connectedness, and learning were .89 and .85, respectively.

## Treatments in the Study

There is considerable evidence that in a supportive environment, students are likely to engage diverse views proposed by others and to build their own arguments on those of others. A number of scholars (e.g. Fahy, 2001; Fahy, 2002, 2003; Garrison, et al., 2000; Jeong, 2006; Rourke, et al., 1999; Steinkuehler, 2001) have suggested that socio-emotionally enhanced behaviors are determinants of a supportive environment. Additionally, findings from several studies indicated that prompting could be an effective means of scaffolding students' behaviors (e.g. 1989, 1990, 1991, 1992, 1994, 1997; King & Rosenshine, 1993; Oh & Jonassen, 2007; Weinberger, et al., 2005). Based on these findings, this study attempted to find a way to promote socio-emotionally enhanced communication using prompts.

### *Description of the Task*

Interactive argumentation is a quite difficult task that requires detailed preparations and clear instructions. The task in the current study was an interactive role-playing argumentation in which pairs of students discussed a given controversial issue via text-based asynchronous communication. Students were assigned roles either as supporters or opponents of a particular position, and this ensured the existence of disagreements. Also, it is likely that students generate co-constructive new knowledge when attempting to bring conflicting viewpoints to resolution (Jermann & Dillenbourg, 2003). The instructions of the dyadic discussion (Appendix C) clearly stated that the individual goal for the discussion was to persuade the other party, and the group goal was

to deepen understanding on the issue through exploring multiple perspectives via argumentative discourse.

*Internet monitoring* ("*should the school monitor K-12 teachers' internet use in school?"*) was chosen as the topic for discussion for the following reasons. The topic should be interesting and important to students so that they are motivated to participate in the discussion. The issue of school monitoring of K-12 teachers' in-school Internet use was selected because not only were the majority of study participants teachers, but recent school adoption and enforcement of guidelines of appropriate Internet use makes it a salient issue. More important, the topic should be controversial, thus generating multiple perspectives. For these reasons, *Internet monitoring* was a perfect topic for the task.

## *Our Little Forum – Online Argumentation Tool*

A text-based asynchronous discussion board was used as a communication tool for the dyadic discussion assignment. I created the discussion boards ("our little forum") by revising "my little forum" (http://mylittleforum.net/), which is open-source web forum software. The original version of my little forum is different from other bulletin boards in that on the main page all clickable threads are displayed in a way which shows the relationship between the messages (Figure 3-1). This feature allows forum users to have an overview of the current status of the discussion without clicking through the main topic to see who replied to whom or to check the various topics of replies.


Figure 3.1 Main Page of Discussion Boards

The discussion environments for the three conditions were exactly same except for the message composition page. Students in the control condition received a blank subject line and a message box, which they need to fill in to post a message (Figure 3.2). In other words, they were not constrained by predefined subjects, and were able to type anything in the subject line. No prompts were provided in the message box, and emoticons were not also provided on the page.


Figure 3.2 Message Composition Page for the Control (No Prompts) Condition

The discussion boards used by the treatment conditions were different from the one used by the control condition in that subjects for discussions are predefined and corresponding prompts are given in the message box upon the selection of a subject. Figure 3.3 shows two screenshots of a message composition page for the cognitive prompts condition. Once a student in the cognitive prompts condition selected a subject from a list of predefined argument behavior types, a message box containing a prompt in the form of corresponding task-oriented note starters appeared on the screen (Figure 3.3). Figure 3.4 shows two screen shots of a message composition page used by students in the socio-cognitive prompts condition. The list of predefined argument behavior types provided to the socio-cognitive prompts condition was the same as the one provided to the cognitive prompts condition. Students in the socio-cognitive prompts condition also received corresponding prompts (note starters) in the message box upon the selection of a subject from the subject list. However, the socio-cognitive prompts were different from the cognitive prompts in various ways.


Figure 3.3 Message Composition Page for the Cognitive Prompts Condition

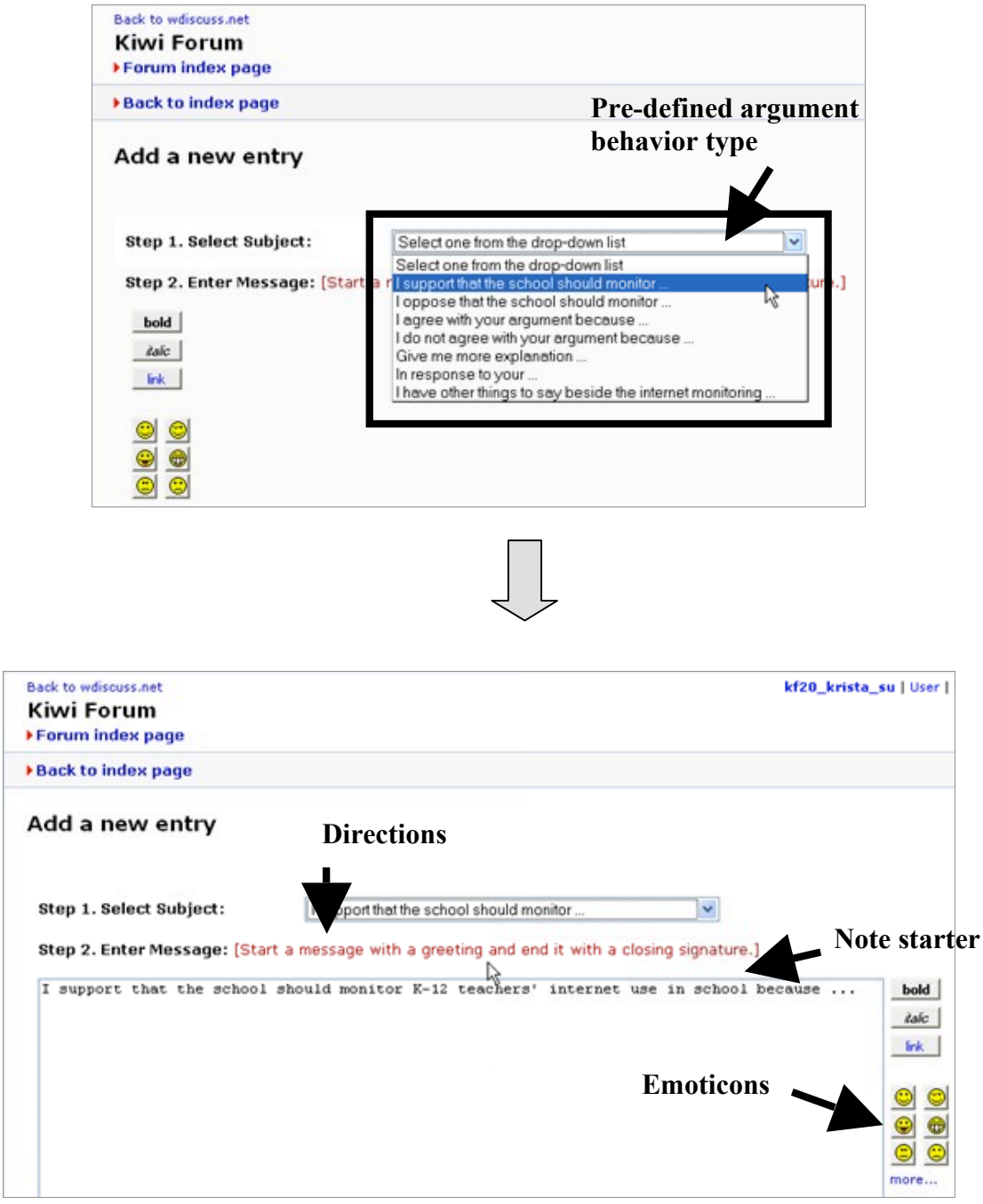



Figure 3.4 Message Composition Page for the Socio-Cognitive Prompts Condition

Socio-cognitive prompts were designed to support both cognitive and social dimensions of interaction, whereas cognitive prompts were designed to support the cognitive dimension only. One of the findings in Jeong's (2006) study was that a closing

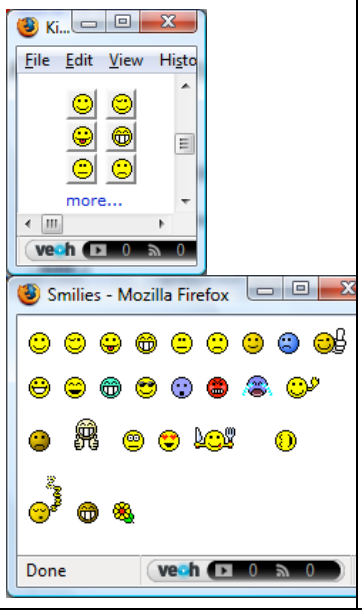
signature elicited a greater number of responses from other participants than messages without a closing signature. Additionally, a number of scholars have proposed such communicative behaviors as acknowledging others' contributions, referencing by name, quoting others' messages, and use of friendly tone as examples of supportive behaviors contributing to productive interactive argumentation (Fahy, 2001, 2002, 2003; Hogan, et al., 2000; Jeong, 2006; Steinkuehler, 2001, 2002). Nussbaum and his colleagues (Nussbaum, et al., 2004) reported that the majority of disagreement observed in online discussions took the form of "I agree with you about X, but…" Forming a disagreement in this way is one argumentative strategy which students use to preserve harmonious social relationships while asserting their ideas in online discussions (Nussbaum, et al., 2004). Brown and Levinson (1987) argued that attempts to alter the behavior of others are inherently face threatening. Starting the message with 'agreement' can be one way of 'softening' the tension because it acknowledges the other party's competency (Nussbaum, et al., 2004).

The socio-cognitive prompts were designed based on these findings. Specifically, students in the socio-cognitive prompts condition received a direct instruction to start messages with a greeting and to close it with a closing sign. More important, the note starters of the socio-cognitive prompts were designed to encourage students to reference a partner's name, quote or rephrase a partner's idea, use a friendly tone, and to acknowledge a partner's work. In addition, clickable emoticons were provided to compensate for the lack of social presence in written communication. Table 3.5 provides a detailed description of prompts used for treatment conditions.

Table 3.5

*Description of Prompts*

| | Cognitive Prompts | Socio-Cognitive Prompts | Socio-Emotionally Supportive Strategies Adopted in the Socio-Cognitive Prompts Condition |
|---|---|---|---|
| **DIRECTIONS** | | • Start the message with a greeting and end it with a closing signature. | • Greeting<br>• Closing signature |
| **SENTENCE OPENER FOR EACH PRE-DEFINED ARGUMENT BEHAVIOR TYPE** | Subject: I support that the school should monitor … | | |
| | • I support that the school should monitor K-12 teachers' Internet use in school because … | • I support that the school should monitor K-12 teachers' Internet use in school because … | |
| | Subject: I oppose that the school should monitor … | | |
| | • I oppose that the school should monitor K-12 teachers' internet use in school because… | • I oppose that the school should monitor K-12 teachers' internet use in school because … | |
| | Subject: I agree with your argument because … | | |
| | • I agree with your argument because ... | • [Address the partner by name], I agree with your argument on ... because ... | • Addressing the partner by name<br>• Referencingg to the content of the partner's post |
| | Subject: I do not agree with your argument because … | | |
| | • I do not agree with your argument because … | • [Address the partner by name], your point on ... is good.... But I do not agree with your argument ... because ... | • Addressing the partner by name<br>• Referencing the content of the partner's post<br>• Challenging the partner's argument in a polite way |

| | | | |
|---|---|---|---|
| | Subject: Give me more explanation … | | |
| | • Give me more explanation … | • [Address the partner by name], I like your idea …, but could you give me more explanation...? | • Addressing the partner by name<br>• Referencing the content of the partner's post<br>• Asking a question in a polite way |
| | Subject: In response to your … | | |
| | • In response to your … | • Thanks [address the partner by name] for your .... Let me respond to your ... | • Expressing appreciation or acknowledging the partner's contribution<br>• Responding to the question in a polite way |
| | Subject: I have other things to say besides Internet monitoring … | | |
| | • I have other things to say besides Internet monitoring … | • [Address the partner by name], I have other things to say besides Internet monitoring ... | • Addressing the partner by name |
| **EMOTICONS** | | Provided readily usable emoticons as follows:<br>  | • Using emoticons |

## Data Collection Procedures

There were four phases of the study: 1) recruitment, 2) pretest, 3) treatment, and 4) posttest. A detailed timeline for each phase can be found in Appendix B.

### *Phase 1: Recruitment of Research Participants*

All data collection took place during the fourth week of class. At the beginning of the third week of the class, the course instructor made an announcement about the study. The announcement included the web address for the online consent form (Appendix A). The consent form included a description of the purpose of the research, as well as of the tasks and procedures which comprised the study. Respondents were assured that the identity of research participants would not be revealed, and that all individuals would remain anonymous in any reporting of the data. Students consented to the study by providing their full name, student id number, and e-mail address. Immediately after submitting their consent to participate in the study, students were asked to complete and submit the personal profile survey online (Appendix D). The first part of the personal profile survey was designed to assess participants' level of argumentativeness. The second part included questions regarding the controversial issue, Internet monitoring. The third part sought demographic information. A total of forty-eight students out of fifty-three consented to participate in the study.

### *Phase 2: Pretest (Pre-Opinion Essay)*

On the first day of the fourth week of the class, students submitted individual opinion essays on the controversial issue, "*Should the school monitor K-12 teachers'*

*internet use in school?*" (for details of the pre-opinion essay assignment, see Appendix B). The pre-opinion essay task required students to complete the essay within 30 minutes and to leave a note at the end of the essay as to how long it took them to complete. This was to ensure that each participant had an equal amount of time to complete the task. The participants' pre-opinion essays were used as the pretest.

### *Phase 3: Treatment (Dyadic Discussion)*

Students who consented to the study and submitted the pretest on time were then randomly assigned to roles as either proponents or opponents, to either one of the dyads, and to any one of the three research conditions (for details, refer to the "Context of the Study and Participants" section of Chapter 3).

On the first day of the fourth week, students received an e-mail that included the forum site address, along with a username and password, which they needed to log in to their own dyadic discussion board. Each discussion board included the announcement message that informed them of their assigned role, explained the details of the dyadic discussion activity, and provided a link to the short movie clip on 'how to use the discussion board to complete the task' (Appendix C).

The potential for cognitive conflict was ensured by the role assignments in which one student acted as a proponent and the other student acted as an opponent of Internet monitoring. All of the students received the same instructions and completed the same tasks except that dyads in the treatment conditions received either task-oriented or socio-cognitive prompts whereas dyads in the control condition did not receive any prompts during dyadic discussions (for details of treatments, refer to the previous section of this

chapter, “Treatments in the Study”). All students were required to post an initial message either in support of or in opposition to Internet monitoring, as assigned. They were also required to read their discussion partner’s messages and make a minimum of three replies to their partner’s postings. The participants’ online written messages were recorded in a database for later analysis.

### *Phase 4: Posttest (Post-Opinion Essay) and Group Community Scale*

Within twenty-four hours following the dyadic discussion, individual students were required to submit an individual opinion essay on the same topic, internet monitoring, in their own words (for details of the post-opinion essay task, see Appendix X). The participants’ post-opinion essays were used as the posttest. Upon the completion of all of the above assignments, students were required to complete and submit another online survey, which was the Group Community Scale (Appendix H). Participants’ responses to the Group Community Scale were recorded in a database for later analysis.

# CHAPTER IV

# RESULTS

Results of the study are based on the data obtained from the thirty-two participants. To begin with, participant profiles are reported. The results of the research questions are then reported one by one.

## Participant Profiles

Data from 32 students were used for data analysis. Specifically, the control condition consisted of 12 students, the cognitive prompts condition (a comparison condition) had 12 students, and the socio-cognitive prompts condition (an experimental condition) had 8 students. Table 4.1 summarizes the general characteristics of the participants, including the number of dyads assigned to each condition. Participants were predominantly master's-level (84.4%) female (78.1%) students. Thirty-one of 32 participants used English as a first language (96.9%) and had taken one or more distance classes before this current class (96.9%). Among the participants, twenty-one (65.6%) identified themselves as teachers.

Table 4.1

*General Characteristics of Participants by Condition (N = 32)*

Frequency (Percentage)

| | Condition | | | |
|---|---|---|---|---|
| | Control (*N*=12) | Cognitive (*N*=12) | Socio-Cognitive (*N*=8) | Total (*N*=32) |
| Gender | | | | |
| Female | 11 (91.7%) | 8 (66.7%) | 6 (75.0%) | 25 (78.1%) |
| Male | 1 (8.3%) | 4 (33.3%) | 2 (25.0%) | 7 (21.9%) |
| Age | | | | |
| >= 25 | 2 (16.7%) | 2 (16.7%) | 1 (12.5%) | 5 (15.6%) |
| 26 - 30 | 4 (33.3%) | 1 (8.3%) | 3 (37.5%) | 8 (25.0%) |
| 31 - 35 | 3 (25.0%) | 2 (16.7%) | 1 (12.5%) | 6 (18.8%) |
| 36 – 40 | 1 (8.3%) | 5 (41.7%) | 1 (12.5%) | 7 (21.9%) |
| 40 < | 2 (16.7%) | 2 (16.7%) | 2 (25.0%) | 6 (18.8%) |
| First Language | | | | |
| English | 11 (91.7%) | 12 (100.0%) | 8 (100.0%) | 31 (96.9%) |
| Other | 1 (8.3%) | 0 (0.0%) | 0 (0.0%) | 1 (3.1%) |
| Academic Status | | | | |
| Master's Student | 11 (91.7%) | 8 (66.7%) | 8 (100.0%) | 27 (84.4%) |
| Doctoral Student | 1 (8.3%) | 1 (8.3%) | 0 (0.0%) | 2 (6.2%) |
| Specialist | 0 (0.0%) | 3 (25.0%) | 0 (0.0%) | 3 (9.4%) |
| Occupation | | | | |
| Full-time Student | 0 (0.0%) | 0 (0.0%) | 2 (25.0%) | 2 (6.2%) |
| Teacher | 10 (83.3%) | 6 (50.0%) | 5 (62.5%) | 21 (65.6%) |
| Technology Specialist | 1 (8.3%) | 1 (8.3%) | 0 (0.0%) | 2 (6.2%) |
| Other | 1 (8.3%) | 5 (41.7%) | 1 (12.5%) | 7 (21.9%) |
| No. of Distance Courses | | | | |
| 1 | 1 (8.3%) | 0 (0.0%) | 0 (0.0%) | 1 (3.1%) |
| 2 - 3 | 2 (16.7%) | 3 (25.0%) | 1 (12.5%) | 6 (18.8%) |
| 4 – 6 | 4 (33.3%) | 3 (25.0%) | 4 (50.0%) | 11 (34.4%) |
| 7 – 10 | 2 (16.7%) | 4 (33.3%) | 2 (25.0%) | 8 (25.0%) |
| 10 < | 3 (25.0%) | 2 (16.7%) | 1 (12.5%) | 6 (18.8%) |
| Dyads | 6 | 6 | 4 | 16 |

Table 4.2 summarizes personal variables that may influence individuals' argument behaviors, argumentation performance, and reasoning performance, and shows the distribution of these variables across the conditions. In later analyses, each personal variable was tested for the possibility of being included as a covariate.

Table 4.2

*Means and Standard Deviations of Participants' Personal Variables by Condition*

| | | Condition | | | |
|---|---|---|---|---|---|
| | | Control (*N*=12) | Cognitive (*N*=12) | Socio-Cognitive (*N*=8) | Total (*N*=32) |
| Approaching Arguments[a] | *M* | 40.08 | 39.25 | 38.50 | 39.38 |
| | *(SD)* | (8.94) | (11.48) | (10.73) | (10.08) |
| Avoiding Arguments[b] | *M* | 39.08 | 36.50 | 41.50 | 38.72 |
| | *(SD)* | (10.14) | (9.36) | (10.21) | (9.75) |
| Prior Attitude[c] | | | | | |
| Certainty[d] | *M* | 5.67 | 5.25 | 5.75 | 5.53 |
| | *(SD)* | (1.07) | (1.42) | (1.28) | (1.24) |
| Topic-Specific Perception[c] | | | | | |
| Knowledge[e] | *M* | 5.08 | 4.42 | 4.62 | 4.72 |
| | *(SD)* | (1.00) | (1.38) | (2.00) | (1.42) |
| Interest[f] | *M* | 4.75 | 5.33 | 5.00 | 5.03 |
| | *(SD)* | (1.49) | (.65) | (1.60) | (1.26) |
| Importance[g] | *M* | 4.67 | 5.42 | 4.38 | 4.88 |
| | *(SD)* | (1.78) | (1.00) | (2.00) | (1.60) |
| Pre-Reasoning Performance[h] | *M* | 1.67 | 3.17 | .62 | 1.97 |
| | *(SD)* | (1.61) | (1.03) | (.74) | (1.58) |

*Note.* [a] Higher scores indicate a greater tendency to approach argumentative situations.
[b] Higher scores indicate a greater tendency to avoid argumentative situations.
[c] Used 7-point Likert scale to measure the variable. Score 1 indicates the lowest level of perceived variables, and score 7 indicates the highest level of perceived variables.
[d] Perceived level of certainty of their opinion on the topic
[e] Perceived knowledge of the topic
[f] Perceived interest in the topic
[g] Perceived importance of the topic
[h] Scores range from 0 to 5, 0 indicating a one-sided argument and 5 indicating a balanced argument.

As shown in Table 4.2, the means for the tendency to approach and avoid argumentative situations of participants were 39.38 (*SD* = 10.08) and 38.72 (*SD* = 9.75) respectively. With regard to participants' prior attitudes toward the issue, the mean of the certainty variable was 5.53 (*SD* = 1.24), indicating a modest level of certainty regarding their initial opinion on the issue. The means for the perceived levels of knowledge about the topic, interest in the topic, and importance of the topic were 4.72 (*SD* = 1.42), 5.03 (*SD* = 1.26), and 4.88 (*SD* = 1.60), respectively. One thing to note is that there were no

significant differences among conditions on the above personal variables. However, there were noticeable differences among conditions on the pre-reasoning performance test scores. Students in the cognitive prompts condition performed better in the pre-reasoning performance test ($M$ = 3.17, $SD$ = 1.03) than those in the socio-cognitive prompts condition ($M$ = .62, $SD$ = .74) and the control condition ($M$ = 1.67, $SD$ = 1.61). The results of ANOVA indicate that this was statistically significant; $F(2, 29)=10.75$, $p <$ .001, Partial $\eta^2$ = .43. Further, post-hoc univariate $F$ tests using the Bonferroni adjustment indicate that students in the cognitive prompts condition significantly outperformed both students in the socio-cognitive prompts condition, with a mean difference of 2.542 ($p$ = .000), and students in the control condition, with a mean difference of 1.500 ($p$ = .018). To address this problem, an ANCOVA was used for research question 3 to control for both the conditional and the unconditional Type I error rate and to increase the power of the test by reducing the likelihood of error by way of a *fluke random assignment* – a significant group difference on a covariate despite random assignment – as recommended by Maxwell and Delaney (2004).

## Simple Data Screening

Prior to data analysis, the data were examined using SPSS 16.0 for accuracy of data entry and missing values. The data were found to be accurate. There were no missing values. Despite unequal sample sizes (control condition, $N$ = 12; cognitive prompts condition, $N$ = 12; socio-cognitive prompts condition, $N$ = 8), the unweighted-means approach was adopted in the following analyses because the experiential design began with the random assignment of equal subjects to each condition, and unequal cell

sizes were the result of natural and incomplete differential ratios (see Tabachnick & Fidell, 2001).

Table 4.3 shows the number of messages and wordings by condition.

Table 4.3

*Number of Messages and Wordings by Condition*

| | | Condition | | |
|---|---|---|---|---|
| | | Control (n=12) | Cognitive (n=12) | Socio-Cognitive (n=8) |
| Number of Messages | *M* | 5.67 | 6.11 | 5.13 |
| | *(SD)* | (1.67) | (1.21) | (0.99) |
| Wordings | *M* | 982.83 | 1094.08 | 1047.63 |
| | *(SD)* | (626.74) | (617.76) | (605.81) |

## Effects of Prompts-based Argumentation Scaffolds on Argumentation

In this section, the effects of prompts-based argumentation scaffolds (PAS) will be reported with regard to socio-emotionally enhanced behaviors, argument behaviors, and argumentation performance.

### *Socio-Emotionally Enhanced Behavior*

| | |
|---|---|
| RH1-1. | Students scaffolded by socio-cognitive prompts will use more socio-emotionally enhanced strategies while they engage in online dyadic argumentation about a controversial issue than students without any supportive prompts. |

| | |
|---|---|
| RH1-2. | Students scaffolded by socio-cognitive prompts will use more socio-emotionally enhanced strategies while they engage in online dyadic argumentation about a controversial issue than students scaffolded by cognitive prompts. |

*Overview.*

The results of the data analysis with regard to the effects of PAS on students' socio-emotionally enhanced behaviors will be reported in this section. To get a quantitative measure of students' socio-emotionally enhanced behaviors, the online postings generated by participants during the dyadic discussion phase were collected and coded based on the coding scheme for such behaviors. Then, the frequency of socio-emotionally enhanced behaviors was translated into socio-emotionally enhanced behavior density. The socio-emotionally enhanced behavior density represents a unit of incidents of socio-emotionally enhanced behaviors per 1.000 words. Rourke et al. (Rourke, et al., 1999) used the social presence density, which is an index of social presence behaviors per 1000 words, to represent the degree of social presence in the asynchronous text-based conference. The use of density rather than raw frequency data allows a meaningful comparison without being affected by the total number of words in different discussion groups (Rourke, et al., 1999).

Figure 4.1 illustrates the socio-emotionally enhanced behavior density of all indicators by condition. Table 4.4 summarizes the socio-emotionally enhanced behavior density for each sub-category, including categories for affective behavior, supportive behavior, and cohesive behavior.

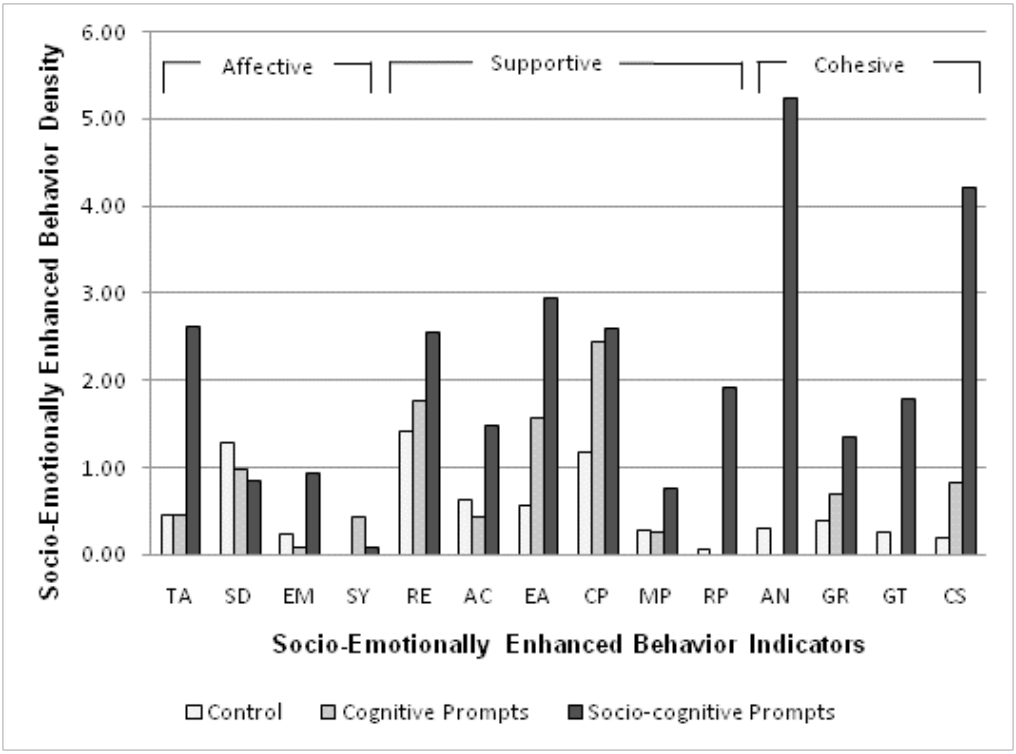



Figure 4.1 Socio-Emotionally Enhanced Behavior Density by Condition[9]

Table 4.4

*Descriptive Statistics of Socio-Emotionally Enhanced Behavior Density by Condition*

| Condition | N | | Socio-Emotionally Enhanced Behavior Density[a] | | | |
|---|---|---|---|---|---|---|
| | | | Affective | Supportive | Cohesive | Total |
| Control | 12 | *M* | 1.98 | 4.08 | 1.12 | 7.19 |
| | | *(SD)* | (3.05) | (1.84) | (2.50) | (5.91) |
| | | *Skewness* | 1.05 | -.80 | 2.39 | 1.38 |
| | | *Kurtosis* | -.86 | 1.10 | 5.22 | .40 |
| Cognitive | 12 | *M* | 1.92 | 6.45 | 1.50 | 9.87 |
| | | *(SD)* | (2.98) | (2.89) | (2.15) | (6.17) |
| | | *Skewness* | 2.31 | .59 | 1.11 | 1.51 |
| | | *Kurtosis* | 5.80 | .21 | -.34 | 1.31 |
| Socio-cognitive | 8 | *M* | 4.47 | 12.24 | 12.59 | 29.30 |
| | | *(SD)* | (2.11) | (7.24) | (4.94) | (12.86) |
| | | *Skewness* | .29 | .10 | .37 | -.00 |
| | | *Kurtosis* | -.34 | -1.80 | -1.56 | -1.44 |

[9] For details regarding socio-emotionally enhanced behaviors, see Table 3.3.

*Note.* [a] Socio-Emotionally Enhanced Behavior Density = (Total number of socio-emotionally enhanced behaviors / Total number of words) * 1000

As shown in Figure 4.1 and table 4.4, the socio-cognitive prompts condition resulted in significantly higher measures of socio-emotionally enhanced behavior density for all 12 indicators with the exception of the self-disclosure (SD) indicator and the sympathy (SY) indicator. Interestingly, the cognitive prompts condition resulted in as a high a measure of CP (challenging/disagreeing politely) as the socio-cognitive prompts condition. This indicates that students in the cognitive prompts condition were able to use the CP strategy without the support of the social prompts.

A one-way multivariate design was used for the current data analysis. The independent variables were three prompts conditions: no prompts, cognitive prompts, and socio-cognitive prompts. The dependent variables were three socio-emotionally enhanced behaviors (affective, supportive, and cohesive). Two planned comparisons were used to test a priori hypotheses. The first planned comparison examined whether students scaffolded by the socio-cognitive prompts will use more socio-emotionally enhanced behaviors than students without any support of prompts. The second planned comparison examined whether the socio-cognitive prompts condition will result in a greater number of socio-emotionally enhanced behaviors than the cognitive prompts condition.

Table 4.5

*Intercorrelations for Socio-Emotionally Enhanced Behaviors*

| | Affective Behavior Density | Supportive Behavior Density | Cohesive Behavior Density |
|---|---|---|---|
| Affective Behavior Density | - | | |
| Supportive Behavior Density | .466** | - | |
| Cohesive Behavior Density | .594** | .739** | - |

** $p < 0.01$ level (2-tailed)

As reported in Table 4.5, the inter-correlations between the dependent variables were ranged from $r = .466$ to $r = .739$ and significant at alpha level .01. Therefore, it is reasonable to perform multivariate tests for planned comparisons. No alpha level was adjusted because these comparisons were planned a priori, and the total number of the planned contrasts did not exceed the degree of freedom associated with the independent variables.

### *Assumptions.*

Prior to the planned comparison analyses, the assumptions for a one-way multivariate analysis of variance (MANOVA) were checked. For both planned comparisons, there was no univariate outlier with standardized scores in excess of 3.29 at $p < .001$. No multivariate outliers were found in either planned comparisons, with Mahalanobis distances in excess of the critical value, 16.27 (with three variables) at $p < .001$. The skewness (2.31) and kurtosis (5.80) of the affective behaviors by the cognitive prompts condition indicated of the possibility of non-normality. The skewness (2.39) and kurtosis (5.22) of the affective behaviors by the control condition also indicated the possibility of non-normality. Several histograms, expected normal probability plots, and detrended normal probability plots also suggested some departures from normal distributions. Shaprio-Wilk (S-W) tests were conducted to test the normality of distributions because the sample size is smaller than 50. The results of the S-W tests are summarized in Table 4.6.

Table 4.6

*Shaprio-Wilk Tests of Socio-Emotionally Enhanced Behavior Density by Condition*

| Outcome | Shaprio-Wilk | | |
|---|---|---|---|
| | Control | Cognitive | Socio-Cognitive |
| Affective Behavior Density | .664** | .693* | .990 |
| Supportive Behavior Density | .951 | .958 | .922 |
| Cohesive Behavior Density | .532** | .736* | .899 |

* $p < .05$
** $p < .001$

As shown in Table 4.6, the results of the S-W tests indicate that the affective behaviors and the cohesive behaviors of the control condition and the cognitive prompts condition are not normally distributed. Even after transforming the data, the problems still remained. Since the non-normality was not caused by outliers, the original data set was used.

All pairs of dependent variables for each level of PAS were considered to be linearly related because there was no suggestion of nonlinearity in any of the within-group scatterplots. Levene's test for homogeneity of variance detected significant differences in error variances of the supportive behaviors between the control condition and the socio-cognitive prompts condition; $F(1, 18) = 37.156$, $p < .05$. Between the cognitive prompts condition and the socio-cognitive prompts condition the homogeneity of variance assumption was also violated for the supportive behaviors, $F(1, 18) = 19.515$, $p < .05$, and for the cohesive behaviors, $F(1, 18) = 11.850$, $p < .05$. Box's M test was used to assess the homogeneity of variance-covariance matrices. The results for both planned comparisons were not significant, suggesting the homogeneity of variance-covariance matrices: $F(6, 1489.506) = 2.945$, $p > .001$ for the first comparison and $F(6, 1489.506) = 2.030$, $p > .001$ for the second comparison. There was no serious violation of

multicollinearity because the correlations between dependent variables were less than .80. In sum, the assumptions of homogeneity of variance-covariance, linearity, and multicollinearity were satisfactory, and the assumptions of normality and homogeneity of variance were violated to a certain extent. Due to the violation of assumption of normality and homogeneity of variance, Pillai's trace was chosen to determine the significance of the multivariate test in this section because it is the most robust criterion among four possible tests (see Tabachnick & Fidell, 2001).

### *Multivariate planned comparisons.*

The results of multivariate and univariate tests for planned comparisons are summarized in Table 4.7. The multivariate test for the planned comparison between the socio-cognitive prompts condition and the control condition was significant by Pillai's criterion, $F(3, 16) = 17.008$, $p = .000$, Pillai's Trace = .761. Using partial $\eta^2$ as a measure of effect size, the results indicated a strong association between prompts-based argumentation scaffolds and socio-emotionally enhanced behaviors because PAS accounted for 76.1% of the total variance of the combined socio-emotionally enhanced behaviors. The results of corresponding univariate analyses indicated that there are significant statistical differences in supportive behaviors between the socio-cognitive prompts and the control conditions, $F(1, 18) = 14.233$, $p = .001$, partial $\eta^2 = .442$, and cohesive behaviors, $F(1, 18) = 47.346$, $p = .000$, partial $\eta^2 = .725$. The effects of socio-cognitive prompts and cognitive prompts on affective behaviors were not significant, but nearly so, at $F(1, 18) = 4.006$, $p = .061$, partial $\eta^2 = .182$. Specifically, students scaffolded by the socio-cognitive prompts had a higher density measure for cohesive

behaviors ($M$ = 12.586) than students without any support of prompts ($M$ = 1.123), with a mean difference of 11.463 ($p$ = .000). For supportive behaviors, students scaffolded by the socio-cognitive prompts ($M$ = 12.240) also had a higher density measure for supportive behaviors than students without any support of prompts ($M$ = 4.080), with a mean difference of 8.160 ($p$ = .001). With regard to affective behaviors, the socio-cognitive prompts condition ($M$ = 4.471) resulted in a higher density measure for affective behaviors than the control condition ($M$ = 1.983), with a mean difference of 2.489 ($p$ = .061).

Table 4.7

*Multivariate and Univariate Tests for Two Planned comparisons for Socio-Emotionally Enhanced Behaviors*

| | Df | *MS* | *F* | *P* | Partial Eta Squared |
|---|---|---|---|---|---|
| 1st Planned Comparison (Socio-cognitive prompts vs. Control) | | | | | |
| Multivariate Test[a] | 3, 16 | | 17.008 | .000 | .761 |
| Univariate Tests | | | | | |
| Affective Behaviors | 1, 18 | 29.731 | 4.006 | .061 | .182 |
| Supportive Behaviors | 1, 18 | 319.611 | 14.233 | .001 | .442 |
| Cohesive Behaviors | 1, 18 | 630.713 | 47.346 | .000 | .725 |
| 2nd Planned Comparison (Socio-cognitive prompts vs. Cognitive prompts) | | | | | |
| Multivariate Test[b] | 3, 16 | | 16.512 | .000 | .756 |
| Univariate Tests | | | | | |
| Affective Behaviors | 1, 18 | 31.304 | 4.359 | .051 | .195 |
| Supportive Behaviors | 1, 18 | 161.055 | 6.318 | .022 | .260 |
| Cohesive Behaviors | 1, 18 | 589.678 | 47.907 | .000 | .727 |

[a] Pillai's Trace = .761
[a] Pillai's Trace = .756

With the Pillai's criterion, the multivariate test for the planned comparison between the socio-cognitive prompts condition and the cognitive condition was found to be significant, $F(3, 16) = 16.512$, $p = .000$, Pillai's Trace = .756. There was a strong association between PAS and socio-emotionally enhanced behaviors because PAS accounted for 75.6% of the total variance of the combined socio-emotionally enhanced behaviors, partial $\eta^2 = .756$. The results of the corresponding univariate analyses indicated that there are significant statistical differences in supportive behaviors between the socio-cognitive and the cognitive conditions, $F(1, 18) = 6.318$, $p = .022$, partial $\eta^2 = .260$ and cohesive behaviors $F(1, 18) = 47.907$, $p = .000$, partial $\eta^2 = .727$. The effects of cognitive and socio-cognitive prompts on affective behaviors was not significant but nearly so, $F(1, 18) = 4.359$, $p = .051$, partial $\eta^2 = .195$. Specifically, students scaffolded by the socio-cognitive prompts had a higher density measure for cohesive behaviors ($M = 12.586$) than students scaffolded by the cognitive prompts ($M = 1.502$), with a mean difference of 11.084 ($p = .000$). For supportive behaviors, students scaffolded by the socio-cognitive prompts ($M = 12.240$) also had a higher density measure for supportive behaviors than students scaffolded by the cognitive prompts ($M = 6.448$), with a mean difference of 5.792 ($p = .022$). With regard to affective behaviors, the socio-cognitive prompts condition ($M = 4.471$) resulted in a higher density measure for affective behaviors than the cognitive prompts condition ($M = 1.918$), with a mean difference of 2.554 ($p = .051$).

## *Argument Behaviors*

| |
|---|
| RH2. There will be differences of argument behaviors across conditions (i.e. the control condition, the cognitive prompts condition, and the socio-cognitive prompts condition). |

### *Overview.*

In this section, the effects of prompts-based argumentation scaffolds on students' argument behaviors will be reported. To get a quantitative measure of students' argument behaviors, the online postings generated by participants during the dyadic discussion phase were collected and coded based on the coding scheme for argument behaviors.

Average coded meaning units for argument behaviors generated by students, excluding initial theory building arguments, were 4.08 for the control condition, 4.50 for the cognitive prompts condition, and 4.63 for the socio-cognitive prompts condition. Descriptive statistics for the frequency of argument behaviors are summarized in Table 4.8. Challenging, counter-challenging, and elaborating arguments were the most frequent type of arguments generated by students in the control condition. Students in the cognitive prompts condition most frequently generated challenging and counter-challenging arguments, whereas students in the socio-cognitive prompts condition most frequently generated challenging and agreeing arguments.

Table 4.8

*Descriptive Statistics for Argument Behaviors by Condition*

| Condition | N | | Argument Behaviors | | | | |
|---|---|---|---|---|---|---|---|
| | | | CH[a] | CC[b] | IN[c] | AG[d] | EL[e] |
| Control | 12 | *M* | 1.50 | 1.08 | .25 | .17 | 1.08 |
| | | *(SD)* | (.91) | (.90) | (.62) | (.39) | (1.24) |
| | | *Skewness* | .44 | .71 | 2.56 | 2.06 | .85 |
| | | *Kurtosis* | -.33 | .53 | 6.24 | 2.64 | -.88 |
| Cognitive | 12 | *M* | 1.83 | 1.25 | .42 | .50 | .50 |
| | | *(SD)* | (.72) | (.62) | (.67) | (.52) | (.52) |
| | | *Skewness* | .26 | -.17 | 1.46 | .00 | .00 |
| | | *Kurtosis* | -.69 | -.09 | 1.39 | -2.44 | -2.44 |
| Socio-cognitive | 8 | *M* | 1.38 | .62 | .62 | 1.62 | .38 |
| | | *(SD)* | (1.06) | (.74) | (.74) | (1.41) | (.74) |
| | | *Skewness* | -.05 | .82 | .82 | .48 | 1.95 |
| | | *Kurtosis* | -.94 | -.15 | -.15 | -.56 | 3.21 |

*Note.* [a] CH = Challenging, [b] CC = Counter-challenging, [c] IN = Integrating, [d] AG = Agreeing, [e] EL = Elaborating

In order to compare students' argument behaviors without being affected by the total number of argument behaviors, the frequency of argument behaviors was translated into the percentage of the total number of argument behaviors. Below is the formula used to calculate each argument behavior as a percentage of the totality of argument behaviors.

$$\text{Argument behavior as a percentage} = \frac{\text{Total number of each argument behavior}}{\text{Total number of all argument behaviors}} \times 100$$

Figure 4.2 illustrates the breakdown of argument behaviors as a percentage by condition.

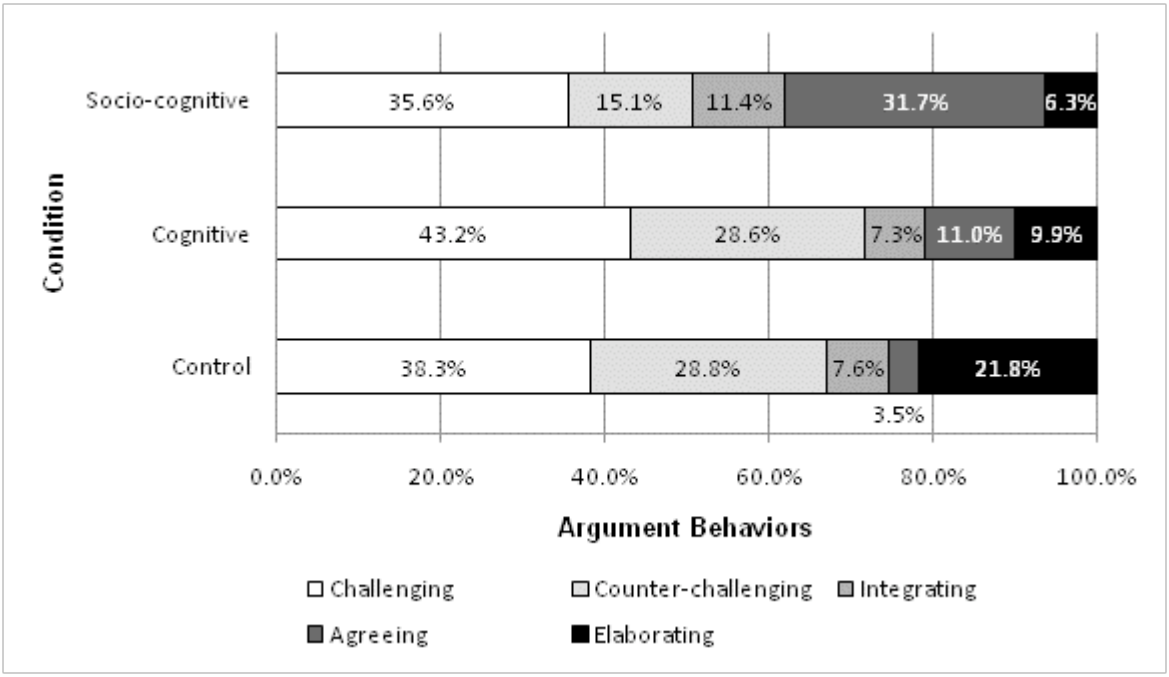



Figure 4.2 Breakdown of Argument Behaviors as a Percentage by Condition

As shown in Table 4.8 and Figure 4.2, students scaffolded by the socio-cognitive prompts generated more integrating ($M$ = .62, 11.35%) and agreeing arguments ($M$ = 1.62, 31.67%) whereas their counterparts engaged in more challenging ($M$ = control: 1.50, 38.33%; cognitive prompts: $M$ = 1.83, 43.23%) and counter-challenging arguments ($M$ = control: 1.08, 28.75%; cognitive prompts: $M$ = 1.25, 28.57%). Students who received no prompts made a greater number of elaborating arguments ($M$ = 1.08, 28.81%) than their counterparts (cognitive prompts: $M$ = .50, 9.88%; socio-cognitive prompts: $M$ = .38, 6.25%).

A one-way MANOVA was performed to investigate differences in argument behaviors across conditions. The independent variable was the classification by prompts condition:  no prompts, cognitive prompts, and socio-cognitive prompts. The dependent

variables were five argument behaviors: challenging, counter-challenging, integrating, agreeing, and elaborating arguments.

Table 4.9

*Intercorrelations for Argument Behaviors*

| | CH [a] | CC [b] | IN [c] | AG [d] | EL [e] |
|---|---|---|---|---|---|
| Challenging | - | | | | |
| Counter-challenging | -.452** | - | | | |
| Integrating | -.151 | -.149 | - | | |
| Agreeing | -.436* | -.155 | .323 | - | |
| Elaborating | -.042 | -.014 | -.153 | .056 | - |

*Note.* [a] CH = Challenging, [b] CC = Counter-challenging, [c] IN = Integrating, [d] AG = Agreeing, [e] EL = Elaborating
** $p < 0.01$ level (2-tailed)
** $p < 0.05$ level (2-tailed)

As reported in Table 4.9, the inter-correlations between the dependent variables were ranged from $r = -.042$ to $r = -.452$. Only two inter-correlations were significant. Since they are somewhat correlated, a MANOVA test was performed.

### *Assumptions.*

Before conducting the MANOVA, the assumptions for MANOVA were checked. First, no univariate or multivariate outliers were identified. With regard to the normality assumption, graphic devices such as histograms, expected normal probability plots, and detrended normal probability plots and numeric values of skewness and kurtosis suggested the non-normality of several distributions. Shaprio-Wilk (S-W) tests were

conducted to test the normality of distributions because the sample size is smaller than 50. The results of S-W tests are summarized in Table 4.10.

Table 4.10

*Shaprio-Wilk Tests of Argument Behaviors in Percentage by Condition*

| Outcome | Shaprio-Wilk | | |
|---|---|---|---|
| | Control | Cognitive | Socio-cognitive |
| Challenging behaviors | .867 | .818* | .912 |
| Counter-challenging behaviors | .865 | .780* | .798* |
| Integrating behaviors | .479* | .674* | .798* |
| Agreeing behaviors | .465* | .650* | .934 |
| Elaborating behaviors | .764* | .650* | .601* |

* $p < .05$

As shown in Table 4.10, a number of distributions were not normally distributed. Despite the violation of the normality assumption, the data were kept intact because it was not caused by outliers and MANOVA is fairly robust with regard to the violation of normality assumption.

All pairs of dependent variables for each level of PAS were linearly related. Levene's test for homogeneity of variance detected a significant difference in error variance of the agreeing behaviors across conditions at alpha level .05. The assumption of homogeneity of variance-covariance matrices was satisfactory because the result of Box's M test was $F(30, 1896.363) = 1.215$, $p > .001$. Bivariate correlations among dependent variables were conducted to check for mulicollinearity, and no serious violation was noted.

Due to the violation of assumptions of normality and homogeneity of variance, Pillai's trace was chosen to determine the significance of the MANOVA in this section

because it is the most robust criterion among four tests (see Tabachnick & Fidell, 2001). Post-hoc tests were then conducted on significant MANOVA results.

### *MANOVA, Post-Hoc Univariate F tests, Stepdown Analysis.*

The multivariate test is significant by Pillai's criterion, $F(10, 52) = 2.989$, $p = .005$, Pillai's Trace = .73, partial $\eta^2 = .37$. The association between PAS and the combined argument behaviors was moderate because PAS accounted for 37% of the total variance of the combined argument behaviors.

Since Bartlett's test of sphericity suggested the correlated dependent variables but prioritizing them cannot be easily done on theoretical grounds, both post-hoc univariate *F* tests and a Roy-Bargmann stepdown analysis with a Bonferroni adjusted alpha level of .01 were performed to better interpret the effects of PAS on each argument behavior. For the stepdown analysis, dependent variables were prioritized in order of univariate significance, resulting in the order of agreeing, elaborating, counter-challenging, challenging, and integrating behaviors. Prior to conducting the stepdown analysis, the homogeneity of regression assumptions was tested and achieved for all procedures of the stepdown analysis (for EL, $F(2, 26) = .33$, $p > .01$; for CC, $F(4, 23) = .22$, $p > .01$; for CH, $F(6, 20) = .48$, $p > .01$; for IN, $F(8, 17) = .73$, $p > .01$). The results of post-hoc univariate *F* tests are summarized in Table 4.11, and the results of the stepdown analysis are summarized in Table 4.12.

Table 4.11

*Univariate ANOVA Tests for Argument Behaviors*

| Source | Dependent Variable | Sum of Squares | df | *Mean Square* | *F* | *p* | Partial Eta Squared |
|---|---|---|---|---|---|---|---|
| Between Groups | CH [a] | 1.177 | 2 | .589 | .757 | .478 | .050 |
| | CC [b] | 1.927 | 2 | .964 | 1.640 | .212 | .102 |
| | IN [c] | .677 | 2 | .339 | .753 | .480 | .049 |
| | AG [d] | 10.677 | 2 | 5.339 | 8.350* | .001 | .365 |
| | EL [e] | 3.083 | 2 | 1.542 | 1.879 | .171 | .115 |
| Within Groups | CH [a] | 22.542 | 29 | | | | |
| | CC [b] | 17.042 | 29 | | | | |
| | IN [c] | 13.042 | 29 | | | | |
| | AG [d] | 18.542 | 29 | | | | |
| | EL [e] | 23.792 | 29 | | | | |

*Note.* [a] CH = Challenging, [b] CC = Counter-challenging, [c] IN = Integrating, [d] AG = Agreeing, [e] EL = Elaborating
* $p < .01$

Table 4.12

*Roy-Bargmann Stepdown for Argument Behaviors*

| Dependent Variable | Source | Sum of Squares | df | *Mean Square* | *F* | *p* | Partial Eta Squared |
|---|---|---|---|---|---|---|---|
| AG [d] | Condition | 10.677 | 2 | 5.339 | 8.350 | .001 | .365 |
| | Error | 18.542 | 29 | .639 | | | |
| EL [e] | AG | 1.915 | 1 | 1.915 | 2.451 | .129 | .080 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Condition | 4.914 | 2 | 2.457 | 3.145 | .059 | .183 |
| | Error | 21.877 | 28 | .781 | | | |
| CC [b] | EL | .013 | 1 | .013 | .020 | .889 | .001 |
| | AG | .006 | 1 | .006 | .010 | .922 | .000 |
| | Condition | 1.475 | 2 | .737 | 1.169 | .326 | .080 |
| | Error | 17.027 | 27 | .631 | | | |
| CH [a] | CC | 6.728 | 1 | 6.728 | 17.052 | .000 | .396 |
| | EL | .225 | 1 | .225 | .570 | .457 | .021 |
| | AG | 5.309 | 1 | 5.309 | 13.456 | .001 | .341 |
| | Condition | 2.388 | 2 | 1.194 | 3.026 | .066 | .189 |
| | Error | 10.258 | 26 | .395 | | | |
| IN [c] | CH | .149 | 1 | .149 | .323 | .575 | .013 |
| | CC | .325 | 1 | .325 | .705 | .409 | .027 |
| | EL | .315 | 1 | .315 | .684 | .416 | .027 |
| | AG | .388 | 1 | .388 | .841 | .368 | .033 |
| | Condition | .123 | 2 | .062 | .134 | .875 | .011 |
| | Error | 11.529 | 25 | .461 | | | |

*Note.* [a] CH = Challenging, [b] CC = Counter-challenging, [c] IN = Integrating, [d] AG = Agreeing, [e] EL = Elaborating

According to the univariate ANOVA tests, there were no significant mean differences in challenging, counter-challenging, integrating, or elaborating argument behaviors among conditions. However, there is a significant statistical difference in the agreeing arguments, $F(2, 29) = 8.350$, $p = .001$, partial $\eta^2 = .365$. The stepdown analysis for effects of PAS on the agreeing arguments was also significant, stepdown $F(2, 29) = 8.350$, $p = .001$, partial $\eta^2 = .365$. Specifically, students scaffolded by the socio-cognitive

prompts ($M$ = 1.62) generated significantly more agreeing arguments than students without any prompts ($M$ = .17), with a mean difference of 1.46 ($p$ = .001). Students scaffolded by the socio-cognitive prompts also generated significantly more agreeing arguments than students scaffolded by the cognitive prompts ($M$ = .50), with a mean difference of 1.12 ($p$ = .013).

### *Performance level of argument behaviors.*

To check the performance level of each argument behavior, in particular agreeing argument behavior, a quality index of argumentation performance for each argument behavior was created. The use of the quality index allows a researcher to check the average performance level of an argument behavior, a measurement which is not affected by the number of students in each condition. Below is the formula used to calculate the index.

$$\text{Quality index of argument performance for each argument behavior} = \frac{\text{Sum of performance scores for an argument behavior}}{\text{Total number of the corresponding argument behavior}}$$

Performance levels of argument behaviors are summarized in Table 4.13.

Table 4.13

*Performance Levels of Argument Behaviors by Condition*

| Condition | | Argument Behavior | | | | |
|---|---|---|---|---|---|---|
| | | CH[a] | CC[b] | IN[c] | AG[d] | EL[e] |
| Control | Frequency | 18 | 13 | 3 | 2 | 13 |
| | Sum of Performance Scores | 43 | 31 | 9 | 3 | 28 |
| | Quality Index | 2.39 | 2.38 | 3.00 | 1.50 | 2.15 |
| Cognitive | Frequency | 22 | 15 | 5 | 6 | 6 |
| | Sum of Performance Scores | 59 | 40 | 10 | 14 | 14 |
| | Quality Index | 2.68 | 2.67 | 2.00 | 2.33 | 2.33 |
| Socio-cognitive | Frequency | 11 | 5 | 5 | 13 | 3 |
| | Sum of Performance Scores | 29 | 12 | 13 | 33 | 8 |
| | Quality Index | 2.64 | 2.40 | 2.60 | 2.54 | 2.67 |

*Note.* [a] CH = Challenging, [b] CC = Counter-challenging, [c] IN = Integrating, [d] AG = Agreeing, [e] EL = Elaborating

As shown in Table 4.13, the quality index of agreeing argument behaviors for the socio-cognitive prompts condition is 2.54. Given that performance scores range from 1 to 3, the agreeing arguments observed in the socio-cognitive prompts condition were of high quality, indicating that students provided substantial reasons for their agreement with their partner's previous argument.

## *Argumentation Performance*

| |
|---|
| RH3-1. The overall quality of argumentation performance of students in the scaffolded |

discussion conditions (i.e., the cognitive prompts condition and socio-cognitive prompts condition) will be better than that of students in the unscaffolded discussion condition (the control condition).

RH3-2. There will be no statistical difference in the overall quality of argumentation performance between the cognitive prompts condition and the socio-cognitive prompts condition.

*Overview.*

This section reports the effects of PAS on students' argumentation performance scores. Argumentation performance scores were obtained by assessing argument behaviors using a rubric. The performance scores of five argument behaviors were summed and used in the analysis. Descriptive statistics of performance scores for each argument behavior are summarized in Table 4.14.

Table 4.14

*Descriptive Statistics of Performance Scores by Condition*

| | | | Performance Scores | | | | | |
|---|---|---|---|---|---|---|---|---|
| Condition | N | | CH[a] | CC[b] | IN[c] | AG[d] | EL[e] | Total |
| Control | 12 | *M* | 3.58 | 2.58 | .75 | .25 | 2.33 | 9.50 |
| | | *(SD)* | (2.39) | (2.47) | (1.87) | (.62) | (2.64) | (2.71) |
| | | *Skewness* | .93 | 1.06 | 2.56 | 2.56 | .81 | -.05 |
| | | *Kurtosis* | .54 | .83 | 6.24 | 6.24 | -.84 | -1.02 |
| Cognitive | 12 | *M* | 4.92 | 3.33 | .83 | 1.17 | 1.17 | 11.42 |
| | | *(SD)* | (1.98) | (1.72) | (1.34) | (1.27) | (1.27) | (3.12) |
| | | *Skewness* | .48 | .02 | 1.46 | .27 | .27 | .74 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | *Kurtosis* | .24 | .24 | 1.39 | -1.86 | -1.86 | .15 |
| Socio-cognitive | 8 | *M* | 3.62 | 1.50 | 1.62 | 4.12 | 1.00 | 11.88 |
| | | *(SD)* | (2.93) | (1.69) | (1.92) | (3.94) | (1.93) | (4.58) |
| | | *Skewness* | .08 | .36 | .71 | 1.09 | 1.76 | .96 |
| | | *Kurtosis* | -1.23 | -1.98 | -.77 | 1.44 | 2.01 | 1.67 |

*Note.* [a] CH = Challenging, [b] CC = Counter-Challenging, [c] IN = Integrating, [d] AG = Agreeing, [e] EL = Elaborating

A planned contrasts method was used to test a priori hypotheses. The independent variables were the three prompts conditions (i.e., no prompts, cognitive prompts, socio-cognitive prompts). The dependent variable was the summed argumentation performance scores. The first planned contrast examined whether students scaffolded by either the cognitive or socio-cognitive prompts received higher argumentation performance scores than students without any supporting prompts. The second planned contrast examined whether there were any differences in argumentation performance scores between the cognitive prompts condition and the socio-cognitive prompts condition. No alpha level was adjusted because there were only two planned contrasts.

### *Assumptions.*

To start with, no univariate outliers were found. Examination of graphic devices (i.e. histograms and normal Q-Q plots) of argument performance scores within conditions indicated that the argumentation performance scores were in approximately normal distribution. In addition, the measures of skewness and kurtosis for the argumentation performance scores fell within the acceptable range of plus or minus three. With regard to the homogeneity of variance assumption, Levene's test was used and resulted in $F(2, 29)$

= .512, $p > .05$. In sum, the assumptions of normality and homogeneity of variance were satisfactory.

Table 4.15

*Shaprio-Wilk Tests of Argumentation Performance by Condition*

| Outcome | Shaprio-Wilk | | |
|---|---|---|---|
| | Control | Cognitive | Socio-cognitive |
| Argumentation Performance | .289 | .272 | .497 |

### *Planned contrasts.*

Table 4.16 lists the contrast coefficients for the two planned contrasts. The results of the planned contrasts are summarized in Table 4.17 and Table 4.18.

Table 4.16

*Contrast Coefficients for the Planned Contrasts*

| Contrast | Condition | | |
|---|---|---|---|
| | Control | Cognitive | Socio-cognitive |
| 1 | -1 | .5 | .5 |
| 2 | 0 | -1 | 1 |

Table 4.17

*1st Planned Contrast for Argument Performance Scores*

| Contrast | *Value of contrast* | *Std. Error* | *t* | *df* | *Sig. (2-tailed)* |
|---|---|---|---|---|---|
| Cognitive + Socio-cognitive vs. Control | 2.15 | 1.250 | 1.716 | 29 | .098 |

Table 4.18

*2nd Planned Contrast for Argument Performance Scores*

| Contrast | *Value of contrast* | *Std. Error* | *t* | *df* | *Sig. (2-tailed)* |
|---|---|---|---|---|---|
| Socio-cognitive vs. Control | .46 | 1.551 | .296 | 29 | .770 |

The first contrast (comparing the mean of the control condition to the combined means of the cognitive and socio-cognitive prompts conditions), using alpha level .05, resulted in $t(29) = 1.716$, $p = .098$. The results indicate that the mean of argumentation performance scores for the scaffolded discussion conditions (cognitive prompts: $M = 11.42$, $SD = 3.12$; socio-cognitive prompts: $M = 11.88$, $SD = 4.58$) was not statistically different from the mean of performance scores for the unscaffolded condition, the control condition ($M = 9.50$, $SD = 2.71$).

The results of the second contrast (comparing the mean of the socio-cognitive prompts condition to the cognitive prompts condition) was $t(29) = .296$, $p = .770$, failing to reject the null hypothesis. Therefore, the results of the contrast test support the priori prediction: the socio-cognitive prompts are as effective as the cognitive prompts in promoting students' argumentation performance.

## Effects of Prompts-based Argumentation Scaffolds on Reasoning Performance

| | |
|---|---|
| RH4. | Students scaffolded by socio-cognitive prompts will score higher in the post-reasoning performance test than their counterparts (i.e., the control condition |

and the cognitive prompts condition) after controlling for the effect of the pre-reasoning performance scores.

This section reports the effects of prompts-based argumentation scaffolds on students' reasoning performance, measured as a learning outcome in terms of their ability to build an argument within the framework of opposing views. Students' pre- and post-reasoning performance scores, which were obtained by assessing the opinion essays submitted prior to and immediately after the treatment, were used in the analyses. Table 4.19 summarizes the descriptive statistics of the pre- and post-reasoning performance scores by condition. Figure 4.3 illustrates pre-, post-, and adjusted post-reasoning performance scores by condition.

Table 4.19

*Descriptive Statistics of Pre- and Post-Reasoning Performance Scores by Condition*

| Condition | N | | Reasoning Performance Scores | | |
|---|---|---|---|---|---|
| | | | Pre | Post | Adjusted Post |
| Control | 12 | *M* | 1.67 | 3.50 | 3.57 |
| | | *(SD)* | (1.61) | (1.00) | |
| | | *Skewness* | .18 | -.66 | |
| | | *Kurtosis* | -1.62 | -.76 | |
| Cognitive | 12 | *M* | 3.17 | 3.33 | 3.04 |
| | | *(SD)* | (1.03) | (1.50) | |
| | | *Skewness* | .211 | -.88 | |
| | | *Kurtosis* | -1.14 | -.73 | |
| Socio-cognitive | 8 | *M* | .62 | 2.12 | 2.45 |
| | | *(SD)* | (.74) | (1.46) | |
| | | *Skewness* | .82 | -.65 | |
| | | *Kurtosis* | -.15 | -.73 | |

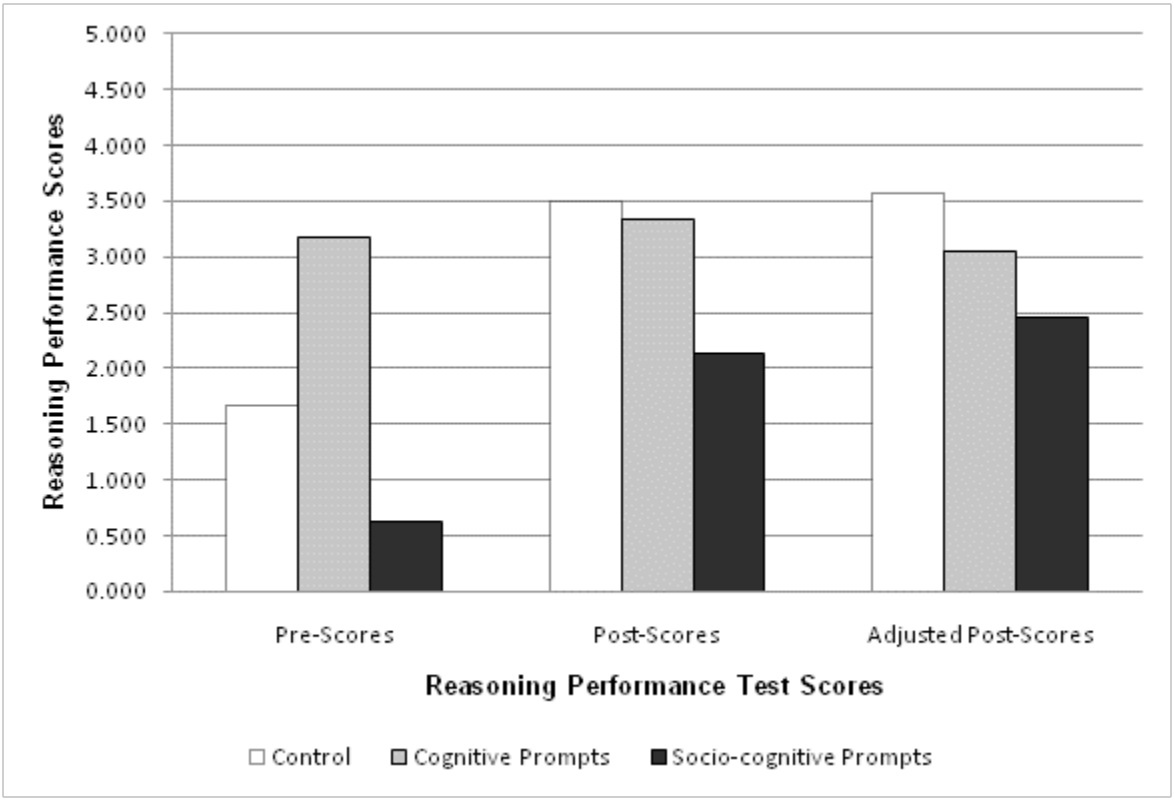



Figure 4.3 Pre- and Post- Reasoning Performance by Condition

As shown in Table 4.19 and Figure 4.3, there was a statistically significant difference in the pre-reasoning performance scores (pre-test) among the three conditions, $F(2, 29) = 10.745$, $p < .001$, Partial $\eta^2 = .426$. Interestingly, the adjusted marginal means for the post-reasoning performance scores show that the control condition (Adjusted $M$ = 3.57) slightly outperformed both the cognitive prompts condition (Adjusted $M$ = 3.04) and the socio-cognitive prompts condition (Adjusted $M$ = 2.45).

To test the effects of prompts-based argumentation scaffolds on post-reasoning performance while controlling for pre-reasoning performance in the dependent variable, the data were analyzed by means of a one-way analysis of covariance (ANCOVA).

According to Maxwell and Delaney (2004), the use of ANCOVA in the case of 'unhappy randomization' is likely to reduce both the conditional and the unconditional Type I error rate and to increase explanatory power through reduced error.

### *Assumptions.*

Prior to the analysis, the assumptions for ANCOVA were examined. There was no univariate outlier with standardized scores in excess of 3.29 at $p < .001$. The normality assumption was granted because the skewness and kurtosis of the distributions, as shown in Table 4.6, fell within an acceptable range of plus or minus three. On the basis of within-group scatterplots, the assumption of linearity was found to be satisfactory. The Levene's test indicated that the assumption of homogeneity of variance for the dependent variable was satisfactory ($F(2, 29)=1.36$, $p > .05$). As for the covariate, the variance ratio of the covariate was ($F_{max}$) = 4.70, much below the criterion of 10, and the sample size ratio was 1.5, less than 4:1, indicating that the homogeneity of variance assumption for the covariate was satisfactory. The interaction between the treatments and the covariate was not significant, $F(2, 26) = .16$, $p = .853$, Partial $\eta^2 = .012$, indicating no violation of homogeneity of regression.

### *ANCOVA.*

The results of ANCOVA indicated that the covariate pre-reasoning performance scores did not have a significant effect on post-reasoning performance scores, $F(1, 28) = 1.52$, $p = .229$. This was not surprising because pre-reasoning performance scores were not significantly related to post-reasoning performance scores, $r(30) = .34$, $p > .05$. More

important, the results showed that PAS did not significantly affect post-reasoning performance scores $F(2, 28) = 1.712$, $p > .05$, Partial $\eta^2 = .11$, after controlling for the effect of pre-reasoning performance scores. Due to the insignificant omnibus *F* test results, no further analysis was conducted. The results of ANCOVA are summarized in Table 4.20.

Table 4.20

*Univariate Analysis of Covariance for Post-Reasoning Performance Scores*

| Source | Sum of Squares | *df* | Mean Square | *F* | Sig. | Partial Eta Squared |
|---|---|---|---|---|---|---|
| Pre-Reasoning Performance Scores | 2.594 | 1 | 2.594 | 1.515 | .229 | .051 |
| Prompts-Based Argumentation Scaffolds | 5.842 | 2 | 2.921 | 1.706 | .200 | .109 |
| Error | 47.948 | 28 | 1.712 | | | |

## Effects of Prompts-based Argumentation Scaffolds on Feelings of Group Community

RH5. Students scaffolded by socio-cognitive prompts will report a higher level of group community than their counterparts (i.e., the control condition and the cognitive prompts condition).

In this section, the effects of prompts-based argumentation scaffolds on students' feelings of group community will be reported. Participants' responses to Group

Community Scale (GCS) on a 7-point Likert scale were used to test the hypothesis. A composite score of connectedness and learning was used to represent students' feelings of group community because the two subscales were highly correlated, $r = .774$, $p < .01$. The descriptive statistics for the connectedness and learning subscales by condition are displayed in Table 4.21. Figure 4.4 illustrates connectedness and learning by condition.

Table 4.21

*Descriptive Statistics on Connectedness and Learning by Condition (N=32)*

| Condition | N | | Sub-scale of GCS | | |
|---|---|---|---|---|---|
| | | | Connectedness | Learning | Total (GCS) |
| Control | 12 | *M* | 47.33 | 51.67 | 99.00 |
| | | *(SD)* | (11.33) | (9.63) | (19.38) |
| | | *Skewness* | -.85 | -.70 | -.75 |
| | | *Kurtosis* | -.33 | .47 | -.10 |
| Cognitive | 12 | *M* | 48.58 | 50.92 | 99.50 |
| | | *(SD)* | (8.9) | (8.57) | (17.30) |
| | | *Skewness* | -.03 | -.60 | -.29 |
| | | *Kurtosis* | -.74 | .36 | -.31 |
| Socio-cognitive | 8 | *M* | 55.62 | 55.62 | 111.25 |
| | | *(SD)* | (8.52) | (7.87) | (14.61) |
| | | *Skewness* | .24 | -.09 | -.03 |
| | | *Kurtosis* | -.24 | -1.09 | -.84 |

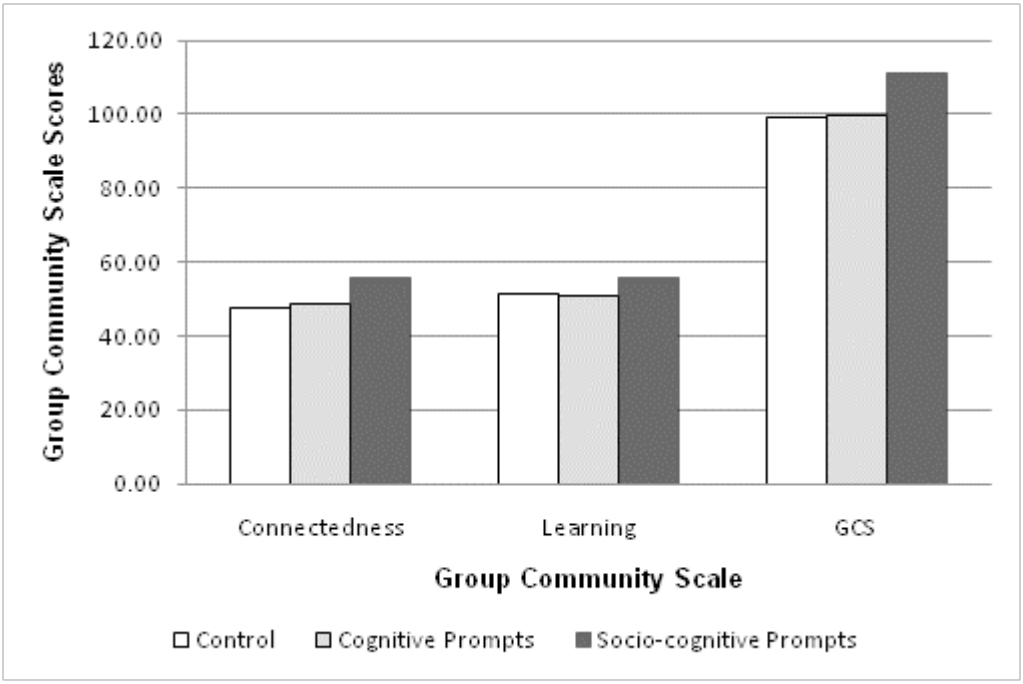



Figure 4.4 Group Community Scale (Connectedness and Learning) by Condition

As shown in Table 4.20 and Figure 4.4, the mean of feelings of group community for students scaffolded by the socio-cognitive prompts was 111.25 (*SD* = -14.61), which is higher than the means of their counterparts (control: *M* = 99.00; cognitive prompts: *M* = 99.50).

To examine the effect of prompts-based argumentation scaffolds on students' feelings of group community, a one-way analysis of variance (ANOVA) was performed using SPSS 16.0 on GCS. The independent variables were the three prompts-based argumentation scaffolds conditions: no prompts, cognitive prompts, and socio-cognitive prompts. Any profile variables were significantly associated with the dependent variables at alpha level .05. As such, no covariate was used in examining this research question.

*Assumptions.*

No univariate outliers were found. Examination of graphic devices (i.e. histograms and normal Q-Q plots) for GCS within conditions indicated that the GCS scores were in approximately normal distribution. In addition, the measures of skewness and kurtosis for the GCS scores fell within the acceptable range of plus or minus three. With regard to the homogeneity of variance assumption, Levene's test was used and resulted in $F(2, 29) = .279$, $p > .05$. In sum, the assumptions of normality and homogeneity of variance were satisfactory.

*ANOVA.*

The results of ANOVA showed that there were no significant differences in students' feelings of group community between the three conditions, $F(2, 29) = 865.500$, $p > .05$, Partial $\eta^2 = .089$. Due to the insignificant omnibus $F$ test results, no further analysis was conducted. The results of ANOVA are summarized in Table 4.22.

Table 4.22

*Univariate Analysis of Variance for Feelings of Group Community*

| Source | Sum of Squares | *df* | Mean Square | *F* | Sig. | Partial Eta Squared |
|---|---|---|---|---|---|---|
| Prompts-based Argumentation Scaffolds | 865.500 | 2 | 432.750 | 1.408 | .261 | .089 |
| Error | 8912.500 | 29 | 307.328 | | | |

# CHAPTER V

# DISCUSSION AND CONCLUSION

This chapter begins with a summary of major findings. Each finding is then discussed one by one in conjunction with the conceptual framework of the current study and literature. To avoid any overgeneralization of the findings, the limitations and weaknesses of the study are also pointed out. After that, theoretical and practical implications of the findings of the study are discussed with respect to computer-supported collaborative argumentation. Finally, research questions and suggestions for future research are discussed.

## Summary of Major Findings

This study explored the effects of prompts-based argumentation scaffolds on peer-led argumentation, individuals' justification of their opinions, and their feelings of group community. The primary interest of this study was the differential effects of cognitive and socio-cognitive prompts. The cognitive prompts were designed to induce students to generate more task-oriented messages, which are likely to create a competitive argumentative environment, during online argumentation. The socio-cognitive prompts, on the other hand, were designed to induce students to generate more socio-emotionally enhanced task-oriented messages, which are likely to contribute to building a warm and supportive argumentative environment, during online argumentation. The rationale of the study was that the communication style of a discussant (task-oriented vs. socio-emotionally supportive communication) is likely to influence a discussion partner's

argumentation. Learning is dependent on not only what is discussed but also how it is discussed.

Overall, this study shows that the design of prompts can have significant effects on students' written communication style. As expected, the socio-cognitive prompts did promote increased student use of socio-emotionally enhanced strategies in a relatively short period of time. Specifically, students scaffolded by the socio-cognitive prompts included socio-emotionally enhanced strategies in their written messages far more than did students in any other conditions.

With regard to argument behaviors, students in the socio-cognitive prompts condition engaged in agreeing activities more than their counterparts. This alone, however, does not really tell whether students accommodate multiple sides of an issue through meaningful argumentation or they agreed each other just to avoid any conflict. This, therefore, should be interpreted in conjunction with other argument behaviors and the quality of each argument behavior (argumentation performance). With regard to the overall argumentation performance, students better performed in overall argumentation when they received any types of prompts than they did not receive prompts. The differences, however, were not statistically significant.

Interestingly, prompts-based argumentation scaffolds have a negative effect on students' adjusted reasoning performance scores. Although the mean differences across conditions were not statistically significant, these interesting results deserve further explanation and will be discussed in details later in this chapter.

Lastly, students in the socio-cognitive prompts condition reported a higher level of group community than their counterparts did, but this was not statistically significant.

# Discussion

## *Effects of Prompts-based Argumentation Scaffolds on Socio-Emotionally Enhanced Behaviors*

The first research question concerned the effect of prompts-based argumentation scaffolds on students' written communication styles, represented as the degree of socio-emotionally enhanced strategies used in their online messages. The result shows that the design of prompts can have substantial effects on students' written communication styles. Specifically, the socio-cognitive prompts increased students' socio-emotionally enhanced strategies use, in particular the use of supportive and cohesive strategies, in online argumentation within a relatively short time. In other words, students scaffolded by the socio-cognitive prompts enriched their online messages by including a greater number of supportive and cohesive strategies than their counterpart did. With regard to affective behaviors, *F* statistics for the main effects of prompts-based argumentation scaffolds on the affective behaviors[10] were nearly significant. Overall, the findings support the assertion that students relying on text-based communication can be trained to project themselves as a real person (Gunawardena, 1995) and to support each other socially and emotionally (Garrison, et al., 2000) through the instructional support. Indeed, students in the current study added socio-emotional components to their messages in a proper manner when they were prompted to do so. In contrast, students rarely used supportive and cohesive strategies when they were not prompted to do so. This tells us that it may

[10] *F* statistics for the main effect of PAS on affective behaviors
Socio-cognitive prompts vs. Control: $F(1, 18) = 4.006$, $p = .061$, partial $\eta^2 = .182$
*S*ocio-cognitive prompts vs. Cognitive prompts: $F(1, 18) = 4.359$, $p = .051$, partial $\eta^2 = .195$

not be easy for online students to use socio-emotionally enhanced strategies without instructional support within a short time. Considering the importance of socio-emotional language (e.g. name referencing, signatures, questions, and I-agree-buts) in eliciting more responses from the other party (Jeong, 2006), the lack of such language use can be problematic for continuing argumentation.

Interestingly, students in the cognitive prompts condition used a polite form of challenging arguments (e.g., "I agree with your point on …, but …", "You made a good point about… However,…", etc.) almost as much as students in the socio-cognitive prompts condition used, whereas the use of such politely challenging arguments in the control condition was less than half of the socio-cognitive prompts condition. There is a possibility that the cognitive prompts aggravated students' "face" concerns, and this led students to preface their disagreement with agreement. Similar findings were also observed in the study conducted by Nussbaum et al. (2004). They found that such mitigated form of disagreement was prevalent in online discussions and attributed it to students' need to maintain harmonious social relationships while asserting their ideas (Nussbaum, et al., 2004).

### *Effects of Prompts-based Argumentation Scaffolds on Argument Behaviors*

The study also examined the effects of prompts-based argumentation scaffolds on students' argument behaviors. The study showed that students across three conditions made a considerable number of opposing arguments because both challenging and counter-challenging arguments accounted for over fifty percent of their total arguments (control: 67.1%; cognitive prompts: 71.8%; socio-cognitive prompts: 50.7%). This result

is inconsistent with previous studies that found the lack of opposing arguments in peer argumentation (e.g. Cho & Jonassen, 2002; Jeong & Joung, 2007; Oh & Jonassen, 2007). The substantial amount of disagreement in all of the conditions found in this study is likely due to the task design. Role-playing was implemented for the dyadic discussion in which each member of a dyad was randomly assigned to be a supporter or an opponent of Internet monitoring. This ensured a disagreement about the given issue. In addition, students might feel that challenging an argument made by their discussion partner would not hurt social relationships because they were role-playing. Entering to confrontational situation may be easier for students when it is through role-playing than their own ideas (Alexopoulou & Driver, 1996). Furthermore, the task instruction provided students with a persuasive goal. Persuasive goals encourage students to engage in confrontational situation. This explanation is supported by Nussbaum's (2005) finding that the persuasion goal resulted in more opposing interactions. The existence of the disagreement about the given issue and the persuasive goal for discussion participants together would have led students to put a considerable effort into challenging and counter-challenging an argument made by the other party.

More important, three prompts conditions, as expected, resulted in some differences in students' argument behaviors. Students in the socio-cognitive prompts condition made more agreeing arguments, and it was statistically significant. Further, the quality of agreeing arguments by the socio-cognitive condition was high. That is, students in the socio-cognitive condition did not agree to the other's party superficially but rather extended the other party's arguments with substantial reasons and evidence along with the expression of agreement. Considerable engagement in both opposing (i.e. challenging

and counter-challenging) and agreeing arguments could be an indicator that students in the socio-cognitive prompts condition did, in fact, critique and consider a variety of arguments, but that they did not rigidly stick to one side. In dyadic discussions, agreeing arguments about a controversial issue can be considered as an example of concession, because the discussion began on a point of disagreement between two discussants. Given the importance of concession in characterizing argumentation as competitive or co-constructive (see Keefer, et al., 2000; Nussbaum, 2005; Resnick, et al., 1993), a considerable incidence of concessions in the form of substantial agreeing arguments by students in the socio-cognitive prompts condition indicates that the style of peer-led argumentation in this condition was somewhat more co-constructive, particularly in terms of consensus building. In contrast, not only was the number of agreeing arguments in the control and cognitive prompts condition fewer to a statistically significant extent, but the considerable incidence of opposing arguments observed in these conditions is indicative of a style of argumentation which was somewhat more competitive.

### *Effects of Prompts-based Argumentation Scaffolds on Overall Argumentation Performance*

The overall argumentation performance scores for the scaffolded discussion conditions (cognitive prompts: $M = 11.42$, $SD = 3.12$; socio-cognitive prompts: $M = 11.88$, $SD = 4.58$) were higher than the scores for the unscaffoled condition (control: $M = 9.50$, $SD = 2.71$). These differences, however, were not statistically significant at alpha level .05, two-tailed ($p = .098$, two-tailed at alpha level .05). In spite of the statistical insignificance, the results of the current study could be taken to imply that student

argumentation performance is improved as a result of prompts-based argumentation scaffolds ($p$ = .049, one-tailed at alpha level .05). Given the small number of subjects used in the analysis and the short treatment time (5 days), the observed differences in performance may well be worthy of note. Previous studies have indicated that it is not easy to improve students' argumentation performance within a short period of time. For example, the treatment in Oh and Jonassen's study (2007) lasted for two weeks, a significantly longer period than the current study (5 days). They did not, however, find any effect of argumentation scaffolds on students' argumentation performance. They argued that the two-week training period might be too short to improve students' argumentation performance.

The results of this study should be interpreted with caution. First, to represent the overall argumentation performance the scores of the five types of argument behaviors were summed and used in the statistical analysis. Therefore, the argumentation performance scores are influenced by the frequency of argument behaviors and the corresponding scores associated with them. As a result, quality argumentation performance does not necessarily mean quality performance across all five types of argument behaviors. In fact, the performance level of argument behaviors indicated that low quality agreeing arguments are the most influential factor in lowering the overall argumentation performance of the students in the control condition. In addition, the coding of argumentation performance scores for elaborating and agreeing arguments were below acceptable inter-coder reliability.

Second, the difference in argumentation performance scores was not statistically significant using a two-tailed t-test at alpha level .05 ($p$ = .098). If it had been tested using

a one-tailed t-test at alpha level .05, the result would be $p = .048$, indicating a marginal, but statistically significant difference in argumentation performance scores as a result of prompts-based argumentation scaffolds received during dyadic discussions. The use of the one-tail t-test increases the power of detecting the significance, particularly when the sample size is extremely small, as in this study. Although the one-tailed t-test can be used when a hypothesis is directional, the study used the two-tailed t-test in order to be stringent. Although there has been theoretical support for using scaffolding as an effective instructional method (see Jonassen, 1999), there has not been enough empirical support for the use of the one-tailed t-test.

Another finding is that the socio-cognitive prompts were as effective as the cognitive prompts in promoting argument performance. This finding is important to note because some may question the design effectiveness of the socio-cognitive prompts in relation to students' working memory load. According to cognitive load theory, our working memory is limited and thus the learning materials should be designed in ways which reduce extraneous cognitive load, especially when intrinsic cognitive load is high (Sweller, van Merrienboer, & Pass, 1998). Making an argument is itself a clearly difficult task. Challenging and counter-challenging others' arguments places heavy demands on working memory. Further, finding a solution that satisfies both sides of a controversial issue is not an easy task. Therefore, it is worthwhile to examine whether enriching a task-oriented message with socio-emotional cues may impose unnecessary, extraneous cognitive load. Certainly, the socio-cognitive prompts require more working memory than the cognitive prompts because the socio-cognitive prompts required students to put extra effort in embedding socio-emotional strategies when composing a task-oriented

message. This process may be considered as interfering with learning because it is likely to increase cognitive load. However, several studies found that the tone of messages affects how people react to them (e.g. Hogan, et al., 2000; Jeong, 2006). For example, Jeong (2006) found that an individual is more likely to explore the content of messages directed at them when the tone of voice is friendly, personal, and supportive. In addition, learning to appreciate the other party's ideas is as important as learning to communicate their own ideas logically and coherently (Stein & Albro, 2001). Therefore, the increase in cognitive load by the socio-emotional cues in the socio-cognitive prompts should not be considered as an increase in unnecessary cognitive load but rather be recognized as necessary and significant.

### *Effects of Prompts-based Argumentation Scaffolds on Reasoning Performance*

Contrary to expectation, students who did not receive any prompts during the dyadic discussion received higher scores than students who received prompts in the post-reasoning performance test, after controlling for the pre-reasoning performance scores. This signifies that students in the control condition considered how opposing views bore on their own point of view to a greater extent than students in the scaffolded conditions. Although the difference in adjusted post-reasoning scores across conditions were not statistically significant, this deserves further explanation.

As shown in Figure 4.2, Breakdown of Argument Behaviors as a Percentage by Condition, students in the control condition put a relatively greater portion of their effort into questioning a partner's ideas and elaborating their own ideas ($M$ = 1.08, $SD$ = 1.24, $P$

= 21.8%) than students in the scaffolded conditions (cognitive prompts: *M* = .50, *SD* = .52, *P* = 9.9%; socio-cognitive prompts: *M* = .38, *SD* = .74, *P* = 6.3%), although the difference was not statistically significant. This phenomenon likely resulted from the fact that their discussions were not scaffolded and they were able to freely discuss their differing positions. Their elaborating arguments were of somewhat high quality (see Table 4.13). The benefit to learning of giving elaborative explanations has been consistently supported by empirical findings in peer learning research (Chinn, et al., 2000). For example, Webb (1992) showed that providing helpful, explanatory elaboration resulted in higher achievement. When students in the current study elaborated their arguments upon request from the other party, they were likely to re-examine their initial argument, clarify its meaning, and elaborate it with further evidence. Each of these activities are clearly beneficial to learning. Receiving elaborated explanations is also helpful in achieving a better understanding of the other party's point of view.

Surprisingly, students in the socio-cognitive prompts condition received the lowest scores on the test. One possible reason for the low performance of the socio-cognitive prompts condition might be explained by the failure of random assignment. As explained in the Participant Profiles section of Chapter 3, there was a statistically significant difference in students' pre-reasoning performance scores. Students in the socio-cognitive prompts condition (*M* = .62, *SD* = .74) did poorly on the pre-reasoning performance test compared to students in the cognitive prompts condition (*M* = 3.17, *SD* = 1.03) and students in the control condition (*M* = 1.67 *SD* = 1.61). Although random assignment, the most rigorous approach for controlling for the extraneous individual variables of subjects during an experimental study (Creswell, 2005), was adopted for the

purpose of assigning students to groups in the current study, this failed to equalize students across conditions, in terms of the relevant variables. Four out of eight students in the socio-cognitive prompts condition developed a one-sided argument in the pre-opinion essay (pre-reasoning performance points = 0). Only one student in the socio-cognitive prompts condition received 2 points in the pre-reasoning performance test. The rest received 1 point. This indicates that most students in the socio-cognitive prompts condition may have been lacking in knowledge regarding their opponents' point of view prior to the dyadic discussion. Or, they might have believed that the consideration of counterarguments in their writing could make their essay less persuasive, as claimed by Santos and Santos (1999). Writing a persuasive argument within the framework of opposing views is not an easy task. In Kuhn's study (1991), only approximately 30 to 40 percent of research participants were able to successfully generate both counterarguments against their own theories and rebuttals to the theories of others when verbally asked to do so. This percentage would almost certainly drop further in the absence of explicit verbal instruction. The failure to include counterarguments in writing has also been noted in other studies (e.g. Leitão, 2003; Perkins, Farady, & Bushey, 1991). Further, Nussbaum and Kardash (2005) found the goal of persuasion has a negative effect on the inclusion of counterarguments in student writing. Although the instructions of both pre- and post-opinion essay tasks specifically informed students that they could include counterarguments in their writing, students might have limited the inclusion of opposing views into their writing intentionally to make the writing more persuasive. A short period of training might not be enough for those lower-level students to develop the ability to write a balanced essay.

### *Effects of Prompts-based Argumentation Scaffolds on Feelings of Group Community*

Although students in the socio-cognitive prompts conditions reported slightly stronger feelings of group community than their counterparts, this was not statistically significant. The study was conducted in the fourth week of the eight-week course. In the first three weeks, students had already gotten to know one another to a certain degree through weekly online discussions. Although the survey directly asked about their feelings with regard to their discussion partner during the week 4 dyadic discussion, their feelings might have been distorted by their prior experience with this person for the previous three weeks.

One thing to note here is that students in all three conditions reported slightly positive feelings of group community. Considering the importance of the role of students' positive feelings towards their learning partner and learning atmosphere in encouraging them to critically explore diverse perspectives and interrelated ideas, online role-playing of interactive argumentation could be an effective means to help students deepen an understanding of the other party's views.

### *Summary of Discussions*

Overall, the design of prompts had some effect on the nature of argumentation in a peer-led context. Students' socio-emotionally enhanced behavior in the context of peer-led interactive argumentation was effectively scaffolded using prompts within a relatively short period of time.The socio-cognitive prompts condition resulted in a relatively more co-constructive style of argumentation, in which students critiqued different arguments

and reached some level of consensus, than the other conditions. On the other hand, the cognitive and control conditions resulted in a relatively more competitive style of argumentation, in which students subjected their opponents arguments to criticism and attempted to prove their points of view. This does not indicate, however, that the former was entirely co-constructive and the latter was entirely competitive, because peer-led discussions may or may not remain within a single style of argumentation (Keefer, et al., 2000; Steinkuehler, 2001). A thorough examination of why more productive discussions were observed for the socio-cognitive prompts condition is beyond the scope of this study. The results of the study, however, indicate that a supportive atmosphere is a contributing factor to the convergence of divergent positions in peer-led argumentation. It is possible that a message reflecting the employment of positive socio-emotional strategies can be too personal, social, and/or polite to argue against. However, the considerable level of opposing arguments (challenging and counter-challenging) observed in the socio-cognitive prompts condition implies that such an effect is not significant.

With regard to argumentation performance, the study provided equivocal support for the claim that prompts-based argumentation scaffolds effectively promote students' argumentation performance ($p = .098$, two-tailed). The results of the study showed that there were not statistically significant differences in students' reasoning performance as a result of prompts-based argumentation scaffolds. Even though the results showed no statistically significant difference, there is some support for the idea that the prompts improve argumentation performance. The study also found that students' feelings of group community did not significantly differ across conditions. However, the slightly

stronger positive feelings of group community by students in the socio-cognitive prompts condition may be worthy of note.

## Limitations of the Study

The results of the current study should be taken with caution due to several limitations of the study. First, although the study was designed and conducted in order to minimize threats to the selection bias to internal validity by using random assignment, there was a statistically significant difference in the pre-test scores among conditions at alpha level .05. Specifically, students in the cognitive prompts condition did well on the pre-test (Range: 2pts – 5pts, $M = 3.17$, $SD = 1.03$) in comparison to students in the socio-cognitive prompts condition (Range: 0pt – 2pts, $M = .62$, $SD = .74$) and students in the control condition (Range: 0pts – 4pts, $M = 1.67$, $SD = 1.61$). Although the effect of the pre-test on the post-test was removed by using the pre-test as a covariate in the data analysis, it is still possible that students who did poorly on the pre-test might have some difficulty in completing the task, whereas students who did well on the pre-test might be more receptive to the task. The failure of random assignment to "equate the groups" (Creswell, 2005) also implies that some individual characteristics other than those investigated in the study may not have been equally distributed among the three conditions, and these extraneous variables may have influenced the outcomes.

Second, the sample size in the present study was small (N = 32). Further, the socio-cognitive prompts condition had only eight students after data screening. With such small sample size, it is difficult to draw conclusions by way of statistical analysis. For example, the current study found no differences among the conditions in students'

feelings of group community. However, it is not quite certain whether this result was due to the small sample size or because the prompts-based argumentation scaffolding in fact had no effect on students' feelings of group community.

Third, the primary data source of the study was quantified data obtained from content analysis. Since the content analysis involved human judgment, establishing acceptable inter-coder reliability is critical in such research. The study achieved acceptable inter-coder reliability for socio-emotionally enhanced behaviors, argument behaviors, and reasoning performance, but failed to achieve acceptable inter-coder reliability for two argumentation performance scores—elaborating and agreeing argument behaviors.

Fourth, the study was conducted in the fourth week of an eight-week class. Therefore, students may have already built a social relationship with their discussion partner.

Fifth, the results of the study should not be over-generalized beyond the current research context. The data were gathered from a specific learning context, that of interactive role-playing argumentation. The conflict of opinions was imposed by means of role-playing in order to force students to handle disagreement via argumentation. This may have resulted in a reduction in the socio-emotional effects on students' argument behaviors because students know they are role-playing. If students actually discuss their own opinions, they might act differently in the face of critiques from the other party.

Sixth, the current study employed ANOVA-like analysis for count data. Although ANOVA-like analysis has been widely used for count data in educational research, it is more appropriate to use event count models (e.g., poisson regression, zero-inflated

poisson regression, negative binominal regression, etc.) when variables are distributed discretely rather than normally (Nussbaum & Schraw, 2007). Some variables in the current study were also discretely distributed. Thus, assumptions were violated in the use of ANOVA-like analysis for such variables.

Finally, during interactive argumentation the behavior of individuals was coded and used in the analysis. Some may argue that interactive argumentation should be analyzed using dyads as a unit of analysis because students worked in pairs and their learning processes were dependent on one another. The focus of the present study, however, was the effects of prompts-based argumentation scaffolds on an individual level, and the same approach has also been used to study interactive argumentation in other studies (e.g. Cho & Jonassen, 2002; Oh & Jonassen, 2007). When the focus of the study is the pattern of interactive argumentation at a group level, the group should be used as the unit of analysis. In addition, investigating patterns of interactive argumentation at a group level is an important issue that needs to be further investigated.

## Implications for Online Interactive Argumentation

Prompts have been successfully used to guide peer tutoring processes (King, 1990), students' problem solving processes (Ge & Land, 2003; Oh & Jonassen, 2007), and collaborative learning (Weinberger, et al., 2005). The study began with the practical question of how to facilitate socio-emotionally enhanced communication in peer-led argumentative contexts using instructional technologies, and whether such communication makes any difference in the nature of peer-led argumentation. The current study shows that students' socio-emotional behaviors during peer-led

argumentation can be effectively scaffolded using prompts. This finding is particularly important for text-based asynchronous communication because the lack of social cues in such communication makes it difficult to develop and maintain a supportive learning atmosphere. The socio-cognitive prompts were developed by simply adding social cues to the cognitive prompts. For example, the task-oriented prompt for a challenging argument was "I do not agree with your argument because …" The socio-emotionally enhanced prompt for a challenging argument was "[Address the partner by name], your point on … is good …. But I do not agree with your argument … because …" By constructing a challenging message which is both friendly and polite, a student will be able to assert his/her opposing opinion without endangering social relationships. The agreement part saves "face" for the other party (Nussbaum, et al., 2004) and allows him/her to find common ground between divergent opinions.

If the pedagogical goals of peer-led argumentation include learning to understand and appreciate different points as well as learning to build a logical and coherent argument (Stein & Albro, 2001), then it is recommended to lend support to the social plane of interactive argumentation. However, this study does not imply that competitive argumentation has no value or is unproductive. Competitive argumentation certainly encourages students to construct more logical, cohesive, and elaborative arguments in support of their position and to undermine their opponents' views.

There are several easy ways to support the development of a supportive atmosphere. For example, online educators could set social rules that students need to follow during discussions or scaffold supportive behaviors by acknowledging students' contributions when managing peer interaction. However, they should also remember that

a message reflecting the employment of positive socio-emotional strategies can be so personal, social, and/or polite that it is difficult to argue against it.

In sum, it is recommended by the findings of the study that if interactive discussions aim to promote competitive argumentation for the purpose of choosing which argument position is superior to the other, then the cognitive prompts may be enough. If the purpose of the interactive discussion is to help students accommodate multiple views and co-construct knowledge through critical argumentation, then the support of social plane is important.

## Suggestions for Future Research

Given the importance of the social dimension in students' argumentative interaction and the potential of CSCA environments for learning, studies focusing on social argumentation in CSCA environments are highly encouraged. The present study provides empirical support for the claim that prompts-based argumentation scaffolds could be used in a way which facilitates students' socio-emotionally enhanced argumentation. However, future research with larger sample sizes would be necessary to confirm the findings of the current study. With adequate sample sizes and proper randomization, future research may find the significance of the effects of prompts-based argumentation scaffolds on students' reasoning performance as well as their feelings of group community. Additionally, future research could use small groups instead of dyads. The social dynamics of small groups may be quite different from those in dyads. For instance, Alexopoulou and Driver (1996) found that the social dynamics of groups of four were better suited for social negotiation of divergent views than those of pairs.

Furthermore, qualitative data from interviews and in-depth case studies would deepen our understanding of how peers' interaction in the cognitive plane is influenced by their interaction in the social plane.

The current study investigated the effects of prompts-based argumentation scaffolds on the behavior of individuals during peer-led argumentation. Although this approach provides valuable insight into interactive argumentation, future research should also examine interactive argumentation at a group level. Argumentation building cannot be fully understood at an individual level because peers' learning processes depend on one another's learning. Analyzing the effects of prompts-based argumentation scaffolding at a group level would better inform whether an intervention is effective in promoting a supportive atmosphere and whether this leads to a productive argumentation.

The study calls for special attention to be paid to the development of systematic assessment tools which could be used to validly and reliably analyze social argumentation in CSCL environments. So far, research in CSCL has considerably relied on Toulmin's model to analyze interactive argumentation, despite consistent warnings from a number of scholars about the inadequacy of Toulmin's model for this task (e.g. Leitão, 2001; O'Keefe, 1982; van Eemeren & Grootendorst, 1992). Furthermore, whereas a number of researchers have pointed out the importance of the social dimension for nurturing conducive environments for learning in CSCL (e.g. Garrison, et al., 2000; Kreijns, et al., 2003), little attention has been given to the development of assessment tools for social argumentation in CSCL. The current study developed several coding schemes based on studies in communication, CSCL, and argumentation in order to

analyze various aspects of social argumentation. Further refinement of the current coding schemes is necessary to better understand the dynamics of social argumentation.

# APPENDIXES

## Appendix A. Consent Form

College of Education
School of Information Science and Learning Technologies
University of Missouri-Columbia
Bosung Kim

2124 W. Arrow Rte. Apt. 912
Upland, CA 91786
Phone: (573) 356-0875
Email: bkq22@mizzou.edu

Dear Student:

This letter/form politely asks your permission to allow me to access some of your work for dissertation research. **You do NOT need to do extra work** except the following short survey. Upon your consent to the study, your work of the fourth week of the class, which includes individual opinion essays, online postings, and response to the group community survey, will be used to explore ways to better support peer-led online argumentation.

All records and information collected in this study are completely confidential. Name, student ID, and any data that can identify the participants will NOT be revealed. Results of this research will be presented and published in aggregate form with no personal identifiers. In any reporting of the data all individuals will be anonymous, so there is no risk of your participation in this study becoming publicly known. We do not foresee any risks or discomforts beyond those you normally experience in the courses that might occur as a result of your consent to the study. There will be no reporting of the data before the end of the semester and your participation will **NOT** affect your grade in this class.

Your consent to the study is completely voluntary, and you may withdraw from the study at any time. You will not be penalized in any way for not consenting to or withdrawing from the study.

If you have further questions, you may reach Bosung Kim at bkq22@mizzou.edu. For additional information regarding human participation in research, please contact the University of Missouri Campus Institutional Board at (573) 882-9585.

To give consent you must be 18 years of age or older. By providing your full name, pawprint, and e-mail address (all fields are required) and submitting the agreement below, you will provide consent to participate in this study.

Thank You,
Bosung Kim

** If you do not see the form below, close the browser and open it again. If it doesn't work, go to http://www.wdiscuss.net/c_survey.php.

First Name: Last Name:

Pawprint:

E-mail:

* Provide the most frequently used email address.
This email address will be only used to contact you when necessary.

Submit

Upon your successful submission of the consent form, you will be asked to complete a short survey.
It will take about 5 minutes to complete. Thank you!

# Appendix B. Week 4 Class Document for the Current Study

**Investigating With Technologies**

**Performance Objectives**
Upon successful completion of this Unit, you will be able to:
- examine the issue of "Internet monitoring" and its implications for K-12 schools

**Path to complete the Unit**
1. Read Theme 1: WDiscuss.net
2. Complete the pre-opinion essay assignment (Due: Nov. 10)
3. Read Chapter 2 in the textbook (it's long and filled with wonderful information)
4. Complete the dyadic discussion assignment (Period: Nov. 12 -15)
5. Complete the post-opinion essay assignment and submit the survey (Due: Nov. 16)

**Theme 1: WDiscuss.net**

Bosung Kim, a doctoral student in the MU School of Information Science and Learning Technologies (SISLT), is conducting a dissertation research study during Week 4 of our class. She is primarily interested in interactive argumentation. If you want to participate in the study and haven't consented to the study yet, go to http://www.wdiscuss.net/consent.php and submit the consent form no later than Nov. 10. Read the consent form for details. We are a learning community. So, your sincere participation will inform our educators on how to support online argumentation.

**Pre-Opinion Essay on Internet Monitoring Assignment (3 points)**

K-12 teachers now have access to the Internet at school or even in the classroom. The Internet is a wonderful place, the home of resources and opportunities that have the potential of changing a person's life in highly desirable ways. Unfortunately, the Internet is also a dangerous place, the home of content and opportunists that have the potential of changing a person's life in highly undesirable ways.

According to the American Management Association reports, "nearly 75 percent of all American companies now use some form of surveillance to spy on employees." Some schools have already started monitoring K-12 teachers' internet use.

The Pre-Opinion Essay Assignment asks you to write an essay expressing your opinion by making arguments on the following question, ***"Should the school monitor K-12 teachers' internet use in school?"***

Arguments are stands you take on an issue, supported by reason and evidence. You may include alternative points of view and counterarguments (and supporting reasons) and consider both arguments and counterarguments when developing your final conclusion.

Your opinion essay should be no less than 100 words and no more than 500 words. You will have 30 minutes to work on your essay. Feel free to first spend a few minutes organizing your thoughts and even making an outline. Don't worry too much about spelling, grammar, punctuation, or writing style. Note how long it took you to complete the essay at the end of your essay (e.g. 27 minutes).

**Important:**
Your opinion essay should **NOT** be an exploration of the role of Internet filters in schools or the importance of freedom of information in a democracy. Your opinion essay should focus on one particular situation – "Internet monitoring."

**Note:**
The Pre-Opinion Essay is due on Nov. 10. Please don't be late in submitting your work. It will affect the following work tremendously this week.

**Dyadic Discussion on Internet Monitoring at WDiscuss.net Assignment (3 points)**

This week's discussion will be held NOT in Blackboard BUT in wdiscuss.net forum site from Nov. 12 to Nov. 15.

An e-mail containing the forum site address, username, and password will be sent out to your **MU e-mail account** by midnight on Nov. 11. Please check your MU e-mail account to get this information. If you have not received the e-mail, contact Bosung Kim (bkq22@mizzou.edu) as soon as possible.

This week's discussion is a pair discussion. You will discuss "internet monitoring" with your partner. Therefore, your active and timely participation is very important. If you cannot participate in the discussion on time, be sure to let the instructor and Bosung Kim (bkq22@mizzou.edu) know about it beforehand.

Once you log into the WDiscuss forum site, be sure to read the announcement posted in the forum site. The announcement describes the task and includes a short video clip on how to use the forum to complete the task.

**Notes:**
- Initial posting should be posted to the site by Nov. 12.
- Please don't wait till the last minute to do the work. You do not want your discussion partner to suffer from it.

**Post-Opinion Essay on Internet Monitoring Assignment (3 points)**

***After having examined the issue of internet monitoring, please write an essay that describes your current opinion*** on the following question, "Should the school monitor K-12 teachers' internet use in school?"

Arguments are stands you take on an issue, supported by reason and evidence. You may include alternative points of view and counterarguments (and supporting reasons) and consider both arguments and counterarguments when developing your final conclusion.

Your opinion essay should be no less than 100 words and no more than 500 words. You will have 30 minutes to work on your essay. Feel free to first spend a few minutes organizing your thoughts and even making an outline. Don't worry too much about spelling, grammar, punctuation, or writing style. Note how long it took you to complete the essay at the end of your essay (e.g. 27 minutes).

**Important:**
Do **NOT** write a reflection paper or a summary paper on the previous dyadic discussion activity. This assignment asks you to write an essay where you make arguments on Internet monitoring after having examined the issue of internet monitoring.

**Note:**
The Post-Opinion Essay is due on Nov. 16.

**Survey (1 Point)**

Upon the completion of the dyadic discussion assignment, go to http://www.wdiscuss.net/survey.php and complete the survey.

**Note:**
The survey will be available on Nov. 16 and due on the same day.

Note: Hope that you enjoy this week's activities!

Note: The dyadic discussion was extended one additional day (Period: Nov. 12-15 → Period: Nov. 12 – 16). As a consequence, the post-opinion essay and the survey were due on Nov. 17.

## Appendix C. Instructions Posted in the Discussion Board

**Announcement: Read this first!**

**Group Name:** Apple 1
**Group Members:** Amy Kim and Tom Smith

**INSTRUCTIONS**
From Nov. 12 to Nov. 15, you and your partner will discuss "Should the school monitor K-12 teachers' internet use in school?"

In recent years, it has been debated whether the school should monitor K-12 teachers' internet use in school (hereafter "internet monitoring"). Advocates of internet monitoring argue that internet monitoring prevents teachers from doing inappropriate Web-based activities (e.g. chatting online, illegal downloading, personal online shopping, online gaming, etc.) at school and thus promotes teachers' productivity and quality of work. They also argue that it can help prevent other destructive behaviors as well as teachers' inappropriate contact with students and other teachers. On the other hand, opponents of internet monitoring claim that it is an invasion of privacy. They argue that it is a basic civil right that cannot be violated in the name of convenience or productivity. They also argue that internet monitoring is likely to negatively affect the morale of teachers by showing a lack of trust in teachers.

In this discussion, you are assigned to take a side of the argument. If your username ends with 'su', provide an argument in support of internet monitoring. If your username ends with 'op', provide an argument in opposition to internet monitoring.

Start discussion by posting a new message that includes your initial argument in support of or in opposition to internet monitoring as assigned. As argumentation continues, provide as many reasons as you can to justify your position; provide evidence that supports your reasons; challenge your partner's arguments; and reply to your partner's challenges or questions. Try to persuade your partner of your point of view. If you believe your partner has a stronger argument, you may revise your argument at this point. This discussion is **NOT** for winning a point **BUT** for deepening understanding on an issue through argumentation.

Even though you may not agree with the side of the argument that you were assigned, we want you to construct the most compelling argument possible because it is important that you see multiple sides to the argument.

**Minimum Post Requirements**
- One initial posting, detailing your assigned view on internet monitoring by Nov. 12, and
- at least three postings in response to your partner's arguments by Nov. 15.
(Please don't wait till the last minute to do the work. You do not want your discussion

partner to suffer from it.)
If you are not clear about the task, contact the instructor or Bosung Kim as soon as possible.

**IMPORTANT!**
Before using the forum, you must watch this short video clip (turn on the volume) to learn how you can use the forum to complete the task. If you have any technical questions, contact Bosung Kim at bkq22@mizzou.edu.

Forum sites work best in Firefox browser. You can download this browser for free from the following sites.

If you are a PC user, download it from here.
If you are a MAC user, download it from here.

# Appendix D. Personal Profile Survey

**Thank you for consenting to the study.The following is the information that you provided.**

First Name: Last Name:

PawPrint:

E-mail:

* Provide the most frequently used email address.

This email address will be only used to contact you when necessary.

## SURVEY

Please complete the following survey. Your responses to this survey are completely confidential. In any reporting of the survey results all individuals will be anonymous.

** All of the fields are required items.

**Directions (1-20):** The following twenty items contains statements about arguing controversial issues. For each statement, indicate how often each statement is true for you personally by selecting one option, that best describe you, among seven options: never or almost never true, usually not true, sometimes but infrequently true, occasionally true, often true, usually true, and always or almost always true.

Do not spend too much time on any one statement because there is no correct or incorrect responses.

1. While in an argument, I worry that the person I am arguing with will form a negative impression of me.

| never or almost never true | usually not true | sometimes but infrequently true | occasionally true | often true | usually true | always or almost always true |
|---|---|---|---|---|---|---|
| ○ | ○ | ○ | ○ | ○ | ○ | ○ |

2. Arguing over controversial issues improves my intelligence.

| never or almost never true | usually not true | sometimes but infrequently true | occasionally true | often true | usually true | always or almost always true |
|---|---|---|---|---|---|---|
| ○ | ○ | ○ | ○ | ○ | ○ | ○ |

3. I enjoy avoiding arguments.

| never or almost never true | usually not true | sometimes but infrequently true | occasionally true | often true | usually true | always or almost always true |
|---|---|---|---|---|---|---|
| ○ | ○ | ○ | ○ | ○ | ○ | ○ |

4. I am energetic and enthusiastic when I argue.

| never or almost never true | usually not true | sometimes but infrequently true | occasionally true | often true | usually true | always or almost always true |
|---|---|---|---|---|---|---|
| ○ | ○ | ○ | ○ | ○ | ○ | ○ |

5. Once I finish an argument I promise myself that I will not get into another.

| never or almost never true | usually not true | sometimes but infrequently true | occasionally true | often true | usually true | always or almost always true |
|---|---|---|---|---|---|---|
| ○ | ○ | ○ | ○ | ○ | ○ | ○ |

6. Arguing with a person creates more problems for me than it solves.

never or almost never true | usually not true | sometimes but infrequently true | occasionally true | often true | usually true | always or almost always true

7. I have a pleasant, good feeling when I win a point in an argument.

never or almost never true | usually not true | sometimes but infrequently true | occasionally true | often true | usually true | always or almost always true

8. When I finish arguing with someone I feel nervous and upset.

never or almost never true | usually not true | sometimes but infrequently true | occasionally true | often true | usually true | always or almost always true

9. I enjoy a good argument over a controversial issue.

never or almost never true | usually not true | sometimes but infrequently true | occasionally true | often true | usually true | always or almost always true

10. I get an unpleasant feeling when I realize I am about to get into an argument.

never or almost never true | usually not true | sometimes but infrequently true | occasionally true | often true | usually true | always or almost always true

11. I enjoy defending my point of view on an issue.

never or almost never true | usually not true | sometimes but infrequently true | occasionally true | often true | usually true | always or almost always true

12. I am happy when I keep an argument from happening.

never or almost never true | usually not true | sometimes but infrequently true | occasionally true | often true | usually true | always or almost always true

13. I do not like to miss the opportunity to argue a controversial issue.

never or almost never true | usually not true | sometimes but infrequently true | occasionally true | often true | usually true | always or almost always true

14. I prefer being with people who rarely disagree with me.

never or almost never true | usually not true | sometimes but infrequently true | occasionally true | often true | usually true | always or almost always true

15. I consider an argument an exciting intellectual challenge.

never or almost never true | usually not true | sometimes but infrequently true | occasionally true | often true | usually true | always or almost always true

16. I find myself unable to think of effective points during an argument.

never or almost never true | usually not true | sometimes but infrequently true | occasionally true | often true | usually true | always or almost always true

17. I feel refreshed and satisfied after an argument on a controversial issue.

never or almost never true | usually not true | sometimes but infrequently true | occasionally true | often true | usually true | always or almost always true

18. I have the ability to do well in an argument.

| never or almost never true | usually not true | sometimes but infrequently true | occasionally true | often true | usually true | always or almost always true |
|---|---|---|---|---|---|---|

19. I try to avoid getting into argument.

| never or almost never true | usually not true | sometimes but infrequently true | occasionally true | often true | usually true | always or almost always true |
|---|---|---|---|---|---|---|

20. I feel excitement when I expect that a conversation I am in is leading to an argument.

| never or almost never true | usually not true | sometimes but infrequently true | occasionally true | often true | usually true | always or almost always true |
|---|---|---|---|---|---|---|

**Directions (21-25):** For each statement, indicate the level of your agreement or disagreement by selecting one option, that best describe you, among seven options: strongly disagree, disagree, somewhat disagree, neither agree nor disagree, somewhat agree, agree, strongly agree.

Do not spend too much time on any one statement because there is no correct or incorrect responses.

21. The school should monitor K-12 teachers' internet use in school.

| strongly disagree | disagree | somewhat disagree | neither agree nor disagree | somewhat agree | agree | strongly agree |
|---|---|---|---|---|---|---|

22. I am certain about my opinion on internet monitoring (specifically, whether the school should monitor K-12 teachers' internet use in school).

| strongly disagree | disagree | somewhat disagree | neither agree nor disagree | somewhat agree | agree | strongly agree |
|---|---|---|---|---|---|---|

23. I am knowledgeable about the issue of internet monitoring (specifically, whether the school should monitor K-12 teachers' internet use in school).

| strongly disagree | disagree | somewhat disagree | neither agree nor disagree | somewhat agree | agree | strongly agree |
|---|---|---|---|---|---|---|

24. I am interested in the issue of internet monitoring (specifically, whether the school should monitor K-12 teachers' internet use in school).

| strongly disagree | disagree | somewhat disagree | neither agree nor disagree | somewhat agree | agree | strongly agree |
|---|---|---|---|---|---|---|

25. Others' differing opinions about the issue of internet monitoring (specifically, whether the school should monitor K-12 teachers' internet use in school) are important to me.

| strongly disagree | disagree | somewhat disagree | neither agree nor disagree | somewhat agree | agree | strongly agree |
|---|---|---|---|---|---|---|

DEMOGRAPHIC QUESTIONS

26. What is your gender? ○ Male ○ Female

27. How old are you? _____ years old

28. What is your native language? _____

29. What is your current academic status?

○ Master student ○ Doctoral student ○ Other _____

30. What is your occupation? _____ (e.g. full-time student, teacher, school administrator etc.)

31. In which academic program are you in?

○ ELPA (Educational Leadership and Policy Analysis) with a focus on _____
○ ESCP (Educational, School, and counseling Psychology) with a focus on _____
○ LTC (Learning, Teaching, & Curriculum) with a focus on _____
○ SISLT (School of Information Science and Learning Technolgies) with a focus on _____
○ SPED (Special Education) with a focus on _____
○ Other _____

32. How many online courses have you taken including this class? (If this is your first online class, select "1 course".)

○ 1 course ○ 2-3 courses ○ 4-6 courses ○ 7-10 courses ○ over 10 courses

Submit

## Appendix E. Rubric for Argumentation Performance

| Behavior Category | Description |
|---|---|
| Proposing a supportive theory | Definition<br>Proposing an initial argument in support of *monitoring K-12 teachers' in-school internet use*<br>Scoring Guides<br>2 = Supportive theory clearly states an opinion in support of internet monitoring with sound reasoning/substantial evidence.<br>1 = Supportive theory clearly states an opinion in support of internet monitoring with some reasoning/evidence.<br>0 = Supportive theory does not clearly state an opinion in support of internet monitoring or provided reasoning/evidence is contradictory. |
| Proposing an opposing theory | Definition<br>Proposing an initial argument in opposition to *monitoring K-12 teachers' in-school internet use*<br><br>Scoring Guides<br>2 = Opposing theory clearly states an opinion in opposition to internet monitoring with sound reasoning/substantial evidence.<br>1 = Opposing theory clearly states an opinion in opposition to internet monitoring with some reasoning/evidence.<br>0 = Opposing theory does not clearly state an opinion in opposition to internet monitoring or provided reasoning/evidence is contradictory. |
| Challenging | Definition<br>Providing a counterargument that falsifies or undermines the primary line of reasoning.<br><br>Scoring Guides<br>2 = Counterargument falsifies or undermines the primary line of reasoning with sound reasoning/substantial evidence (e.g. envisioning conditions when the primary argument does not apply or pointing out the sufficiency and validity of the reasons/evidence).<br>1 = Simple disagreement or objection is provided with some reasoning/evidence.<br>0 = Counterargument does not contradict the primary argument or fails to falsify or undermine the primary argument. |

| | |
|---|---|
| Counter-challenging | Definition<br>Providing a rebuttal that rebuts a counterargument (an opposite line of reasoning).<br><br>Scoring Guides<br>2 = Rebuttal successfully falsifies or undermines the preceding statement with sound reasoning/substantial evidence.<br>1 = Simple disagreement or objection or reassertion of the primary argument is provided with some reasoning/evidence.<br>0 = Rebuttal does not contradict the counterargument or contradicts the primary argument. |
| Integrating | Definition<br>Integrating primary and opposite lines of reasoning, suggesting a creative solution, or illustrating exceptions or conditions based on the examination of both primary and opposing lines of reasoning.<br><br>Scoring Guides<br>2 = A statement effectively integrates the preceding differing points of view, suggests a creative solution, or illustrates exceptions or conditions with reasons in light of previous argumentation.<br>1 = A statement integrates preceding differing points of view to a certain extent or encourages a creative solution, exceptions, or conditions based on previous argumentation to certain extent.<br>0 = An integration is not based on the preceding lines of arguments and counterarguments. |
| Elaborating | Definition<br>Elaborating preceding argument by way of reason or evidence (e.g. personal beliefs, experience, expert opinions, research findings, etc.) or asking a question seeking additional information about a preceding statement.<br><br>Scoring Guides<br>2 = Explanation elaborates a preceding statement with sound reasoning/substantial evidence. Provided questions are reasonably written to clarify or elaborate the preceding statement with reasons.<br>1 = Explanation is merely a restatement of the preceding statement. Provided questions are written to clarify or elaborate the preceding statement to certain extent without reasons.<br>0 = Explanation is not related to the preceding statement. Provided question is irrelevant to the preceding statement. |

| | |
|---|---|
| Agreeing | Definition<br>Expressing an agreement with the preceding argument.<br><br>Scoring Guides<br>2 = An agreement is expressed with sound reasoning/substantial evidence.<br>1 = Simple agreement is provided with some reasons.<br>0 = An agreement contradicts the preceding argument or the provided reasons are contradictory. Or no reason was given. |

# Appendix F. Rubrics for Opinion Essays

## *A. Step 1: Assessing the Quality of Argument Components in Opinion Essay*

| Quality / Category | 3 | 2 | 1 |
|---|---|---|---|
| Final Claim (FC) | Final claim is clearly stated. | Final claim is vaguely stated. | Final claim is inconsistent. |
| Supporting Argument (SA) | A supporting argument includes a clear claim supporting the final claim and is well developed using clear and convincing reasons/evidence that are elaborated. | A supporting argument is moderately developed using some plausible reasons/evidence and may not be convincing enough, mainly due to problems with clarity of presentation of reasons. | A supporting argument is poorly developed using no or unrelated reasons/evidence. |
| Counter-argument (CA) | A counterargument includes a clear counterclaim to the supporting argument and is well developed using clear and convincing reasons/evidence that are elaborated. | A counterargument is moderately developed using some plausible reasons/evidence and may not be convincing enough mainly due to problems with clarity of presentation of reasons. | A counterargument is poorly developed using no or unrelated reasons/evidence. |
| Rebuttal (RE) | A rebuttal rebuts the counterargument successfully by demonstrating the counterargument (a) is invalid, (b) lacks as much force or correctness as the original argument, or (c) rests on a false assumption. | A rebuttal is moderately developed using some plausible reasoning/ evidence and may not be convincing enough mainly due to clarity of presentation of reasons. | A rebuttal is poorly developed using no or unrelated reasons/evidence or simply restating the supporting argument. |
| Integration (IN) | A solution, condition, and/or exception are plausible and explained clearly and in detail. In addition, it is also explicitly described how | A solution, condition, and/or exception are somewhat explained. It may not describe how it would satisfy both sides of the issue. | A solution, condition, and/or exception are poorly explained and unclear. It does not describe how it would satisfy both sides of the |

| | | | |
|---|---|---|---|
| | it satisfies both sides of the issue. | | issue. |
| Weighing (WE) | Evidence on both sides is clearly weighed, or the benefits and/or drawbacks of both supporting argument and counterargument are well explained, and this clearly shows why the supporting argument outweighs the counterargument. | Evidence on both sides is weighed to some extent, or the benefits and/or drawbacks of the supporting argument and counterargument are moderately explained, and this attempts to show why the supporting argument outweighs the counterargument; argument falls short of being entirely clear and/or conclusive | Evidence on sides is inadequately weighed or the benefits and/or drawbacks of the supporting argument and counterargument are poorly explained. Nearly complete failure of the argument to show why the supporting argument outweighs the counterargument. |

* When the idea unit cannot be placed in any of the above categories, mark it as "others".

## *B. Descriptions and Examples of Coding Categories*

| Coding Category | Description | Example |
|---|---|---|
| Final Claim | An opinion or stance on the given controversial question ("should the school monitor K-12 teachers' internet use in school?"). It can be (a) yes, the school should monitor K-12 teachers' in-school internet use, (b) no, the school shouldn't monitor K-12 teachers' in-school internet use, (c) yes, … with some restrictions ("contingent"), or (d) yes …. no (contradictory). | I believe that school districts should monitor K-12 teacher's in-school internet use. |
| Supporting Argument | An argument that supports the final claim.<br>* When the final claim is contingent, an argument related to the "yes" part will be coded as supporting argument. | As much as we like to think of our teachers as respectable, responsible professionals, the truth is that they do not always live up to this expectation. There have been cases where teachers have been found to be accessing inappropriate internet sites at schools. As such, it seems only obvious that a school district would need to monitor the internet actions of its teachers to ensure that the technology was not being used |

| | | | |
|---|---|---|---|
| | | | in an inappropriate and potentially illegal manner. |
| Counterargument | | An argument that refutes the supporting argument or gives an opposing reason to the final claim. * When the final claim is contingent, an argument related to the "restriction" part will be coded as counterargument. May include contingencies that indicate when the final claim does not apply. For example: "Yes, … with some restrictions" (final claim). "Districts should not be monitoring teacher's internet usage to make a personal judgment on a teacher." (Counterargument). | Opponents may argue that internet monitoring threatens teachers' academic freedom. For example, a science teacher may think twice about accessing information related to the theory of Evolution if they know that a creationist administration is in place. |
| Response to Counterargument | Rebuttal | A response to a counterargument that refutes a counterargument. | However, it seems a stretch to think that internet monitoring would be used in this way. A teacher accessing both sides of a controversial issue to present a fair presentation to students would not, in and of itself, be cause for concern on the part of administration. Too, if the administration held to such an agenda, the problem would not be with Internet monitoring but with the administration, and the problem should be addressed outside of the realm of internet monitoring. |
| | Integration | A response to a counterargument that integrates a counterargument into their argument by presenting solutions or by allowing some exceptions or conditions. | It may be too costly and a waste of time and effort to monitor all of the teachers. Internet monitoring can begin when there is a sign of inappropriate use. For successful internet monitoring implementation, administrators need to communicate with teachers about the details of internet monitoring. Also, an explicit internet monitoring policy needs to be communicated with teachers. |
| | Weighing | A response to a counterargument that weighs the benefit and/or drawbacks of a supporting argument and a counterargument | In sum, the benefits of monitoring (e.g. student safety) are greater than the drawbacks, and internet monitoring should be implemented in schools. |

## *C. Step 2: Assessing the Level of Argument Development Within the Framework of Opposing Views*

| Score | Description |
|---|---|
| 5 | a. Essay develops supporting arguments and counterarguments effectively and in balance. In addition, a response to the counterarguments is well developed contributing to the final conclusion either by refuting the counterarguments, by integrating the counterarguments into the arguments, or by weighing two sides of an issue. |
| 4 | a. There are counterarguments and the responses to the counterarguments are well-developed (regardless of the quality of the counterarguments).<br>b. Counterarguments are well developed and responses to the counterarguments are moderately developed.<br>c. Contingent argument is well developed. |
| 3 | a. Responses to implicit counterarguments are well developed.<br>b. Counterarguments are either moderately or poorly developed and responses to the counterarguments are moderately developed.<br>c. Counterarguments are well developed and responses to the counterarguments are poorly developed.<br>d. Contingent argument is moderately developed. |
| 2 | a. Responses to implicit counterarguments are moderately developed.<br>b. Counterarguments are either moderately or poorly developed and responses to the counterarguments are poorly developed.<br>c. Contingent argument is poorly developed. |
| 1 | a. Responses to implicit counterarguments are poorly developed.<br>b. There are counterarguments only, without any response to the counterarguments.<br>c. Essay develops different arguments at the beginning and end of the essay. |
| 0 | a. Essay develops supporting arguments only. |

# Appendix G. Inter-coder Reliability Calculation

## *A. Socio-Emotionally Supportive Behaviors*

*Contingency Table of Cohen's Kappa Coefficient*

| | | CODER B | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **TA** | **SD** | **EM** | **SY** | **RE** | **AC** | **EA** | **CP** | **MP** | **RP** | **AN** | **GR** | **GT** | **CS** | **SUM** |
| CODER A | **TA** | **29** | | | | | 1 | | | | | | | | | **30** |
| | **SD** | | **27** | | | | | 1 | | | | | | | | **28** |
| | **EM** | | | **12** | | | | | | | | | | | | **12** |
| | **SY** | | | | **3** | | | 1 | | | | | | | | **4** |
| | **RE** | | | | | **50** | | | | | | | | | | **50** |
| | **AC** | | | | | | **21** | | | | | | | | | **21** |
| | **EA** | | | | | | | **41** | 1 | | | | | | | **42** |
| | **CP** | | | | | 1 | | | **51** | | | | | | | **52** |
| | **MP** | | | | | | | | | **7** | | | | | | **7** |
| | **RP** | | | | | | | | | | **13** | | | | | **13** |
| | **AN** | | | | | | | | | | | **39** | | | | **39** |
| | **GR** | | | | | | | | | | | | **26** | | | **26** |
| | **GT** | | | | | | | | | | | | | **15** | | **15** |
| | **CS** | | | | | | | | | | | | | | **42** | **42** |
| | **SUM** | **29** | **27** | **12** | **3** | **51** | **22** | **43** | **52** | **7** | **13** | **39** | **26** | **15** | **42** | **381** |

Therefore, $P_o = .99$, $P_c = .09$, $\kappa = .99$

*Contingency Table of Kappa Coefficient with Omission Calculation*

| | | CODER B | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **TA** | **SD** | **EM** | **SY** | **RE** | **AC** | **EA** | **CP** | **MP** | **RP** | **AN** | **GR** | **GT** | **CS** | **NC** | **SUM** |
| CODER A | **TA** | **29** | | | | | 1 | | | | | | | | | 1 | **31** |
| | **SD** | | **27** | | | | | 1 | | | | | | | | | **28** |
| | **EM** | | | **12** | | | | | | | | | | | | | **12** |
| | **SY** | | | | **3** | | | 1 | | | | | | | | | **4** |
| | **RE** | | | | | **50** | | | | | | | | | | | **50** |
| | **AC** | | | | | | **21** | | | | | | | | | | **21** |
| | **EA** | | | | | | | **41** | 1 | | | | | | | 1 | **43** |
| | **CP** | | | | | 1 | | | **51** | | | | | | | 1 | **53** |
| | **MP** | | | | | | | | | **7** | | | | | | | **7** |
| | **RP** | | | | | | | | | | **13** | | | | | | **13** |
| | **AN** | | | | | | | | | | | **39** | | | | | **39** |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **GR** | | | | | | | | | | | | **26** | | | | **26** |
| | **GT** | | | | | | | | | | | | | **15** | | | **15** |
| | **CS** | | | | | | | | | | | | | | **42** | | **42** |
| | **NC** | | 2 | | | 7 | 1 | 3 | 5 | | | | | | | | **18** |
| | **SUM** | **29** | **29** | **12** | **3** | **58** | **23** | **46** | **57** | **7** | **13** | **39** | **26** | **15** | **42** | **3** | **402** |

Therefore, $P_o = .94$, $P_c = .09$, $\kappa_{woc} = .93$

## *B. Argument Behaviors*

*Contingency Table of Cohen's Kappa Coefficient*

| ` | | CODER B | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | **ST** | **OT** | **CH** | **CC** | **IN** | **EL** | **AG** | **SUM** |
| CODER A | **ST** | **16** | | | | | | | **16** |
| | **OT** | | **17** | | 1 | | | | **18** |
| | **CH** | | | **47** | | | 3 | 2 | **52** |
| | **CC** | | | | **29** | 1 | 3 | | **33** |
| | **IN** | | | 1 | | **9** | 2 | 1 | **13** |
| | **EL** | | | | | 1 | **13** | 1 | **15** |
| | **AG** | | | | | 1 | 2 | **18** | **21** |
| | **SUM** | **16** | **17** | **48** | **30** | **12** | **23** | **22** | **168** |

Therefore, $P_o = .89$, $P_c = .18$, $\kappa = .86$

*Contingency Table of Kappa Coefficient with Omission Calculation*

| | | CODER B | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | **ST** | **OT** | **CH** | **CC** | **IN** | **EL** | **EA** | **NC** | **SUM** |
| CODER A | **ST** | **16** | | | | | | | | **16** |
| | **OT** | | **17** | | 1 | | | | | **18** |
| | **CH** | | | **47** | | | 3 | 2 | | **52** |
| | **CC** | | | | **29** | 1 | 3 | | 1 | **33** |
| | **IN** | | | 1 | | **9** | 2 | 1 | | **13** |
| | **EL** | | | | | 1 | **13** | 1 | | **15** |
| | **EA** | | | | | 1 | 2 | **18** | | **21** |
| | **NC** | | | 1 | | 1 | 2 | 1 | | **5** |
| | **SUM** | **16** | **17** | **49** | **30** | **13** | **25** | **23** | **1** | **174** |

Therefore, $P_o = .86$, $P_c = .17$, $\kappa_{woc} = .83$

## *C. Argumentation Performance*

*Contingency Table of Cohen's Kappa Coefficient*

*For the performance of proposing initial supportive theory*

| | | CODER B | | | |
|---|---|---|---|---|---|
| | | **ST-0** | **ST-1** | **ST-2** | **SUM** |
| CODER A | **ST-0** | **0** | 1 | | **1** |
| | **ST-1** | | **1** | 2 | **3** |
| | **ST-2** | | 1 | **11** | **12** |
| | **SUM** | **0** | **3** | **13** | **16** |

Therefore, $P_o = .75$, $P_c = .64$, $\kappa = .30$

*For the performance of proposing initial opposing theory*

| | | CODER B | | | |
|---|---|---|---|---|---|
| | | **OT-0** | **OT-1** | **OT-2** | **SUM** |
| CODER A | **OT-0** | **0** | | | **0** |
| | **OT-1** | | **3** | 1 | **4** |
| | **OT-2** | | | **13** | **13** |
| | **SUM** | **0** | **3** | **14** | **17** |

Therefore, $P_o = .94$, $P_c = .67$, $\kappa = .82$

*For the challenging performance*

| | | CODER B | | | |
|---|---|---|---|---|---|
| | | **CH-0** | **CH-1** | **CH-2** | **SUM** |
| CODER A | **CH-0** | **0** | | | **0** |
| | **CH-1** | 1 | **12** | 1 | **14** |
| | **CH-2** | | 3 | **30** | **33** |
| | **SUM** | **1** | **15** | **31** | **47** |

Therefore, $P_o = .89$, $P_c = .56$, $\kappa = .76$

*Contingency Table of Kappa Coefficient with Omission Calculation*

*For the performance of proposing initial supportive theory*

| | | CODER B | | | | |
|---|---|---|---|---|---|---|
| | | **ST-0** | **ST-1** | **ST-2** | **NC** | **SUM** |
| CODER A | **ST-0** | **0** | 1 | | | **1** |
| | **ST-1** | | **1** | 2 | | **3** |
| | **ST-2** | | 1 | **11** | | **12** |
| | **NC** | | | | | **0** |
| | **SUM** | **0** | **3** | **13** | **0** | **16** |

Therefore, $P_o = .75$, $P_c = .64$, $\kappa_{woc} = .30$

*For the performance of proposing initial opposing theory*

| | | CODER B | | | | |
|---|---|---|---|---|---|---|
| | | **OT-0** | **OT-1** | **OT-2** | **NC** | **SUM** |
| CODER A | **OT-0** | **0** | | | | **0** |
| | **OT-1** | | **3** | 1 | | **4** |
| | **OT-2** | | | **13** | | **13** |
| | **NC** | | | | | **0** |
| | **SUM** | **0** | **3** | **14** | **0** | **17** |

Therefore, $P_o = .94$, $P_c = .67$, $\kappa_{woc} = .82$

*For the challenging performance*

| | | CODER B | | | | |
|---|---|---|---|---|---|---|
| | | **CH-0** | **CH-1** | **CH-2** | **NC** | **SUM** |
| CODER A | **CH-0** | **0** | | | | **0** |
| | **CH-1** | 1 | **12** | 1 | | **14** |
| | **CH-2** | | **3** | **30** | | **33** |
| | **NC** | | | 1 | | **1** |
| | **SUM** | **1** | **15** | **32** | **0** | **48** |

Therefore, $P_o = .88$, $P_c = .55$, $\kappa_{woc} = .72$

*For the counter-challenging performance*

| | | CODER B | | | |
|---|---|---|---|---|---|
| | | **CC-0** | **CC-1** | **CC-2** | **SUM** |
| CODER A | **CC-0** | **0** | 1 | | **1** |
| | **CC-1** | | **10** | | **10** |
| | **CC-2** | | 2 | **17** | **19** |
| | **SUM** | **0** | **13** | **17** | **30** |

Therefore, $P_o = .90$, $P_c = .51$, $\kappa = .80$

| | | CODER B | | | | |
|---|---|---|---|---|---|---|
| | | **CC-0** | **CC-1** | **CC-2** | **NC** | **SUM** |
| CODER A | **CC-0** | **0** | 1 | | | **1** |
| | **CC-1** | | **10** | | 1 | **11** |
| | **CC-2** | | 2 | **17** | | **19** |
| | **NC** | | | | | **0** |
| | **SUM** | **0** | **13** | **17** | **1** | **31** |

Therefore, $P_o = .87$, $P_c = .48$, $\kappa_{woc} = .75$

*For the integrating performance*

| | | CODER B | | | |
|---|---|---|---|---|---|
| | | **IN-0** | **IN-1** | **IN-2** | **SUM** |
| CODER A | **IN-0** | **0** | | | **0** |
| | **IN-1** | | **3** | | **3** |
| | **IN-2** | | 1 | **5** | **6** |
| | **SUM** | **0** | **4** | **5** | **9** |

Therefore, $P_o = .89$, $P_c = .52$, $\kappa = .77$

| | | CODER B | | | | |
|---|---|---|---|---|---|---|
| | | **IN-0** | **IN-1** | **IN-2** | **NC** | **SUM** |
| CODER A | **IN-0** | **0** | | | | **0** |
| | **IN-1** | | **3** | | | **3** |
| | **IN-2** | | 1 | **5** | | **6** |
| | **NC** | | 1 | | | **1** |
| | **SUM** | **0** | **5** | **5** | **0** | **10** |

Therefore, $P_o = .80$, $P_c = .45$, $\kappa_{woc} = .64$

*For the elaborating performance*

| | | CODER B | | | |
|---|---|---|---|---|---|
| | | **EL-0** | **EL-1** | **EL-2** | **SUM** |
| CODER A | **EL-0** | **0** | | | **0** |
| | **EL-1** | | **7** | 1 | **8** |
| | **EL-2** | | 2 | **3** | **5** |
| | **SUM** | **0** | **9** | **4** | **13** |

Therefore, $P_o = .77$, $P_c = .54$, $\kappa = .49$

| | | CODER B | | | | |
|---|---|---|---|---|---|---|
| | | **EL-0** | **EL-1** | **EL-2** | **NC** | **SUM** |
| CODER A | **EL-0** | **0** | | | | **0** |
| | **EL-1** | | **7** | 1 | | **8** |
| | **EL-2** | | 2 | **3** | | **5** |
| | **NC** | | 1 | 1 | | **2** |
| | **SUM** | **0** | **10** | **5** | **0** | **15** |

Therefore, $P_o = .67$, $P_c = .47$, $\kappa_{woc} = .38$

*For the agreeing performance*

| | | CODER B | | | |
|---|---|---|---|---|---|
| | | **AG-0** | **AG-1** | **AG-2** | **SUM** |
| CODER A | **AG-0** | **1** | | | **1** |
| | **AG-1** | | **8** | 1 | **9** |
| | **AG-2** | | 5 | **3** | **8** |
| | **SUM** | **1** | **13** | **4** | **18** |

Therefore, $P_o = .67$, $P_c = .46$, $\kappa = .38$

| | | CODER B | | | | |
|---|---|---|---|---|---|---|
| | | **AG-0** | **AG-1** | **AG-2** | **NC** | **SUM** |
| CODER A | **AG-0** | **1** | | | | **1** |
| | **AG-1** | | **8** | 1 | | **9** |
| | **AG-2** | | 5 | **3** | | **8** |
| | **NC** | | 1 | | | **1** |
| | **SUM** | **1** | **14** | **4** | **0** | **19** |

Therefore, $P_o = .63$, $P_c = .44$, $\kappa_{woc} = .34$

## Appendix H. Group Community Scale

### *A. Comparisons of Items between Classroom Community Scale and Group Community Scale*

| Item Number | Original Items of Classroom Community Scale (Rovai, 2002) | Items of Group Community Scale in the Current Study |
|---|---|---|
| | Connectedness | |
| 1 | I feel that students in this course care about each other. | I felt that my discussion partner cared about me. |
| 3 | I feel connected to others in this course. | I felt connected to my discussion partner. |
| 5 | I do not feel a spirit of community. | I did not feel a spirit of community. |
| 7 | I feel that this course is like a family. | I felt that my discussion partner was like a friend. |
| 9 | I feel isolated in this course. | I felt isolated during the discussion. |
| 11 | I trust others in this course. | I trusted my discussion partner during the discussion. |
| 13 | I feel that I can rely on others in this course. | I felt that I could rely on my discussion partner. |
| 15 | I feel that members of this course depend on me. | I felt that my discussion partner depended on me. |
| 17 | I feel uncertain about others in this course. | I felt uncertain about my discussion partner. |
| 19 | I feel confident that others will support me. | I felt confident that my discussion partner would support me. |
| | Learning | |
| 2 | I feel that I am encouraged to ask questions. | I felt that I was encouraged to ask questions during the discussion. |
| 4 | I feel that it is hard to get help when I have a question. | I felt that it was hard to get help from my discussion partner when I had a question. |

| | | |
|---|---|---|
| 6 | I feel that I receive timely feedback. | I felt that I received timely feedback from my discussion partner. |
| 8 | I feel uneasy exposing gaps in my understanding. | I felt uneasy exposing gaps in my understanding during the discussion. |
| 10 | I feel reluctant to speak openly. | I felt reluctant to speak openly during the discussion. |
| 12 | I feel that this course results in only modest learning. | I felt that this discussion activity resulted in only modest learning. |
| 14 | I feel that other students do not help me learn. | I felt that my discussion partner did not help me learn. |
| 16 | I feel that I am given ample opportunities to learn. | I felt that I was given ample opportunities to learn. |
| 18 | I feel that my educational needs are not being met. | I felt that my educational needs were not being met. |
| 20 | I feel that this course does not promote a desire to learn. | I felt that this dyadic discussion did not promote a desire to learn. |

### *B. Group Community Scale Survey*

**Instructions:** Below, you will see a series of statements concerning your experience that you have recently participated in the group discussion where you and your partner discuss the issue "*internet monitoring of K-12 teachers' in-school internet use"* via online. Please indicate how strongly you agree or disagree with each statement below.

Do not spend too much time on any one statement, but give the response that seems to describe how you feel. All items are required.

| | | Strongly Disagree | | | Neutral | | | Strongly Agree |
|---|---|---|---|---|---|---|---|---|
| 1. | I felt that my discussion partner cared about me. | O | O | O | O | O | O | O |
| 2. | I felt that I was encouraged to ask questions during the discussion. | O | O | O | O | O | O | O |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 3. | I felt connected to my discussion partner. | O | O | O | O | O | O | O |
| 4. | I felt that it was hard to get help from my discussion partner when I had a question. | O | O | O | O | O | O | O |
| 5. | I did not feel a spirit of community. | O | O | O | O | O | O | O |
| 6. | I felt that I received timely feedback from my discussion partner. | O | O | O | O | O | O | O |
| 7. | I felt that my discussion partner was like a friend. | O | O | O | O | O | O | O |
| 8. | I felt uneasy exposing gaps in my understanding during the discussion. | O | O | O | O | O | O | O |
| 9. | I felt isolated during the discussion. | O | O | O | O | O | O | O |
| 10. | I felt reluctant to speak openly during the discussion. | O | O | O | O | O | O | O |
| 11. | I trusted my discussion partner during the discussion. | O | O | O | O | O | O | O |
| 12. | I felt that this discussion activity resulted in only modest learning. | O | O | O | O | O | O | O |
| 13. | I felt that I could rely on my discussion partner. | O | O | O | O | O | O | O |
| 14. | I felt that my discussion partner did not help me learn. | O | O | O | O | O | O | O |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 15. | I felt that my discussion partner depended on me. | O | O | O | O | O | O | O |
| 16. | I felt that I was given ample opportunities to learn. | O | O | O | O | O | O | O |
| 17. | I felt uncertain about my discussion partner. | O | O | O | O | O | O | O |
| 18. | I felt that my educational needs were <u>not</u> being met. | O | O | O | O | O | O | O |
| 19. | I felt confident that my discussion partner would support me. | O | O | O | O | O | O | O |
| 20. | I felt that this dyadic discussion did <u>not</u> promote a desire to learn. | O | O | O | O | O | O | O |

*Note.*
For items 1, 2, 3, 6, 7, 11, 13, 15, 16, and 19, the following scoring scale will be used: strongly agree=7, agree=6, somewhat agree=5, neutral=4, somewhat disagree=3, agree=2, strongly disagree = 1; for items 4, 5, 8, 9, 10, 12, 14, 17, 18, and 20, a reverse scoring scale will be used.
Items 1, 3, 5, 7, 9, 11, 13, 15, 17, and 19 are related to students' feelings of connectedness; items 2, 4, 6, 8, 10, 12, 14, 16, 18, and 20 are related to students' satisfaction with the learning experience.

# REFERENCES


Alexander, P. A., Buehl, M. M., & Sperl, C. T. (2001). The persuasiveness of persuasive discourse. *International Journal of Educational Research, 35*, 651-674.

Alexopoulou, E., & Driver, R. (1996). Small-group discussion in physics: Peer interaction modes in pairs and fours. *Journal of Research in Science Teaching, 33*(10), 1099-1114.

An, H., Kim, S., & Kim, B. (2008). Teacher perspectives on online collaborative learning: Factors perceived as facilitting and impeding successful online group work. *Contemporary Issues in Technology and Teacher Education, 8*(1), 65-83.

Anderson, R. C., Nguyen-Jahiel, K., McNurlen, B., Archodidou, A., Kim, S. Y., Reznitskaya, A., et al. (2001). The snowball phenomenon: Spread of ways of talking and ways of thinking across groups of children. *Cognition and Instruction, 19*(1), 1-46.

Andriessen, J., Baker, M., & Suthers, D. (2003a). Argumentation, computer support, and the educational context of confronting cognitions. In J. Andriessen, M. Baker & D. Suthers (Eds.), *Arguing to learn: Confronting cognitions in computer-supported collaborative learning environments* (pp. 1-25). Boston, MA: Kluwer Academic.

Andriessen, J., Baker, M., & Suthers, D. (Eds.). (2003b). *Arguing to learn: Confronting cognitions in computer-supported collaborative learning environments*. Boston, MA: Kluwer Academic.

Andriessen, J., Erkens, G., van de Laak, C., Peters, N., & Coirier, P. (2003). Argumentation as negotiation in electronic collaborative writing. In J. Andriessen, M. Backer & D. Suthers (Eds.), *Arguing to Learn: Confronting Cognitions in Computer-Supported Collaborative Learning Environments* (pp. 79-115). Netherlands: Kluwer Academic Publishers.

Baker, M. (1999). Argumentation and constructivist interaction. In J. Andriessen & P. Coirier (Eds.), *Foundations of argumentative text processing* (pp. 179-202). Amsterdam: University of Amsterdam.

Baker, M. (2003). Computer-mediated argumentative interactions for the co-elaboration of scientific notions. In J. Andriessen, M. Baker & D. Suthers (Eds.), *Arguing to learn: Confronting cognitions in computer-supported collaborative learning environments* (pp. 47-78). Boston, MA: Kluwer Academic.

Baker, M., Andriessen, J., Lund, K., Amelsvoort, M. v., & Quignard, M. (2007). Rainbow: A framework for analysing computer-mediated pedagogical debates. [Feature Article]. *International Journal of Computer-Supported Collaborative Learning, 2*(2/3), 315-357.

Baker, M. J., Quignard, M., Lund, K., & Séjourné, A. (2003). *Computer-supported collaborative learning in the space of debate.* Paper presented at the International Conference on Computer Support for Collaborative Learning, Dordrecht.

Bell, N., Grossen, M., & Perret-Clermont, A.-N. (1985). Sociocognitive conflict and intellectual growth. In M. W. Berkowitz (Ed.), *Peer conflict and psychological growth* (pp. 283-322). San Francisco: Jossey-Bass.

Bell, P., & Linn, M. C. (2000). Scientific arguments as learning artifacts: designing for learning from the web with KIE. [Article]. *International Journal of Science Education, 22*(8), 797-817.

Blair, J. A., & Johnson, R. H. (1987). Argumentation as dialectical. *Argumentation, 1*(1), 41-56.

Brown, P., & Levinson, S. C. (1987). *Politeness: Some universals in language usage*. Cambridge, UK: Cambridge University Press.

Burnett, R. E. (1993). Decision-making during the collaborative planning of co-authors. In A. Penrose & B. Sitko (Eds.), *Hearing ourselves think: Cognitive research in the college writing classroom* (pp. 125-146). NY: Oxford University Press.

Chan, C. K. K. (2001). Peer collaboration and discourse patterns in learning from incompatible information. *Instructional Science, 29*(6), 443-479.

Chinn, C. A. (2006). Learning to argue. In C. E. Hmelo & G. Erkens (Eds.), *Collaborative learning, reasoning, and technology* (pp. 355-383). Mahwah, N.J.: Erlbaum.

Chinn, C. A., & Anderson, R. C. (1998). The structure of discussions that promote reasoning. *Teachers College Record, 100*(2), 315-368.

Chinn, C. A., O'Donnell, A. M., & Jinks, T. S. (2000). The structure of discourse in collaborative learning. *Journal of Experimental Education, 69*(1), 77-97.

Cho, K. L., & Jonassen, D. H. (2002). The effects of argumentation scaffolds on argumentation and problem solving. *Etr&D-Educational Technology Research and Development, 50*(3), 5-22.

Cohen, J. (1960). A coefficient of agreement for nominal scales. *Educational and Psychological Measurement, 20*, 37-46.

Creswell, J. W. (2005). *Educational research : planning, conducting, and evaluating quantitative and qualitative research*. Upper Saddle River, N.J.: Pearson/Merrill Prentice Hall.

de Vries, E., Lund, K., & Baker, M. (2002). Computer-mediated epistemic dialogue: Explanation and argumentation as vehicles for understanding scientific notions. *Journal of the Learning Sciences, 11*(1), 63-103.

Driver, R., Newton, P., & Osborne, J. (2000). Establishing the norms of scientific argumentation in classrooms. *Science Education, 84*(3), 287-312.

Ebenezer, J., & Puvirajah, A. (2005). WebCT Dialogues on Particle Theory of Matter: Presumptive reasoning schemes. *Educational Research & Evaluation, 11*(6), 561-589.

Erkens, G., Andriessen, K., & Peters, N. (2003). Interaction and performance in computer-supported collaborative tasks. In H. van Oostendorp (Ed.), *Cognition in a digital world* (pp. 225-251). Mahwah, N.J.: Mahwah, NJ: Erlbaum.

Fahy, P. J. (2001). Patterns of interaction in a computer conference transcript. *International Review of Research in Open and Distance Learning, 2*(1).

Fahy, P. J. (2002). Epistolary and expository interaction patterns in a computer conference transcript. *Journal of Distance Education, 17*(1), 20-35.

Fahy, P. J. (2003). Indicators of support in online interaction. *International Review of Research in Open and Distance Learning, 4*(1).

Felton, M., & Kuhn, D. (2001). The development of argumentive discourse skill. *Discourse Processes, 32*(2&3), 135-153.

Ferretti, R. P., MacArthur, C. A., & Dowdy, N. S. (2000). The Effects of an Elaborated Goal on the Persuasive Writing of Students With Learning Disabilities and Their Normally Achieving Peers. *Journal of Educational Psychology, 92*(4), 694-702.

Garrison, D. R., Anderson, T., & Archer, W. (2000). Critical inquiry in a text-based environment: Computer conferencing in higher education. *The Internet and Higher Education, 2*(2-3), 87-105.

Ge, X., & Land, S. M. (2003). Scaffolding students' problem-solving processes in an ill-structured task using question prompts and peer interactions. *Educational Technology Research & Development, 51*(1), 21-38.

Golanics, J. D., & Nussbaum, E. M. (2008). Enhancing online collaborative argumentation through question elaboration and goal instructions. *Journal of Computer Assisted Learning, 24*, 167-180.

Goldman, A. I. (1999). *Knowledge in a social world*. Oxford, Clarendon Press, N.Y.: Oxford University Press.

Gunawardena, C. N. (1995). Social presence theory and implications for interaction and collaborative learning in computer conferences. *International Journal of Educational Telecommunications, 1*(2/3), 147-166.

Gunawardena, C. N., & Zittle, F. (1997). Social presence as a predictor of satisfaction within a computer mediated conferencing environment. *American Journal of Distance Education, 11*(3), 8-25.

Heller, P., Keith, R., & Anderson, S. (1992). Teaching problem solving through cooperative grouping. Part 1: Group versus individual problem solving. *American Journal of Physics, 60*(7), 627-636.

Henri, F. (1992). Computer conferencing and content analysis. In A. Kaye (Ed.), *Collaborative learning through computer conferencing: The Najaden papers* (pp. 117-136). Berlin: Springer-Verlag.

Hoadley, C. M. (2000). Teaching science through online, peer discussions: SpeakEasy in the Knowledge Integration Environment. *International Journal of Science Education, 22*(8), 839-857.

Hogan, K., Nastasi, B. K., & Pressley, M. (2000). Discourse patterns and collaborative scientific reasoning in peer and teacher-guided discussions. *Cognition and Instruction, 17*(4), 379-432.

Inch, E. S., & Warnick, B. (2002). *Critical thinking and communication: the use of reason in argument* (4th ed.). Boston: Allyn & Bacon.

Inch, E. S., Warnick, B., & Endres, D. (2006). *Critical thinking and communication: the use of reason in argument* (5 ed.). Boston: Allyn & Bacon.

Infante, D. A., & Rancer, A. S. (1982). A Conceptualization and Measure of Argumentativeness. *Journal of Personality Assessment, 46*(1), 72.

Järvelä, S., & Häkkinen, P. (2003). The levels of web-based discussions: Using perspective-taking theory as an analytical tool. In H. van Oostendorp (Ed.), *Cognition in a digital world* (pp. 77-95). Mahwah, N.J.: Lawrence Erlbaum Associates.

Jeong, A. C. (2006). The effects of conversational language on group interaction and group performance in computer-supported collaborative argumentation. *Instructional Science, 34*(5), 367-397.

Jeong, A. C., & Joung, S. (2007). Scaffolding collaborative argumentation in asynchronous discussions with message constraints and message labels. *Computers & Education, 48*(3), 427-445.

Jermann, P., & Dillenbourg, P. (2003). Elaborating new arguments through a cscl scenario. In G. Andriessen, M. Baker & D. Suthers (Eds.), *Arguing to learn: Confronting cognitions in computer-supported collaborative learning environments*. Kluwer, Amsterdam: The Netherlands.

Johnson, D. W., & Johnson, R. (2004). Cooperation and the use of technology. In D. H. Jonassen (Ed.), *Research for Educational Communications and Technology* (2 ed., pp. 785-811). Bloomington, IN Association for Educational Communications & Technology.

Jonassen, D. H. (1999). Designing constructivist learning environments. In C. M. Reigeluth (Ed.), *Instructional design theories and models: Their current state of the art* (2nd ed.). Mahwah, NJ: Lawrence Erlbaum Associates.

Jonassen, D. H. (2004). *Learning to solve problems: An instructional design guide.* San Fran Cisco: Jossey-Bass.

Jonassen, D. H., & Remidez, H. (2002). *Mapping alternative discourse structure onto computer conferences.* Paper presented at the Computer Supported for Collaborative Learning, Boulder, CO.

Keefer, M. W., Zeitz, C. M., & Resnick, L. B. (2000). Judging the quality of peer-led student dialogues. *Cognition and Instruction, 18*(1), 53-81.

King, A. (1989). Verbal interaction and problem-solving within computer-assisted cooperative learning groups. *Journal of Educational Computing Research, 5*(1), 1-15.

King, A. (1990). Enhancing peer interaction and learning in the classroom through reciprocal questioning. *American Educational Research Journal, 27*(4), 664-687.

King, A. (1991). Effects of training in strategic questioning on children's problem-solving performance. *Journal of Educational Computing Research, 5*(1), 1-15.

King, A. (1992). Facilitating elaborative learning through guided student-generated questioning. [Article]. *Educational Psychologist, 27*(1), 111-126.

King, A. (1994). Guiding knowledge construction in the classroom: effects of teaching children how to question and how to explain. [Feature Article]. *American Educational Research Journal, 31*(2), 338-368.

King, A. (1997). ASK to THINK-TEL WHY: A model of transactive peer tutoring for scaffolding higher level complex. *Educational Psychologist, 32*(4), 221.

King, A. (1999). Discourse patterns for mediating peer learning. In A. M. O'Donnell & A. King (Eds.), *Cognitive perspectives on peer learning* (pp. 87-115). Mahwah, N.J.: L. Erlbaum.

King, A., & Rosenshine, B. (1993). Effects of guided cooperative questioning on children's knowledge construction. *Journal of Experimental Education*(61), 127-148.

Koschmann, T. D. (2003). CSCL, argumentation, and Deweyan inquiry: Argumentation is learning. In J. Andriessen, M. Baker & D. Suthers (Eds.), *Arguing to learn: Confronting cognitions in computer-supported collaborative learning environments* (pp. 261-269). Boston, MA: Kluwer Academic.

Kreijns, K., Kirschner, P. A., & Jochems, W. (2003). Identifying the pitfalls for social interaction in computer-supported collaborative learning environments: a review of the research. *Computers in Human Behavior, 19*, 335-353.

Kreijns, K., Kirschner, P. A., Jochems, W., & Buuren, H. V. (2004). Determining sociability, social space, and social presence in (a)synchronous collaborative groups. *Cyper Psychology & Behaviors, 7*(2), 155-172.

Kuhn, D. (1991). *The skills of argument*. Cambridge, England: Cambridge University Press.

Kuhn, D., Shaw, V., & Felton, M. (1997). Effects of Dyadic Interaction on Argumentive Reasoning. *Cognition and Instruction, 15*(3), 287-315.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cmbridge, England: Cmbridge University Press.

Leitão, S. (2000). The potential of argument in knowledge building. *Human Development, 43*, 332-360.

Leitão, S. (2001). Analyzing changes in view during argumentation: A quest for method. *Forum: Qualitative Social Research, 2*(3).

Leitão, S. (2003). Evaluating and selecting counterarguments - Studies of children's rhetorical awareness. [Article]. *Written Communication, 20*(3), 269-306.

Maxwell, S. E., & Delaney, H. D. (2004). *Designing experiments and analyzing data: A model comparison perspective* (2nd ed.): Lawrence Erlbaum Associates.

Mercer, N. (1996). The quality of talk in children's collaborative activity in the classroom. *Learning and Instruction, 6*(4), 359-377.

Meyers, R. A., Brashers, D. E., & Hanner, J. (2000). Majority-minority influence: identifying argumentative patterns and predicting argument-outcome links. *Journal of Communication, 50*(4), 3-30.

Munneke, L., Andriessen, J., Kanselaar, G., & Kirschner, P. (2007). Supporting interactive argumentation: Influence of representational tools on discussing a wicked problem. *Computers in Human Behavior, 23*(3), 1072-1088.

Nussbaum, E. M. (2002). How Introverts versus Extroverts Approach Small-Group Argumentative Discussions. *The Elementary School Journal, 102*(3), 183-197.

Nussbaum, E. M. (2005). The effect of goal instructions and need for cognition on interactive argumentation. [Article]. *Contemporary Educational Psychology, 30*(3), 286-313.

Nussbaum, E. M., & Bendixen, L. D. (2003). Approaching and avoiding arguments: The role of epistemological beliefs, need for cognition, and extraverted personality traits. [Article]. *Contemporary Educational Psychology, 28*(4), 573-595.

Nussbaum, E. M., Hartley, K., Sinatra, G. M., Reynolds, R. E., & Bendixen, L. D. (2004). Personality interactions and scaffolding in on-line discussions. *Journal of Educational Computing Research, 30*(1&2), 113-137.

Nussbaum, E. M., & Jacobson, T. E. (2004). *Reasons that students avoid intellectual arguments*. Paper presented at the American Psychological Association.

Nussbaum, E. M., & Kardash, C. M. (2005). The effects of goal instructions and text on the generation of counterarguments during writing. [Article]. *Journal of Educational Psychology, 97*(2), 157-169.

Nussbaum, E. M., & Schraw, G. (2007). Promoting argument-counterargument integration in students' writing. [Article]. *Journal of Experimental Education, 76*(1), 59-92.

Nussbaum, E. M., & Sinatra, G. M. (2003). Argument and conceptual engagement. *Contemporary Educational Psychology, 28*(3), 384-395.

Nussbaum, E. M., Winsor, D. L., Aqui, Y. M., & Poliquin, A. M. (2007). Putting the pieces together: Online argumentation vee diagrams enhance thinking during

discussions. [Feature Article]. *International Journal of Computer-Supported Collaborative Learning, 2*(4), 479-500.

O'Keefe, D. J. (1982). The concepts of argument and arguing. In J. R. Cox & C. A. Willard (Eds.), *Advances in argumentation theory and research* (pp. 3-23). Carbondale, IL: Southern Illinois University Press.

O'Keefe, D. J. (1999). How to handle opposing arguments in persuasive messages: A meta-analytic review of the effects of one-sided and two-sided messages. In M. E. Roloff (Ed.), *Communication yearbook* (Vol. 22, pp. 209–249). Thousand Oaks, CA: Sage.

Oh, S. (2005). *The effects of constraint based argumentation scaffolding and epistemological beliefs on ill structured diagnosis-solution problem solving.* Unpublished Doctoral dissertation, University of Missouri.

Oh, S., & Jonassen, D. H. (2007). Scaffolding online argumentation during problem solving. *Journal of Computer Assisted Learning, 23*(2), 95-110.

Oshima, J., & Oshima, R. (2002). Coordination of asynchronous and synchronous communication: Differences in qualities of knowledge advancement discourse between experts and novices. In T. D. Koschmann, R. Hall & N. Miyake (Eds.), *CSCL 2: Carrying forward the conversation* (pp. 55-84). Mahwah, N.J.: Erlbaum.

Perelman, C., & Olbrechts-Tyteca, L. (1969). The new rhetoric: A treatise on argumentation. In J. Wilkinson & P. Weaver (Eds.). Nortre Dame, London: University of Notre Dame Press.

Perkins, D. N., Farady, M., & Bushey, B. (1991). Everyday reasoning and the roots of intelligence. In J. F. Voss, D. N. Perkins & J. W. Segal (Eds.), *Informal reasoning and education* (pp. 83-106). Hillsdale, NJ: Erlbaum.

Piaget, J. (1985). *The equilibration of cognitive structures*. Chicago: University of Chicago Press.

Resnick, L. B., Salmon, M., Zeitz, C. M., Wathen, S. H., & Holowchak, M. (1993). Reasoning in conversation. *Cognition and Instruction, 11*(3/4), 347-364.

Reznitskaya, A., Anderson, R. C., McNurlen, B., Nguyen-Jahiel, K., Archodidou, A., & Kim, S.-y. (2001). Influence of Oral Discussion on Written Argument. *Discourse Processes, 32*(2/3), 155-175.

Rourke, L. (2000). *Operationalizing social interaction in computer conferencing.* Paper presented at the 16th Annual conference of the Canadian Association for Distance Education, Quebec City.

Rourke, L., Anderson, T., Garrison, D. R., & Archer, W. (1999). Assessing social presence in asynchronous test-based computer conferencing. *Journal of Distance Education, 14*(2), 51-70.

Rourke, L., & Kanuka, h. (2007). Barriers to online critical discourse. *International Journal of Computer-Supported Collaborative Learning, 2*(1), 105-126.

Rovai, A. P. (2002). Development of an instrument to measure classroom community. *Internet and Higher Education, 5*, 197-211.

Sampson, V. D., & Clark, D. B. (2006). *Assessment of argument in science education: A critical review of the literature.* Paper presented at the The International Conference of Learning Sciences, Bloomington, IN.

Santos, C. M. M., & Santos, S. L. (1999). Good argument, content and contextual dimensions. In J. Andrissen & P. Coirier (Eds.), *Foundations of argumentive text processing* (pp. 75-95). Amsterdam: Amsterdam University Press.

Savicki, V., Kelley, M., & Ammon, B. (2002). Effects of training on computer-mediated communication in single or mixed gender small task groups. *Computers in Human Behavior, 18*(3), 257-269.

Scardamalia, M., & Bereiter, C. (1991). Higher Levels of Agency for Children in Knowledge Building: A Challenge for the Design of New Knowledge Media. *The Journal of the Learning Sciences, 1*(1), 37-68.

Scardamalia, M., & Bereiter, C. (1992). An architecture for collaborative knowledge-building. In E. De Corte, M. C. Linn, H. Mandl & L. Verschaffel (Eds.), *Computer-based learning environments and problem solving* (Vol. 84, pp. 41-46). Berlin: Springer-Verlag.

Scardamalia, M., & Bereiter, C. (1993). Technologies for knowledge-building discourse. *Communications of the ACM, 36*(5), 37-41.

Scardamalia, M., & Bereiter, C. (1993-1994). Computer support for knowledge-building communities. *Journal of the Learning Sciences, 3*(3), 265-283.

Scardamalia, M., & Bereiter, C. (1996). Computer Support for Knowledge-Building Communities. In T. Koschman (Ed.), *CSCL: Theory and practice of an emerging paradigm* (pp. 249-268). Mahwah, NJ: Lawrence Erlbaum Associates.

Scardamalia, M., Bereiter, C., & Lamon, M. (1994). The CSILE Project: Trying to Bring the Classroom into World 3. In K. McGilly (Ed.), *Classroom lessons : integrating cognitive theory and classroom practice* (pp. 201-228). Cambridge, Mass.: MIT Press.

Scardamalia, M., Bereiter, C., McLean, R. S., Swallow, J., & et al. (1989). Computer-supported intentional learning environments. *Journal of Educational Computing Research, 5*(1), 51-68.

Scardamalia, M., Bereiter, C., McLean, R. S., Swallow, J., & Woodruff, E. (1987). *Computer-supported intentional learning environments*. Paper presented at the Annual Meeting of the American Educational Research Association.

Scardamalia, M., Bereiter, C., & Steinback, R. (1984). Teachability of reflective processes in written composition. *Cognitive Science, 8*(173-190).

Schwarz, B. B., Neuman, Y., & Biezuner, S. (2000). Two Wrongs May Make a Right ... If They Argue Together! *Cognition and Instruction, 18*(4), 461-494.

Simon, P. (2006). Including omission mistakes in the calculation of Cohen's Kappa and an analysis of the coefficient's paradox features. *Educational and Psychological Measurement, 66*(5), 765-777.

Simosi, M. (2003). Using Toulmin's Framework for the Analysis of Everyday Argumentation: Some Methodological Considerations. *Argumentation, 17*(2), 185.

Slavin, R. E. (1995). *Cooperative learning: Theory, research, and practice* (Vol. 2nd ed). Boston: Allyn & Bacon.

Slavin, R. E. (1996). Research on cooperative learning and achievement: What we know, what we need to know. [Review]. *Contemporary Educational Psychology, 21*(1), 43-69.

Stacey, E. (2002). Quality online participation: establishing social presence. In T. Evans (Ed.), *Research in Distance Education 5* (pp. 138-253). Geelong: Deakin University Press.

Stegmann, K., Weinberger, A., & Fischer, F. (2007). Facilitating argumentative knowledge construction with computer-supported collaboration scripts. [Feature Article]. *International Journal of Computer-Supported Collaborative Learning, 2*(4), 421-447.

Stein, N. L., & Albro, E. R. (2001). The origins and nature of arguments: Studies in conflict understanding, emotion, and negotiation. *Discourse Processes, 32*(2&3), 113-133.

Steinkuehler, C. A. (2001). *The quality of preservice science teachers' social argumentative reasoning*. Paper presented at the Annual Conference National Association for Research in Science Teaching.

Steinkuehler, C. A. (2002). *A discourse analysis of online social argumentation*. Paper presented at the Annual Meeting of the American Educational Research Association.

Suthers, D. D. (2003). Representational guidance for collaborative inquiry. In J. Andriessen, M. Baker & D. Suthers (Eds.), *Arguing to learn: Confronting cognitions in computer-supported collaborative learning environments* (pp. 27-46). Kluwer, Dordrecht: The Netherlands.

Suthers, D. D., & Hundhausen, C. D. (2003). An Experimental Study of the Effects of Representational Guidance on Collaborative Learning Processes. *Journal of the Learning Sciences, 12*(2), 183-218.

Sweller, J., van Merrienboer, J. J. G., & Pass, J. (1998). Cognitive architecture and instructional design. *Educational Psychology Review, 10*(3), 251-296.

Tabachnick, B. G., & Fidell, L. S. (2001). *Using multivariate statistics* (4th ed.). Needham Heights, MA: Allyn & Bacon.

Teichert, M. A., & Stacy, A. M. (2002). Promoting understanding of chemical bonding and spontaneity through student explanation and integration of ideas. *Journal of Research in Science Teaching, 39*(6), 464-496.

Toulmin, S. E. (1958). *The uses of argument*. Cambridge, England: Cambridge University Press.

Tu, C. H., & McIsaac, M. (2002). The relationship of social presence and interaction in online classes. *American Journal of Distance Education, 16*(3), 131-150.

van Eemeren, F. H., & Grootendorst, R. (1992). *Argumentation, communication, and fallacies: A pragma-dialectical perspective*. Hillsdale, NJ: Erlbaum.

van Eemeren, F. H., & Grootendorst, R. (1999). Developments in argumentation theory. In J. Andriessen & P. Coirier (Eds.), *Foundations of argumentative text processing* (pp. 43-57). Amsterdam: Amsterdam University Press.

van Eemeren, F. H., Grootendorst, R., & Henkemans, F. S. (1996). *Fundamentals of argumentation theory: A handbook of historical backgrounds and contemporary developments*. Mahwah, NJ: Erlbaum.

van Eemeren, F. H., Grootendorst, R., & Kruiger, T. (1987). *Handbook of argumentation theory: A critical survey of classical backgrounds and modern studies*. Dordrecht-Halland: Foris Publications.

van Eemeren, F. H., & Houtlosser, P. (2003). The development of the pragma-dialectical approach to argumentation. *Argumentation, 17*(4), 387-403.

van Eemeren, F. H., & Houtlosser, P. (2006). Strategic maneuvering: A synthetic recapitulation. *Argumentation, 20*(4), 381-392.

Veerman, A. L. (2003). Constructive discussions through electronic dialogue. In J. Andriessen, M. Baker & D. Suthers (Eds.), *Arguing to learn: Confronting cognitions in computer-supported collaborative learning environments* (pp. 117-143). Boston, MA: Kluwer Academic.

Veerman, A. L., & Treasure-Jones, T. (1999). Software for problem solving through collaborative argumentation. In J. Andriessen & P. Coirier (Eds.), *Foundations of argumentative text processing* (pp. 203). Amsterdam: Amsterdam University Press.

Vorobej, M. (2006). *A theory of argument*. Cambridge, N.Y.: Cambridge University Press.

Vygotsky, L. S. (1978). Mind in society: The development of higher psychological processes. In M. Cole, V. John-Steiner, S. Scribner & E. Souberman (Eds.). Cambridge, MA: Harvard University Press.

Vygotsky, L. S. (1981). The genesis of higher order mental functions. In J. W. Wertsch (Ed.), *The concept of activity in soviet psychology* (pp. 144-184). Armonk, NY: Sharpe.

Walton, D. N. (1996). *Argumentation schemes for presumptive reasoning*. Mahwah, N.J.: Lawrence Erlbaum Associates.

Webb, N. M. (1992). Testing a theoretical model of student interaction and learning in small groups. In R. Hertz-Lazarowitz & N. Miller (Eds.), *Interaction in cooperative groups: The theoretical anatomy of group learning* (pp. 102-119). New York: Cambridge University Press.

Wegerif, R. (1998). The social dimension of asynchronous learning networks. *Journal of Asynchronous Learning Network, 2*(1), 34-49.

Wegerif, R., Mercer, N., & Dawes, L. (1999). From social interaction to individual reasoning: an empirical investigation of a possible socio-cultural model of cognitive development. *Learning and Instruction, 9*(6), 493-516.

Weinberger, A., Ertl, B., Fischer, F., & Mandl, H. (2005). Epistemic and social scripts in computer-supported collaborative learning. [Article]. *Instructional Science, 33*(1), 1-30.

Willard, C. A. (1983). *Argumentation and the social grounds of knowledge*. Tuscaloosa: University of Alabama Press.

Zohar, A., & Nemet, F. (2002). Fostering students' knowledge and argumentation skills through dilemmas in human genetics. *Journal of Research in Science Teaching, 39*(1), 35-62.

# VITA

Bosung Kim was born in South Korea. She received a B.A. in History Education from Sung Kyun Kwan University in South Korea in 1997, a M.S. in Instructional Systems Technology from Indiana University Bloomington in 2003, and a Ph.D. in Learning Technologies from the University of Missouri – Columbia, in 2009. While pursuing her doctoral degree at the University of Missouri, she worked as a research assistant on numerous projects and taught online graduate courses for over two years. She has also co-authored and published several academic articles. She is married to Gyung-Ho Jeong, who is currently a professor in political science at Claremont Graduate University. They have a daughter, Jane Kim Jeong, who was born in 2007.