CRITICAL THINKING IN A SYNCHRONOUS ONLINE DISCOURSE: THE PEDAGOGICAL ROLE OF INSTANT MESSAGING IN HIGHER EDUCATION

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ABSTRACT

The adoption of Instant Messaging (IM) technology as an educational tool in higher educational practice is beginning to emerge, and concerns remain about the effectiveness of this technology in learning environments. This thesis reports on an exploratory study that used a mixed method approach to investigate the use of IM for promoting critical thinking in a synchronised online discussion, and the role of time as a variable for enhancing critical thinking skills. Two models for operationalising critical thinking in online environments were adopted for analysis and coding purposes. Results indicate that high-level critical thinking skills (e.g. Integration, Assessment, and Inference) were evident in generated discussions. We also found evidence of a positive correlation between time and critical thinking, further validating the potential role of IM in higher education. We discuss the implications of these findings and propose a planned integration strategy and structured discussion activities as part of that strategy.

Keywords: Instant messaging, Critical Thinking, Educational Tools, Time-on-Task, Cognitive Presence

Subject Terms: Educational Technology, Computer-assisted Instruction, Internet in Education

DEDICATION

To God Almighty, who saw me through the challenging periods of this program and gave me the ability, strength and wisdom to complete this degree.

To my husband who supported me financially, emotionally, and psychologically with motivating words of encouragement in my 'down' moments. Who would always leave his work to baby sit our daughter so I could complete this program.

To my daughter who tolerated my inadequate attention to her during my busy schedules. Who endured my time away from home to complete this work.

To my family, especially my mum and my uncle who supported me with words of encouragement and prayers.

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1 INTRODUCTION

This thesis was inspired by the increased use of instant messaging (IM) in higher education being one of the emerging technologies in learning environments. Often, the primary objective motivating research on the study of IM usage is to establish its benefits and role in various learning contexts, with the aim of facilitating the acceptance of this technology as an educational tool. This thesis focuses on the role of IM in promoting critical thinking in an online environment and provides insight into the benefits of this technology in synchronous learning networks.

This chapter consists of six sections. The first section discusses the background information. The second part presents the problem statement. The third part focuses on the research questions that guided this thesis. The fourth part discusses the significance of the study. The fifth section presents a flow chart of the thesis, while final section gives an overview of the chapters.

1.1 Background

In the last few decades, educational environments have undergone a major change due to the influence of information and communication technology (Khine, Yeap, & Lok, 2003). Some of these changes can be attributed to the increased use of computer-meditated communication (CMC) tools as learning networks in various educational settings. The added advantage, which is mainly to bridge the barrier of time and space

and in some cases an extension of face-to-face classroom have significantly benefited distributed learning environments. As such, CMC has made a significant contribution in changing the traditional methods of teaching and learning.

Many studies validate the importance of CMC tools and concur with the notion that several advantages arise from the use of these tools. Some benefits that could not have been derived forty years ago in learning environments have been made possible since the advent of CMC tools. For instance, students who are geographically distributed are able to engage effectively in “distance learning”, simulating a face-to-face classroom. Video conferencing, computer conferencing, white boards, chat rooms, and instant messaging not only provide a social presence for participants but also facilitate the sharing of learning resources and the building of online communities, which are essential ingredients in a learning environment (Nicholson, 2003; Rovai, 2002). In addition, communication within communities of learners is aided by the use of CMC tools (Veerman & Veldhuis-Diermanse, 2001).

The advantages offered by CMC tools have opened up a world of opportunities for educators and learners. Traditional classrooms have expanded learning environments from pen-and-paper correspondence courses to include interactive and integrated learning environments (Berge & Collins, 1995). Students have more options for constructing knowledge due to varied delivery formats such as graphics, animations, videos, etc and more. CMC tools in learning networks also provide the advantages of accessing countless learning resources from other servers and communicating with other people who are not necessarily involved in the course.

The use of instant messaging (IM) in higher education or other formal settings is a recent development in online communities. The initial use of IM was to maintain social status among teenagers; however, this technology has gradually made its way into learning environments. The use of IM today has expanded to include applications that were not anticipated when the technology was first introduced. For instance, IM is used for task support, improved participation, cognitive development, teacher-mentoring, and enriched learning outcomes through discussion.

This thesis focuses on highlighting the benefits of using IM technology for teaching and learning critical thinking skills. In using the term 'critical thinking', we refer to Dewey's (1933) definition of critical thinking as the use of logical arguments in a persistent and active consideration of any supposed form of knowledge with the aim of constructing or reconstructing knowledge (read further in sections 2.3 and 2.3.1). Critical thinking is often cited as one of the objectives of any educational experience, and is a key teaching goal for instructors who realise the importance of this skill beyond the classroom. This thesis aims to establish critical thinking as a beneficial learning outcome that can emerge from the use of IM technology.

1.2 Problem Statement

IM offers great benefits for enhancing teaching and learning in different contexts. There is an increased use of this technology as a support for various educational activities such as sharing resources, planning projects, coordinating assignments, and obtaining feedback from peers (Pew Internet, 2004; Bakker et al., 2007). This is a pointer to the potential role of IM technology in higher educational practises. Immediate feedback,

team collaboration, quick clarifications, and context-embedded discussions are some features of IM that are valuable in certain learning contexts (see section 2.2.1). These features of IM should also provide some advantage in teaching critical thinking skills. For instance, context-embedded discussions promote real-time explorations of the subject such that quick clarifications are made and misconceptions clarified in context. McCracken and Dobson (2005) proposed that synchronous tools encourage 'thinking on one's feet', which is a necessary skill in learning environments. The spontaneous nature of IM discussions promote thinking impulsively, and this could be a valuable feature for promoting critical thinking. IM technology provides the benefit of a social presence in online communities. It is possible that the benefit of a social presence afforded by IM technology creates a 'conducive learning atmosphere' that could foster critical thinking in online communities. This social support is particularly beneficial to students in distributed learning environments. Some of these characteristics have been researched for other CMC tools, but have not been investigated for IM technology as it relates to critical thinking.

The advent of IM usage in learning environments is not without some challenges. Being primarily considered a social tool in the past (Pew Internet, 2001; Pew Internet, 2004; Kim, Kim, Park, & Rice, 2007), concerns remain about the role of this technology as an effective educational tool (Farmer, 2003; 2005). These concerns are speculative arguments that are not supported by any empirical evidence. In contrast, recent studies (Sotillo, 2006; Wang & Beasley, 2005; Hrastinski, 2006; Murphy & Rodriguez-Manzanares, 2008) provide evidence in support of IM as a potential educational tool. Thus, some advantages may accrue to the use of IM in higher educational practises

provided its usage is channelled in the right direction. However, extensive research has not been conducted on the pedagogical values of IM in higher education (Johnson, 2006).

There is a possibility that some instructors are currently unaware of integration possibilities for this technology; hence, they are unable to take advantage of the benefits promised by IM tools. IM is a promising educational tool when instructors carefully plan for its integration into the curriculum and provide structured activities to guide students in its usage. The issue of concern therefore should be focused on 'integration possibilities' and the 'design of structured activities' for IM technology. At the end of this study, we provide some integration possibilities for various learning contexts; this helps create the necessary awareness for IM as an educational tool.

Since IM is a fairly new educational tool, its specific roles in various learning contexts have not been fully researched (Johnson, 2006; Farmer, 2003). Further research is required to unveil the nature of learning activities that can be effectively supported by this tool. Other benefits that accrue from the use of this technology in various educational contexts also need to be identified. As proposed by Garrison, Anderson, and Archer (2000), the success of any learning endeavour is partly dependent on the mediating tool. A possible negative issue with IM tools could be a lack of verbal cues. Therefore, research on the extent to which IM technology either hinders or encourages critical thinking would be valuable, in particular to observe whether a lack of verbal cues such as tone of voice impairs the process of critical thinking in IM discussions.

In the light of the above notion, we seek to investigate whether certain features of IM technology (e.g. real-time discussions, context-embedded texts, immediate response and feedback, and quick clarifications) support or hinder critical thinking and observe

whether structured questioning promotes critical thinking. The level of detail in this study does not include the specific contributions to critical thinking of each IM feature mentioned above, but rather the contributions of IM from a holistic perspective. Critical thinking is a crucial construct in any learning endeavour (Fahy, 2005; McMillan, 1987; National Institute of Education, 1984). Critical thinking in this context would involve the use of inferences, assessment, and inductive and deductive reasoning in analysing an 'issue' with a focus on creating or improving knowledge in a social discourse. Critical thinking in this sense also involves evaluating possible actions or proposing solutions as a strategy for resolving the issue (refer to sections 2.4, 2.4.1, and 2.4.2 to read further).

Until now, no published research has investigated the role of IM in teaching and learning critical thinking. This study extends research on IM as an educational tool and provides empirical evidence supporting the role of this technology in enhancing critical thinking skills. We posit that the spontaneous nature of IM discussions, the archived texts for further references, and the immediacy afforded by this technology would be beneficial in promoting critical thinking skills. Some of these features have been investigated for other CMC tool, but not for IM. This technology has made its way into higher educational practises, it is therefore necessary to conduct further research on IM in order to establish its specific contributions as an educational tool.

1.3 Research Questions

The role of instant messaging in encouraging or restricting critical thinking remains an issue that needs investigation. If IM is used in teaching critical thinking, we need to understand the occurrence and nature of critical thinking in IM discussions. In order to further comprehend the occurrence of this construct in IM technology, we also need to understand the roles of certain factors (e.g. time on task) as it relates to critical thinking in instant messaging discussions.

In this work, Garrison, Anderson, and Archer's (2001) taxonomies would be adopted for categorising messages into phases of critical thinking (*Triggering, Exploration, Integration,* and *Resolution*); and also for observing 'high levels' of critical thinking as defined in this model. We also employ Perkins & Murphy's (2006) model in identifying cognitive processes (*Clarification, Assessment, Inference,* and *Strategies*) as defined in this model (to read further on this two models, refer to sections 2.4.2 and 2.4.3).

This study asks the following exploratory research questions:

1. Can we detect critical thinking in synchronous online discussion mediated by IM?
2. Is it possible to achieve high levels of critical thinking skills with the use of structured questions in IM discussions?
3. What is the relationship between time-on-task and critical thinking during IM discussions?
4. By what processes did students engage in critical thinking during this context of IM usage?

5. What critical thinking processes did individual students most and least frequently engage in?
6. What is the least and most frequently used critical thinking process at the group level?

Research questions 5 and 6 do not suggest that individual critical thinking and group critical thinking would be necessarily different; this could very well be, but this issue is not the focus in this study. The rationale for these questions is to determine if the taxonomies in Perkins & Murphy's (2006) model can be adopted for improving critical thinking individually or at the group level.

Literature on IM usage in higher education has provided evidence regarding its effectiveness in various learning outcomes; however further educational benefits of this technology in other learning contexts need to be fully explored (Johnson, 2006). Answering the above research questions would provide a new opportunity regarding the use of IM in learning environments.

1.4 Significance of the Study

While the educational advantages (as it relates to critical thinking) of other CMC tools (e.g. computer conferencing, white boards, chat rooms, etc) have been investigated in prior research, the unique characteristics of IM has not been researched accordingly. This thesis investigates how IM technology may be used to promote or enhance critical thinking skills. By exploring the stated research questions, We aim to provide helpful answers to inform instructors on curriculum organisation (e.g. use of discussions, time management, delivery methods) for promoting critical thinking using IM technology, as

well as design strategies for integrating IM technology in various learning contexts. Kennedy, Fisher, and Ennis (1991) suggest several challenges faced by instructors while teaching or promoting critical thinking; in particular, the structure of the learning activities and delivery strategies are some of the challenges mentioned. This study helps provide useful additional information that may address these issues and expand the taxonomic and explanatory basis for them.

1.5 Flow Chart of the Thesis

The intent of this thesis is to find evidence for and deepen the understanding of the concept of critical thinking in synchronous discussions using instant messaging. An initial pilot study (involving 6 volunteer students) was conducted to provide clarity on the nature of instant messaging discussions, and to provide insight into other factors that could inform the study of the use of instant messaging as an educational tool for promoting critical thinking. Transcripts from the pilot study revealed that critical thinking processes could be detected in instant messaging discussions. After the pilot study, 32 more volunteer students were recruited for the main study. During the analysis of transcripts, it was observed that participants used varying lengths of time (ranging from 10 minutes to about 60 minutes) for their discussions. This observation influenced the decision to investigate the relationship between ‘time on task’ and critical thinking. Correlation analysis was conducted using a statistical software tool.

Having established the evidence of critical thinking in IM discussions, and the relationship between time and critical thinking, we further explored the occurrence of critical thinking in IM discussions. We performed an in-depth analysis of the cognitive

processes by which students engaged in critical thinking. Using Perkins and Murphy's (2006) model of critical thinking processes, we observed 'logical arguments, evaluation of assumptions, inductive and deductive reasoning, and proposal of possible actions' inherent in the exchanged messages. Analysing cognitive processes would be necessary in a scenario where the instructor's objective is to encourage a combination of two or more processes (i.e. broader use of processes) that may improve critical thinking skills. Read further on the use of broader cognitive processes in sections 4.3 and 4.4).

1.6 Overview of the Chapters

This thesis is organised into five chapters, consisting of Introduction, Literature Review, Research Methodology, Results and Discussions, and Summary and Conclusion". The chart on the next page is a concept map that provides an overview of the chapters. The content of each chapter varies according to the discussions presented. Chapter 1 is a statement of the motivation for this research and discusses the rationale for this study. This chapter presents the background information regarding the framework of the study. Chapter 2 provides a review of literature relevant to this research; the gap in prior research regarding the pedagogical uses of IM technology informs the questions we investigate in this study. Chapter 3 outlines the methodology of the research and provides relevant information regarding the design and nature of the study. Chapter 4 reports the findings and presents discussions on the obtained results. Chapter 5 concludes this thesis by re-visiting the research questions and discussing results in comparison to prior research. In addition, this chapter reflects on the two models adopted in this thesis, and provides a direction for future research on the educational advantages of IM technology

in higher education. Concepts are inter-referenced across chapters. For instance, the discussions in chapter 2 highlight the rationale for the research questions in chapter 1. Chapter 5, which presents a detailed discussion of results obtained in chapter 4, references back to the discussions in chapter 2.

As reported by Farmer (2003), students come into higher institutions with their instant messaging habits. They spend long hours interacting with this technology. Instructors should therefore seize this opportunity to create a 'richer' educational experience for these students. This study has the potential of creating awareness regarding the pedagogical roles of IM in higher education. We hope that this would not only provide new opportunities regarding the use of IM in learning environments, but would facilitate the acceptance of IM technology as an instructional tool in higher educational practises.

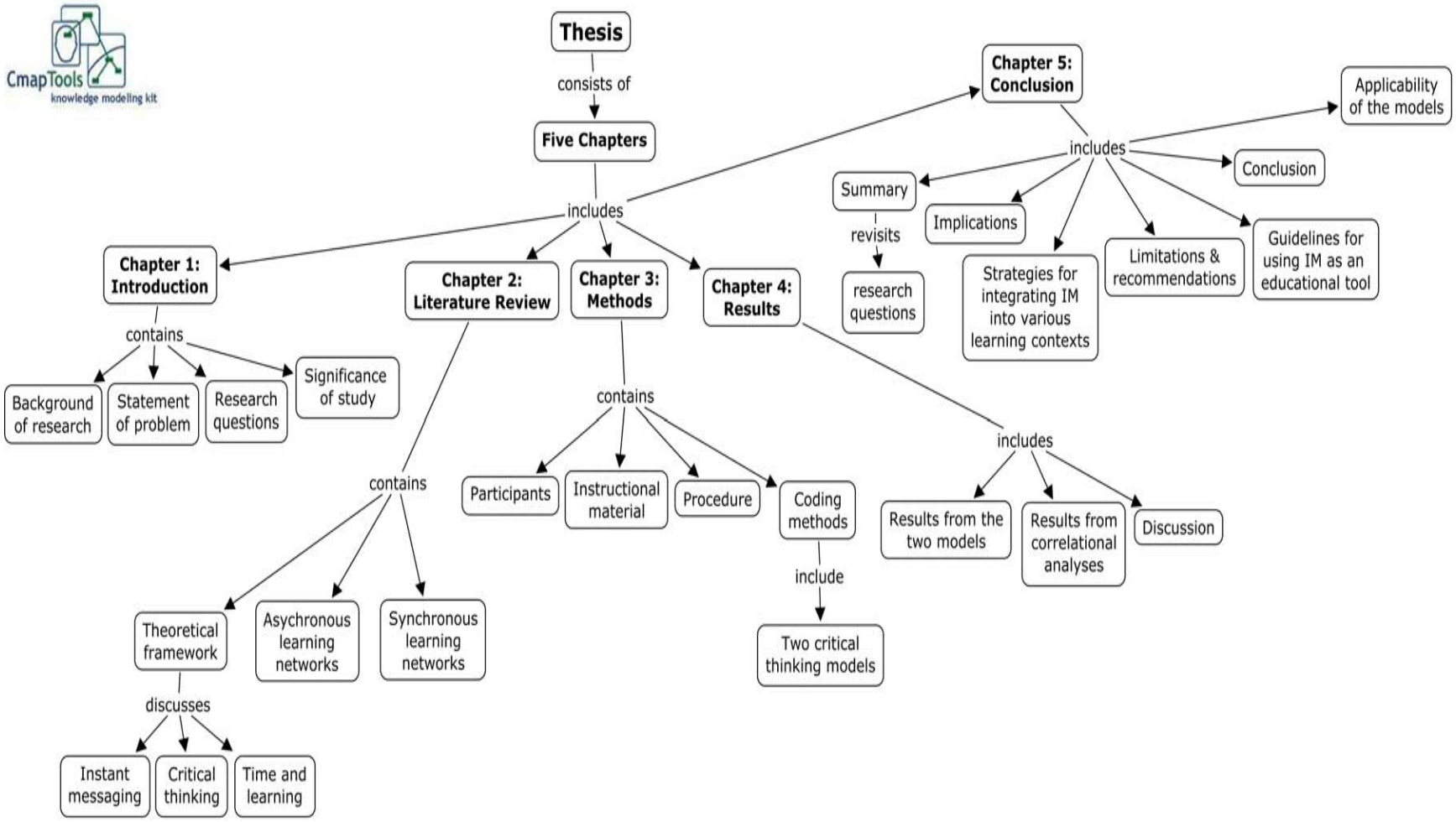

Figure 1 Overview of Chapters

2 LITERATURE REVIEW

Despite its growing popularity as a computer-mediated communication tool, Bakker, Sloep, and Jochems (2007) suggested that the adoption of IM technology as an educational tool in higher education has been relatively slow. While a majority of students (89%) indicate the use of instant messaging for their studies, instructors remain sceptical about the effectiveness of this tool and its adoption in higher education. Prior studies (Pew Internet, 2004; Sotillo, 2006; Bakker et al., 2007; Murphy & Rodriguez-Manzanares, 2008) provide empirical evidence that IM is being adopted by students as a support for a variety of educational activities such as sharing resources, discussing course materials, and collaborating on team projects. These studies reveal the potential of IM as an educational tool and provide insight into how this technology could benefit different learning contexts.

Only a few studies in educational research have investigated the role of IM in learning environments. As of today, there is no published research on the potential role of IM technology as it relates to critical thinking in higher education. This thesis is focused on investigating how instant messaging could be used for promoting or enhancing critical thinking skills in higher education. We adopted a framework developed by Garrison, Anderson, and Archer (2001) for detecting critical thinking in synchronous discussions.

This chapter consists of five parts. The first part outlines a review of literature on computer-mediated communication tools with an emphasis on asynchronous and synchronous learning networks. The second part presents an overview of instant

messaging usage in higher education. The third part is focused on critical thinking; specifically, its meaning, importance, and assessment in online contexts. The fourth part presents the theoretical framework for this study focusing on the social constructivist theory of learning, the community of inquiry, the practical inquiry model, and a model of critical thinking processes. The fifth part presents a review of literature on time and learning, and provides a background for our third research question that seeks to investigate the relationship between time and critical thinking.

2.1 Asynchronous and Synchronous Learning Networks

Asynchronous and synchronous learning networks are computer-mediated tools adopted in higher education for the purpose of teaching and learning, especially in web education and distant learning classrooms. The majority of the literature on the use of these technologies in higher education is focused on asynchronous learning networks designed to promote interaction and communication and facilitate the learning of course contents among participants (Hiltz, 1986; Light & Light, 1999).

Students in asynchronous learning networks may be assigned to read a portion of the course material and engage in extensive threaded discussions. This process allows participants the time to reflect, meditate on prior contributions, consult with external resources, and offer constructive responses to the discussions (De Wever, Schellens, & Valcke, 2006). Educators posit that text-based asynchronous discussions encourage in-depth and more thoughtful contributions that are necessary to foster meaning in online learning (Johnson, 2006). In contrast, synchronous text-based discussions occur in real time and require the simultaneous participation of students and teachers (Romiszowski &

Mason, 2004). Participants do not have the time to consult external resources before contributing.

The use of synchronous tools in higher education is not as common as asynchronous tools, but they have been reported successful for holding virtual office hours, team decision making, brainstorming activities, community building, and dealing with technical terms (Johnson, 2006). Several studies that have investigated the educational benefits of asynchronous text-based discussions report that such discussions reflect high-level cognitive skills (Jarvela & Hakkinen, 2002; Meyer, 2003) and high levels of complex and critical thinking skills (Aviv, Erlich, Ravid, & Geva, 2003).

Recent studies have shown that synchronous text-based discussions are associated with deeper levels of processing, high-order learning, and improved memory (Kinzie, Whitaker & Hofer, 2005; Garcia, Nussbaum & Bolton, 2005). While asynchronous environments allow participants the time to reflect and consult external resources thereby promoting in-depth contributions, synchronous environments may assist in building skills that would nurture thinking on the spot (or thinking spontaneously) which is experienced in real-life and often expected in a face-to-face classroom. McCracken and Dobson (2005) support the notion that immediacy of interaction and spontaneous thinking on one's feet is an important skill in the research university, and these advantages could provide great benefits in a learning environment. The use of synchronous networks could be adopted to encourage students to think on their feet and also promote social presence and interaction, which according to Dede and Kremer (1999), occurs less in asynchronous environments when compared to synchronous environments.

The length of time taken for a discussion to mature in an asynchronous interchange is cited as one of its drawbacks (Johnson, 2006), and the added time required to make decisions may not necessarily result in better decisions (McCracken & Dobson, 2005). Therefore, time spent in consulting external resources may not always produce richer discussions, and the quality of discourse is not relatively better in an asynchronous medium.

While our use and understanding of asynchronous technologies has a much longer history than synchronous technologies, virtual office hours, team decision making, brainstorming sessions, community building, remote guest speakers, and promoting specific learning skills are a few of the ways in which we may be able to capitalize on synchronous technologies (McCracken & Dobson, 2005). There is some evidence that synchronous discussions may be viable in learning contexts, however the instructional benefits of these tools have not been well-researched (Johnson, 2006).

Our work on the use of synchronous technologies, specifically instant messaging, is an attempt to determine whether students will be able to engage in critical thinking in a real-time context and thus extends research on the instructional benefits and educational uses of synchronous text-based discussions. We adopted a conceptual framework from the practical inquiry (PI) model designed to operationalize critical thinking through the manifestation of cognitive presence. This content analysis framework is derived primarily from the previous work of Garrison, Anderson, and Archer (2001) and discussed in section 2.4.2. The next section focuses on instant messaging and describes a number of studies regarding its usage in higher education, as well as its potential role in learning environments.

2.2 Instant Messaging

Instant messaging (IM) is an online communication tool that allows real-time communication either through personal computers or a mobile device. This technology allows the use of a 'buddy list' for storing names and contacts of friends for quick and easy access. Communication in IM can be either text-based or voice interchange. This thesis focuses on text-based IM discussions.

The growth of instant message usage has increased over the last few decades. Fifty three million adults use IM, and 74% of that population are young people (Pew internet, 2001; Pew internet, 2004). Cunliffe (2005) reports that the number of active IM accounts is expected to increase to 1.4 billion by 2007, with 1,380 billion messages exchanged on daily basis. Corporate organizations and some educational systems have adopted and benefited from this technology in terms of instant response, ease of use, and cost (Farmer, 2003). In most workplaces, instant messaging supports a variety of informal tasks such as quick questions, clarifications, coordinating events, scheduling meetings, and organising events. Taking advantage of its real-time communication, workers are able to maintain social connections, improve communication, and increase productivity (Nardi, Whittaker, & Bradner, 2000).

Aside from being used by workers in corporate organisations, instant messaging has become very common among teens, specifically college and high school students, though mostly as a social medium (Pew Internet, 2001; Pew Internet, 2004; Kim et al., 2007); Farmer (2003) reports a percentage usage of 88% among students. IM has been used as a collaborative tool during team projects, as a support tool for discussing course readings outside school hours, and as a communication tool with teachers for quick

clarifications. Therefore, instant messaging has great potential as an educational tool and should be adopted more frequently for educational purposes.

2.2.1 Instant Messaging in Educational Settings

The increased tendency to adopt computer-mediated communication tools in asynchronous and synchronous learning networks is one of the major changes today under the influence of information technology (Khine, Yeap, & Lok, 2003). Some of these tools include computer conferencing, web conferencing, e-mails, white boards, chat rooms, video conferencing, and instant messaging. Researchers who have investigated the use and effectiveness of synchronous learning networks in collaborative learning (Hsieh & Hsu, 2005; Scott, 2002; Noriko, Curtis & Charoula, 2000; Schellens & Valcke, 2004), activity-based learning (Garcia, Nussbaum & Bolton, 2005), and discussion-based learning (Wang & Beasley, 2005) state that these tools increase interaction among students, promote participation, and facilitate real-time learning.

No single means of communication is perfectly adequate (there are advantages and disadvantages); therefore the combination of both asynchronous and synchronous tools would be highly beneficial in any learning context. Hrastinski (2006) supports this perspective and combined the use of IM with discussion boards during an online course, resulting in increased participation and interaction among students. The combined advantages of both means of communication would further reduce their individual disadvantages and offer a richer learning experience to students.

The use of instant messaging (IM) as a synchronous online communication tool is just emerging in higher educational practices and fast gaining recognition. Godwin-Jones (2005) reports IM as one of the emerging technologies in digital literacy. Instructors who

have explored its use in various learning contexts, as well as researchers investigating its effectiveness in educational practises, often cite communication skills, multitasking skills, community building, collaborative learning, immediate feedback, and mentoring as some benefits arising from the use of such technology.

As expected with any new technology, there are reservations about the potential role of instant messaging in higher education. As reported by Farmer (2003), some educators consider it distracting and time wasting for students and thus recommend banning it in the classrooms. In addition, some educators are unable to see beyond the 'socializing' aspect of this tool and thus consider its usage somewhat ineffective for learning. Some instructors have accepted its usage to a large extent, but are not convinced that instant messaging technology could play an important role in higher education, thinking that it does not possess the same potential as other educational tools. These are just speculations characterised by a lack of empirical evidence. No study has been conducted to support the claim that IM is time wasting or distracting. In contrast, studies have been conducted to investigate the role of instant messaging in higher education, thus providing some empirical evidence that this tool is capable of supporting real-time learning, collaborative learning, increasing participation among students, and improving interaction for timid students. Bronstein and Newman (2006) support the notion that IM has high potential as a learning tool, and thus should be accepted and embraced as an emerging technology tool with great prospects for tomorrow's educational experience.

Sotillo (2006) conducted an exploratory study that provided corrective feedback to students in an ESL class via an instant messaging tool; benefiting from the immediate feedback, students readily made corrections and exhibited improved language skills.

Hsieh and Hsu (2005) adopted the use of instant messaging for cooperative learning; this facilitated resource sharing and students completed team tasks at a faster rate. Hrastinski (2006) employed instant messaging to increase students' level of participation in an online group work; he noted a higher sense of participation and a greater commitment to instructional activities. Instant messaging has also been used to increase interaction among students (Castillo, Fragoso & Favela, 2006) and improve working memory (Garcia, Nussbaum & Bolton, 2005). Grinter and Palen (2002) noted that students used text-based instant messaging to practise and improve their writing skills in French. Lu, Chiou, Day, Ong and Hsu (2006) developed an intelligent ChatBot system (called TutorBot) that uses instant messaging to provide students with on-line coaching in an English learning environment. This afforded students the opportunity to learn phonics and word pronunciations in a real-time learning context. Kinzie et al. (2005) explored the use of instant messaging to promote deeper processing of information during lecture. They noted that the highest percentage of students (53.2%) discussed course contents and assigned tasks. Kinzie et al. (2005, p.151) argue that threaded discussions that occur outside class hours are removed in time and space; thus concepts, topics, or questions that students might want to explore may be lost in the process. They therefore concluded that IM should be used during classroom lecture to promote in-class discussion centred on relevant topics (e.g. clarifying questions) that would enhance their understanding of the course content in context. This is a perspective we seek to expand on in this thesis; one of the pedagogical uses of IM would be to encourage class discussions during lecture thereby affording students the opportunity to clarify misconceptions in a less intrusive way.

These studies provide valuable insights into the current and potential ways in which IM may be employed in higher education .The advantages of using this tool should not be lost due to speculations about improper usage. If instant messaging is to be adopted within the classroom environment, teachers need to impose boundaries to control its usage and channel discussions in the right and intended direction; outside class hours, students can collaborate with peers on assignments or class notes.

Since this tool has become the favoured means of communication among college and high-school students who have already adopted the its use of as a primary means of communication, it may therefore become necessary to include this tool in their educational experience to create a fun and fulfilling educational atmosphere that could be captivating and engaging, thus encouraging learning.

Instant messaging is a promising tool, and though drawbacks (such as misuse, time wasting, and increased faculty workload) are speculated, its potentials outweigh its disadvantages when used in the right context. It could be used in virtual office hours, in class discussions, during lectures (by remote guest speakers), in supplementary classrooms, and for mentoring students and providing immediate feedback. Furthermore, instant messaging could be used outside class hours to encourage immediate interaction, coordinate course activities, and promote social presence among students involved in web education, or distant learning; this could re-create the role of common spaces (e.g. hallways and foyers), and students may be less likely to drop out (Nicholson, 2002; Rovai, 2002).

While some of the advantages of using instant messaging have been mentioned in the previous sections, it is also important to consider the ways in which the technology

may be integrated into a variety of educational contexts. IM provides flexible communication that allows informal use of language, short utterances, heavy use of abbreviations, code words, emoticons, and other symbols (Godwin-Jones, 2005). These advantages would be beneficial in informal settings when students are collaborating with peers on assigned tasks, thus simulating a face-to-face environment outside class hours. Repman, Zinskie, and Carlson (2005) uphold the notion that IM promotes real-time communication, and thus could facilitate educational activities such as project planning, file sharing, and quick clarifications. Bronstein and Newman (2006) share this perspective and state that IM technology facilitates real-time learning because students can obtain immediate response to questions.

Instant messaging is less intrusive than a face-to-face classroom. Green et al. (2006) explored this benefit in a psychology class and noted that students who communicated with a stranger using instant messaging felt 'happier' and more comfortable than students in the face-to-face condition. Timid students could take advantage of its less intrusive nature and connect with peers and instructor using the IM technology. Wang and Beasley (2005) employed an instant messaging tool in establishing a structured online classroom where students met virtually and led discussions in turns. The instructor structured discussions to include a 'summary of chapter', 'feedback or critique on the chapter', and 'critical inquiry questions drawn from the chapter'; student's involvement in course activities generally improved. The use of instant messaging in this context relates directly to the notion we uphold regarding the use of instant messaging in a classroom setting. The instructor should structure discussion topics as part of classroom activity to enhance deeper processing of course contents. The use of instant messaging

would also eliminate the noise associated with many students speaking aloud during face-to-face discussions.

Participants (95%) in our study reported that instant messaging was easy to use; they experienced no technological difficulties, thus confirming 'ease of use' as one of its cited benefits. This mode of communication should be adopted more frequently during classroom or online discussions to teach specific skills (e.g. writing skills, communication skills, or thinking skills).

As of today, the greatest use of IM among college and high school students is for enhancing social connections and maintaining status (Farmer, 2003; Pew Internet, 2001); however, an exciting and rich educational experience can also be achieved when students are guided to proper usage within a classroom environment, and other learning contexts. Students are already using this technology, so it may no longer be ignored; teachers should start thinking about various situations in which this technology may be beneficial and begin to incorporate its usage in different learning contexts.

Benefits of instant messaging have also been explored for administrative purposes. Cunliffe (2005) reports the administrative use of instant messaging in some universities for students with admission queries, and for prospective students wishing to make inquiries. This service provides fast answers and saves long-distance calls. Southern Illinois University (2001) used an instant messaging system to connect students with librarians; students obtained instant responses to their questions while the library saved some costs. Librarians could use this technology to provide fast service to users in a time-sensitive environment.

2.2.2 Instant Messaging Software Tools

Several software tools support text-based instant messaging applications. Enterprise level instant messaging software tools offer information security to users by providing data encryption and authentication; examples of such tools are Lotus IM, Enterprise IM & Presence Platform, Data Tel, Magi Secure IM, Sametime 3, IMici BM, College IM, Yahoo Messenger (Enterprise Edition), Corporate IM, Secure IM, IM Spyware, Gaim etc. These tools can be used when issues regarding privacy or concerns about security arise. Free instant messaging software tools do not offer information security; examples are Yahoo Messenger, MSN Messenger, AIM (America Online Instant Messenger), ICQ, IRC (Internet Relay Chat), etc. College and high school students most commonly use free instant messaging tools and studies have shown that these tools has been successfully used as a means of communication in some learning contexts (Sotillo, 2006; Lee, 2002; Grinter & Palen, 2002; Green et al., 2005).

Some IM client developers (such as Trillian, iChat, etc) provide support for audio and video exchanges; advantages offered by audio exchanges may be beneficial to ease the pain of prolonged typing. This may have its own disadvantages, but could be beneficial in some learning contexts. Web-cameras have ushered in another exciting dimension to instant messaging discussions; users can see themselves over the internet while engaging in discussions. IM with audio and video components would provide additional information in terms of ‘tone of voice’, and ‘body language’ for improved comprehension of communicated messages. This would be beneficial in distance learning online classrooms for promoting a ‘social presence’ among peers. The next section is

focused on critical thinking and how instant messaging may be adopted for specific thinking skills.

2.3 Critical Thinking

Critical thinking can be defined as the active, persistent, and careful consideration of any supposed form of knowledge or belief, backed in the light of the grounds that support it, and further conditions to which it tends (Dewey, 1933). This is a mode of thinking about any subject, content, or problem in which the thinker improves the quality of his or her own thinking by carefully analysing, assessing, and reconstructing it (Paul & Elder, 2007).

In the past, critical thinking has also been defined to include dispositions and abilities that occur within a larger perspective in which thinking is conceptualised; for instance being ‘open-minded’ or ‘considerate of other people’ and the ‘ability to weigh the credibility of evidence’ or ‘evaluate assumptions’ are some dispositions and abilities often associated with critical thinking (Pithers & Soden, 2000). However, this thesis did not consider critical thinking dispositions, but is focused mainly on Dewey’s (1933) definition of critical thinking. This latent construct cuts across various subjects and disciplines, and though not currently taught as a separate course in many curriculum, it is often a watchword for instructors and educators who realise its importance; the aim is mostly to improve or enhance critical thinking.

Dewey’s (1933) definition of critical thinking as an ‘active process’ connotes that critical thinking is not a passive process where students passively listen to an instructor, or just receive ideas and information from someone else. Dewey (1933)

proposes that critical thinking is essentially an active process in which one thinks through themselves, raise relevant questions, and finds the relevant information. This form of thinking involves the identification of a problem along with its associated assumptions, judging the validity and reliability of the assumptions or sources of data (Pithers & Soden, 2000, p. 239), and evaluating each other's opinion and beliefs. The ultimate purpose in this endeavour is to come to a reasonable conclusion or resolution of the issue and in the process (re) construct knowledge.

Dewey's (1933) idea of critical thinking revolves around one's personal beliefs and often derived from personal experiences. The reasons or grounds supporting one's beliefs are most times framed by personal experiences that connect the past with the future and stimulate responsiveness to challenges or issues. In order words, personal experiences play a key role in critical thinking because it evokes reflection and serves as a reservoir from which critical thinking is drawn. Dewey's (1933) constructivist approach to learning through reflective thinking is that learning occurs both in the individual's social and personal worlds. In the social world, the individual learns from other people, the environment, and society. In the personal world, the individual learns from their personal life experiences.

In conclusion, Dewey's (1933) notion of critical thinking involves the following elements: Reasoning or thinking, giving reasons, and evaluating reasoning. Providing reasons for one's position or beliefs is often accompanied by supporting relevant evidence; such as the source of the argument and the implication to which it tends. Evaluating reasoning is to challenge other people's ideas asking for proof that proffered evidence is valid.

2.3.1 Meaning of Critical Thinking

There is divergence of opinion about what constitutes critical thinking. To explore this diversity, we consider two key figures in history as guides. Dewey (1933) used the term ‘reflective thinking’ to refer to the kind of thinking that goes on in the mind under serious consideration of the subject matter; he focused on the idea of problem solving for learning (Kennedy, Fisher & Ennis, 1991). Dewey (1933) upholds the notion that self-inquiry is necessary for problem solving, and this process facilitates learning. When a state of doubt (or a problem) is encountered, people engage in an active search based on experience and prior knowledge to resolve the problem (Baron, 1981). The act of self-inquiry as a means to solving a problem invokes the process of thinking. Dewey (1933) therefore argues that critical thinking (i.e. thinking invoked through self-inquiry in search of a solution to a problem or doubt) is an essential construct for facilitating learning, and should be the focus of educational objectives. This thesis adopted Dewey’s (1933) definition of critical inquiry through self-inquiry.

The second guide is Benjamin Bloom who created a taxonomy (Bloom’s Taxonour) of educational objectives which equates categories such as ‘application, analysis, synthesis, and evaluation’ to critical thinking (Bloom, Englehart, Furst, Hill, & Krathwohl, 1956). Bloom et al. (1956) created these categories as a source for curriculum objectives, or an aid for measuring educational outcomes. Bloom et al.’s (1956) definition of critical thinking is not of much relevance to this work and thus will not be explored further.

As previously mentioned, critical thinking is often defined as a combination of general dispositions and abilities, along with specific experience and knowledge in that

subject domain (Kennedy et al., 1991 p.15). Ennis's (1987) definition of critical thinking incorporates taxonomies of dispositions and specific abilities (skills); he argues that a person may possess critical thinking skills and yet may not be disposed or inclined to use or exhibit them. Dispositions that have been previously associated with critical thinking include attitudes such as open mindedness, whole heartedness, responsibility, being impartial, staying relevant, and questioning (Baron, 1981; Kennedy et al., 1991). This thesis did not consider 'dispositions' as part of critical thinking skills; thus this perspective of critical thinking will not be further explored.

The importance of critical thinking is emphasized across domains. Critical thinking skills are largely required for success in any field of endeavour; people often find themselves in situations where they have to solve complex problems. Even for effective citizenship in a democracy, Kennedy et al. (1991, p.12) report that critical thinking skills are essential for a capable, thinking electorate. Paul (1993) and Nickerson (1987) both uphold the idea that thinking is a significant part of humans and mastery of such skills is necessary for being a fully developed human being (Reece, 2002, p. 2). In educational sectors, critical thinking (or high-order learning) is also viewed as a prime objective of all types of learning, including distance education (Fahy, 2005). Educators appreciate the importance of critical thinking skills, and often seek to promote this construct alongside teaching course content materials. McMillan (1987) discusses two reports from the National Institute of Education published in 1984 that emphasized the development of critical thinking skills in undergraduate and graduate education, laying specific emphasis on "analysis, problem-solving, communication, and synthesis skills".

Pithers and Soden (2000, p.238) described an inquiry method for promoting critical thinking. Students identify questions worth pursuing and subsequently engage in a self-directed search that interrogates knowledge (Pithers & Soden, 2000, p.238). We believe that instant messaging can be designed in this context to promote critical thinking through self-directed inquiries and negotiation of meaning in a structured discourse.

For teaching critical thinking skills that are transferable to other domains, researchers have emphasized the importance of addressing real-word problems (rather than focusing on artificial problems) along with the use of group work and teacher questioning (Kennedy et al., 1991, p. 18). Dillon (1984) found critical thinking to be related to peer-interaction, teacher support and teacher questioning. Pithers and Soden (2000, p.239-240) review various strategies that have been adopted in the past for teaching critical thinking: some instructors seek to promote 'spirit of inquiry', 'open-mindedness' as dispositions required for promoting critical thinking. Abilities and competencies (such as identifying a problem with its associated arguments, analysing, making use of inferences, inductive and deductive reasoning, skills of argument, and evaluating assumptions) have also been encouraged as a way of teaching critical thinking skills. McMillan (1987) reported studies that used different instructional variables (e.g. emphasis on problem solving, argumentation, discussions, and representation modes) for enhancing critical thinking skills. There is no consensus on any particular method for teaching critical thinking.

Discussion is often suggested as a preferred method (Kennedy et al., 1991, p. 17). Dillon (1984) distinguished between recitation and discussion, making an argument that discussion calls for higher cognitive skills than recitation; he also states that there is little

empirical research on the use of discussion for promoting critical thinking skills. In the last decade, computer-mediated communication tools have been adopted to promote online discussions geared towards critical thinking. Most of these studies (e.g. Bullen, 1998; Newman, Webb, & Cochrane, 1995; Fahy, 2005; Garrison, Anderson, & Archer 2001; Meyer, 2003; Stein, Wanstreet, Glazer, Engle, Harris, Johnston, Simons, & Trinko, 2007; Ennis, 1987) adopted the use of asynchronous tools, and share the belief that online discussions promote the development of critical thinking skills which could foster high-order learning.

There is scant empirical evidence on the use of synchronous tools for teaching critical thinking. This thesis seeks to extend research on the use of synchronous tools for critical thinking skills. We posit that instant messaging tools would add valuable pedagogical benefits to the teaching of critical thinking in higher education through peer-to-peer or teacher-to-student structured discussions targeted at enhancing specific thinking skills.

Researchers have attempted to measure critical thinking in various ways; content analysis techniques have become prominent in the past few years. As is discussed in chapter 3, this thesis adopts content analysis techniques to investigate how IM discussions promote critical thinking skills. The literature review for this project is limited to critical thinking in online discussions in a computer-mediated environment. Assessing or measuring critical thinking is a challenging endeavour; the session below discusses different attempts in online contexts.

2.3.2 Measuring Critical Thinking in Online Discussions

Critical thinking is a latent construct and as such often very difficult to detect in online learning and computer-mediated communications; it is most often inferred by analysis of ‘traces’, ‘symptoms’, or ‘indicators’ of high-level cognitive activity found in transcripts (Fahy, 2005, p.14) . Although several attempts have been made to assess this construct in online group discussions, there is no single method that is agreed upon for measuring critical thinking.

Newman, Webb, and Cochrane (1995) developed a content analysis instrument that supports group learning, deep learning, and can be used to measure critical thinking. This model assigns a number of positive and negative indicators to some concepts such as: relevance, importance, novelty, outside knowledge, ambiguities, linking ideas, justification, critical assessment, practical utility, and width of understanding. This model is somewhat complex because it further classifies the indicators into several descriptions using 40 codes, and it uses phrases, sentences, paragraphs, or units of meaning found in the messages to illustrate these indicators; this level of complexity is not required in detecting critical thinking in this thesis.

Bullen (1997) produced a model based on Dewey’s (1933), Ennis’s (1987), and Garrison’s (1993) concepts. Bullen’s model consists of four categories of critical thinking, and analysis is based on positive and negative indicators of these skills. For this thesis, the intention is to detect critical thinking, and not to classify this skill into positive or negative ones; hence Bullen’s model was not adopted for this purpose.

Rourke, Anderson, Garrison, and Archer (1999) developed a framework for measuring social presence as an important element of the community of inquiry; social

messages expressed in online discussions are considered vital to motivate learners to critical thinking. This model identifies three categories (*affective responses, interactive responses,* and *cohesive responses*) for categorizing social presence in online discussions. Our work is focused on critical thinking through 'cognitive presence', thus Rourke's et al. (1999) model, which is focused on social presence, is not relevant to our work.

In any educational experience, the core element is cognitive presence; it reflects high-order learning (Garrison, Anderson, & Archer, 2001, p. 7) and is most often associated with the literature and research relating to critical thinking (De Wever, Schellens, Valcke, & Keer, 2006). Garrison et al., (2001) developed a model for measuring critical thinking in online discussions. This model, which is referred to as 'Practical Inquiry', operationalizes critical thinking through cognitive presence. The Practical Inquiry framework consists of descriptors and indicators for detecting critical thinking in online discussions, and provides taxonomies for classifying levels of critical thinking. This model is most applicable to the objectives of this project, which is to detect critical thinking through the manifestation of cognitive presence in instant messaging discussions. Our work adopted the use of the practical inquiry model for operationalizing critical thinking in this context. The next section discusses the theoretical framework, the community of inquiry, and the practical inquiry model as well as how it operationalizes critical thinking.

2.4 Theoretical Framework

The theoretical framework for this study stems from the social constructivist theory of learning in which the learner actively constructs knowledge and builds new

concepts. This is a student-centred approach in which the student is responsible for negotiating meaning (through a social discourse), and making decisions about their learning based on the process of inquiry. This approach emphasizes the advantages of problem-solving through a collaborative nature for learning.

2.4.1 A Community of Inquiry (COI) Model

A community of inquiry can be described as a community of learners who listen to one another, evaluate assumptions, build on one another's ideas, and challenge one another to supply reasons for supported or unsupported opinions in a constructive and argumentative discourse. Garrison, Anderson, and Archer (2001) proposed a conceptual framework for a community of inquiry for the purpose of evaluating critical thinking in a text-based online environment.

This framework has its roots in Lipman's (1991) work on communities of inquiry and clearly identifies three interrelated elements that are necessary for successful learning in higher education; it assumes that learning occurs through the interaction of these elements: **Cognitive Presence** (operationalized by a *practical inquiry model*), **Teaching Presence**, and **Social Presence**. Their work focuses on the use of Computer Mediated Communications (CMC) in a community of inquiry for creating (or sustaining) cognitive presence, which serves as a means through which students engage in critical thinking (Gunawardena, Lowe, & Anderson, 1997; Fahy, 2001). **Teaching Presence** involves the selection, organisation, and presentation of course content, design and development of learning activities, and assessment (Garrison et al., 2000). **Social Presence** relates to the ability of participants to make social connections, projecting their personal characteristics into the community.

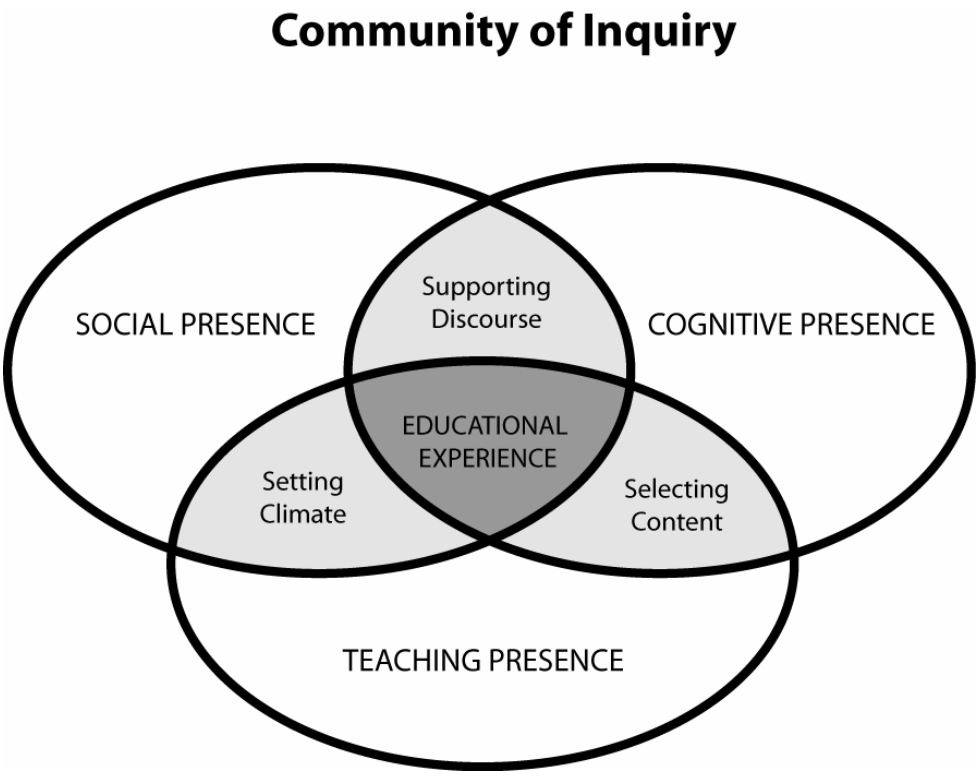

Figure 2 Community of Inquiry Model (Garrison et al., 2000)

Cognitive Presence refers to the extent to which participants construct meaning through sustained discussions and interaction. Cognitive presence is based on Dewey's (1933) definition of critical thinking as a required construct for facilitating learning in a problem-solving environment through self-inquiry. Garrison et al. (2000) also maintain the notion that cognitive presence is the most crucial element in a community of inquiry.

As stated in previous sections, this thesis is focused on detecting critical thinking by analysing cognitive presence in a synchronous discourse. Therefore, Garrison's et al. (2001) model of practical inquiry is most relevant to this project and chapter 3 presents the methodology and approach in using this framework to analyse transcripts as a means

of detecting critical thinking in instant messaging discussions. The next section discusses the practical inquiry model for operationalizing critical thinking.

2.4.2 Practical Inquiry Model and Critical Thinking

The practical inquiry (PI) model was proposed by Garrison et al. (2001) as an analysis tool for evaluating the learning process of individuals collaborating in a text-based online environment. It operationalizes critical thinking based on the manifestation of cognitive presence in online discussions. This thesis is grounded in the practical inquiry model and focuses on the manifestation of 'cognitive presence' as an indication of critical thinking; the PI model therefore informs and guides the methodology of the research.

The PI model is both a process and an outcome of an online community engaged in reflective critical discourse; it therefore uses the 'nature and quality of critical discourse' found in transcripts to detect critical thinking in an online community (Garrison et al., 2001, p.7-8). The practical inquiry model assumes a problem-solving concept (Newman et al.,1995); students collaborate in a social discourse to solve problems and in the process (re)construct knowledge. To date, the PI model has only been applied to asynchronous discussions; this thesis is therefore adapting the framework in an innovative way. In order to detect critical thinking, transcripts were coded into each of these four phases using a set of descriptors and indicators provided by Garrison et al. (2001). A description of each of these phases is provided below:

Triggering Event is the lower phase of the model, which reflects the initial phase of critical thinking. This stage is described as "evocative" where students may

communicate a sense of puzzlement by asking questions. This stage manifests when there is an issue, dilemma, or problem emerging from experience.

Exploration is the second phase of this process. Students begin to search for relevant information to make sense of the problem; during this stage, students shift between their private, reflective world (or personal experience) and the social exploration of ideas – that is, between reflection and critical discourse. Early in this phase, students begin to grasp the nature of the problem and engage in fuller exploration of relevant ideas. This stage is usually described as "inquisitive" and characterized by brainstorming, questioning, and vast exchange of information.

Integration is the higher quadrant of the model where students begin to construct meaning from the ideas generated from the exploration phase. During this phase, students are able to connect and synthesize ideas by integrating information from various sources. Having grasped the nature of the problem, students begin to create possible solutions or hypotheses that are "tentative" in nature. This stage is usually characterized by convergence among group members; for instance, reference to previous message followed by substantiated agreement (e.g. "yes, I agree because…").

Resolution is the highest quadrant of the model and provides a resolution of the problem or dilemma. The resolution phase represents a "commitment" to a solution. Students in this phase engage in applying new ideas, testing or defending solutions, and critically assessing the concepts and solutions presented in the discourse. The PI model involves a progression through these four phases (though not in a successive order) starting with a *trigger*, to *exploration*, to *integration*, and finally to a *resolution*. Garrison et al. (2001) posit that students involved in the practical inquiry model constantly move

to and from their private (internal reflections) and shared world (social discourse) thus (re)constructing knowledge and experience. *Resolution* being the final stage or phase may reveal discontinuities, producing a new triggering event, and the practical inquiry process begins again.

The Practical Inquiry model focuses on cognitive presence, and provides categories for measurement. This model can be applied to discussions in higher education, and it is easy to use; there are no complexities associated with positive or negative thinking as with other models described earlier. This model assumes a problem-solving approach (Newman et al., 1995) and this directly relates to the discussion activities designed for our study.

The Practical Inquiry model was adopted for this study because it is grounded in Dewey's (1933) model of critical thinking. The PI model presents a model that is consistent with the notion that educational learning experience is 'collaborative' and 'reflective'. The process of knowledge construction or re-construction in the PI model involves both in the individual's social and private worlds. 'Action' and 'deliberation' reflects this continuous internal processes occurring in both worlds. Imagination and reflection on personal experiences occur in the private world, while discussions (action) occur in the shared (social) world. Therefore, the practical inquiry presents a model that recognises the personal and social worlds of the learner as essential environments that supports critical thinking in educational practises. The processes in the PI model are not passive but active in which students think, raise questions, challenge ideas, and find relevant information. The method for coding transcripts using the PI model is described in chapter 3.

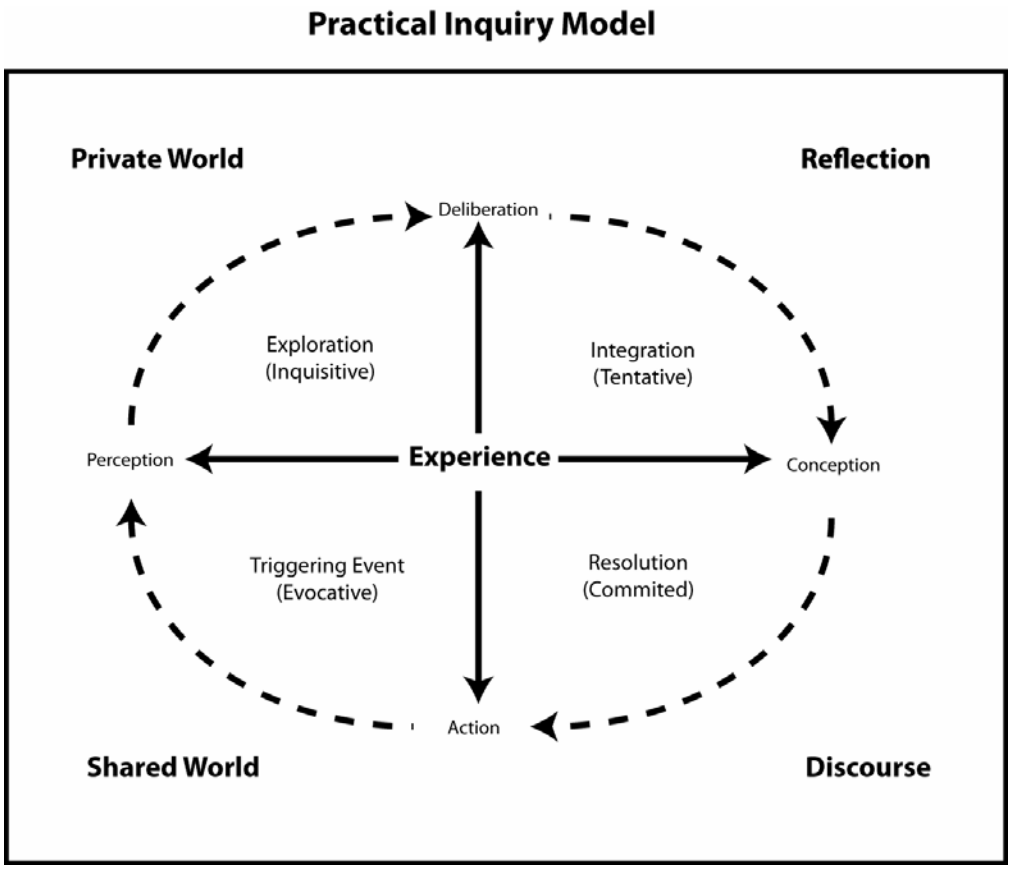

Figure 3 Practical Inquiry Model (Garrison et al., 2001)

The terms ‘Reflection’ and ‘Discourse’ refer to the two processes associated with the PI model. Reflection occurs in the ‘private world’ where students ‘deliberate’ and reflect on prior knowledge. The discourse occurs in the ‘shared world’ as students question and challenge ideas (‘action’) in the process of self-inquiry. Students in a practical inquiry constantly transitions between the private world (abstract world) and the shared world (concrete world) manifesting cognitive processes that associate the conception of ideas and facts.

The PI model proposes a hierarchical approach such that *triggering event*, which reflects the initial phase of critical thinking, is the lowest phase and *resolution* is the highest phase of critical thinking. As implied by the authors of this model, critical thinking in the PI model is achieved through a logical sequence across the phases presented in this model. This presents a relationship between elements suggesting that *triggering event*s connects to *exploration*, which connects to *integration*, and then *resolution* in an upward ladder. That is, critical thinking would usually start from a showing a sense of puzzlement, and asking the right questions and this process would facilitate the understanding of the issue, and exploration of ideas, which would in turn lead to the connection of ideas, and finally end up in a commitment to a solution. This may seem the case in theory but not necessarily true in practise as discussed in section 5.2.

As mentioned in chapter 1, the studies conducted in this thesis involved detecting critical thinking in instant messaging discussions, investigating the relationship between time on task' and critical thinking, and identifying the cognitive processes by which students engage in critical thinking. The next section therefore presents another model adopted for this thesis.

2.4.3 A Model for Critical Thinking Processes

Perkins and Murphy (2006) developed a model for identifying critical thinking processes or assessing individual cognitive engagement in the context of online discussions. The development of this model was influenced by the previous work of many researchers investigating critical thinking constructs in online discussions (Norris

& Ennis, 1989; Henri, 1992; Clulow & Brace-Govan, 2001; Garrison, Anderson, Archer, 2001; Newman, Webb, & Cochrane, 1995; Bullen, 1997).

This model was developed based on the theoretical compatibility and practicality of the various definitions of critical thinking outlined by each of the above-mentioned authors. Four critical thinking processes were identified: *"Clarification", "Assessment", "Inference"*, and *"Strategies"*. Each process consists of a set of indicators that captures the particular critical thinking process in question. To ensure discriminate capability, each indicator refers to only one aspect of a critical thinking process, thus no two indicators refer to the same aspect of critical thinking process. For instance, *Clarification* includes all aspects of proposing, describing, or defining an issue; *Assessment* refers to various types of judgments, including the use of evidence to support or refute an argument; *Inference* covers inductive and deductive reasoning, and all other thinking skills; *Strategies* includes proposals for dealing with the issue under consideration. The indicators for each of these critical thinking processes cover a wide variety of actions or cognitive behaviour associated with such processes. Table 1 on the next page, summarises the model.

Table 1 Model of Critical Thinking Processes (Perkins & Murphy, 2006)

CLARIFICATION (All aspects of stating, clarifying, describing, or defining the issue under discussion)	**ASSESSMENT** (Evaluating assumptions, making judgments, providing evidence, links with other issues)	**INFERENCE** (Connecting ideas, appropriate conclusions by inductive or deductive reasoning, hypothesizing)	**STRATEGIES** (Proposing solutions, or evaluating possible actions)
Indicators: • Proposes an issue for debate. • Analyses, negotiates or discusses the meaning of the issue. • Identifies one or more underlying assumptions. • Identifies relationships among statements. • Defines or criticizes the definition of relevant terms.	Indicators: • Provides or asks for reasons that proffered evidence is valid or relevant. • Specifies assessment criteria, such as the credibility of the source. • Makes a value judgment on the assessment criteria or a situation or topic. • Gives evidence for choice of assessment criteria.	Indicators: • Makes appropriate deductions or inductions. • Makes appropriate inferences. • Arrives at a conclusion • Deduces relationships among ideas. • Makes a generalization that shows other thinking skills	Indicators: • Takes action. • Describes possible actions. • Evaluates possible actions. • Predicts outcomes of proposed actions.

Clarification is associated with processes that seek understanding of the issue, or express understanding at a low level. Such processes include asking questions, stating,

clarifying, describing, or defining the issue. The second process, *Assessment,* involves the use of judgments, evaluating some aspects of the debate, and the use of assessments. The third process, *Inference,* describes the use of hypotheses, making generalizations, as well as the use of deductive and inductive reasoning. *Strategies* cover all aspect of proposing, discussing, or evaluating possible actions in an attempt to resolve the issue. *Strategy* in this case does not mean the use of an algorithm to analyse or solve the problem, but refers to practical proposal for dealing with the issue.

Dewey's (1933) notion of critical thinking equally frames this model of critical thinking processes. The processes in this model involve cognitive behaviours that also occur in both social and private worlds. For instance, identifying underlying assumptions, identifying relationships among ideas, making judgements on assessment criteria, and making appropriate inductions and conclusions are processes that stem from one's personal experiences during reflections in the private world, but discussed in a social environment. Therefore, Perkins and Murphy's (2006) model borrows from Dewey's (1933) model of critical thinking involving 'active processes' of reasoning, giving reasons, and questioning beliefs. This model of critical thinking processes is equally grounded in the notion that learning is 'reflective' and requires a 'collaborative effort' – This informed its adoption as the second model in this study. The methodology for coding transcripts using Perkins and Murphy's (2006) model is discussed in detail in chapter 3.

Detecting critical thinking in instant messaging discussions provided preliminary evidence that this technology is capable of supporting this construct, confirming the hypothesis that instant messaging could be a valuable educational tool when used in the

right context. Identifying critical thinking processes focused on investigating the critical thinking processes that occurred during the IM discussions. Identifying critical thinking processes provides insight into how specific thinking skills may be strengthened or facilitated in the context of a particular course. Chapter 4 presents results for the identified thinking processes.

As mentioned in chapter 1, the third research question investigates the relationship between time and critical thinking. The next section discusses the role of time in learning, highlighting our interest in this variable, and the rationale for this investigation.

2.5 Time and Learning

Time plays an important role in any educational experience: Length of school days, Classroom time, Instructional time, Academic learning time (ALT), and Engaged time (time-on-task) are various time variables that impact the learning processes or the degree of learning (Cotton, 1989).

Before focusing on the specific time variable to be investigated in our study, we first define the other time variables, as well as discuss some past research studies relating to time and learning. Length of school days refer to the amount of time spent in school (i.e. the number of school days in a year or the number of hours in a school day). Classroom time is the amount of time spent in the classroom (this includes recess time, lunchtime, etc). Instructional time is the amount of time allocated to various learning activities or subjects with the purpose of teaching a particular set of knowledge, concepts, or skills. Academic learning time is the portion of the engaged time that students spend

on tasks at an appropriate level of difficulty with high levels of success. Engaged time refers to the portion of the time during which students are actively engaged in learning activities or tasks (Cotton, 1989). Considering time as a valuable educational resource, the challenge is usually how to allocate this resource to various educational activities for the purpose of maximizing productivity given other constraints.

In response to this challenge, educational researchers have investigated how these different time variables affect or influence various learning processes; this may give insight into the length of time to be allocated to various learning activities. Carroll (1963) reported that learning outcome is dependent on the time actually spent and the time needed; he concludes that these time-based quantities could serve as a measure of student's learning outcomes or achievements. He therefore proposes that the process of learning is defined by the time (i.e. how long) it takes to learn a given task(s); thus for any given task, educators should consider giving enough time for learning to occur. By considering a third variable (time allocated), Gettinger (1985) obtained a result similar to Carroll's; she concludes that time allocated, time actually spent, and time needed are three variables that could influence learning or student's achievement.

While these two studies (Carroll, 1963; Gettinger, 1985) have shed light regarding the importance of time in learning, 'time needed' is largely dependent on the nature of the task and prior knowledge and can be difficult to estimate. Due to students' unique characteristics and unequal abilities, the time required to learn a given task becomes varied. Anderson (1976) therefore extended the research on 'time needed' by considering individual differences which could be further classified into student's ability and prior knowledge.

Anderson (1976) focused on varying the instructional time and time-on-task as a strategy for mastery learning, and concluded that inequality in learner characteristics can be reduced by varying the 'time needed' to suit specific needs. Berliner (1990) concurs that instructional time is an important concept in learning; he specifically views academic learning time (ALT) and engaged time (time-on-task) as a pivot upon which student's achievement can be balanced.

These studies have outlined the roles of different time variables in various learning processes and provide evidence that time is needed for learning even though it may vary from individual to individual. Instructional time is a valuable resource in any educational experience because it plays a vital role in the development of relevant skills (Anderson, 1976; Berliner, 1990). However, an increase in instructional time does not always lead to an increase in achievement; there is a point beyond which 'more time' may not produce more learning (Stallings, 1980). Educators are therefore faced with the challenges of not only allocating the right amount of instructional time but also balancing the time in such a way to maximize production and learning outcomes.

Literature relating to time and learning have pointed out the difference between the time available for (or allocated to) learning and the time students actively engage in learning tasks or activities; engaged time in learning activities is referred to as 'time-on-task'. Time-on-task is an important portion of the instructional time because this is the time when students pay attention to learning tasks and are actively engaged. As mentioned in the above studies, this variable has been used (sometimes in conjunction with other time variables) to determine, predict, or measure student's learning outcomes.

Stallings (1980) reports a research study on time-on-task as it relates to reading, academic verbal interactions, and mathematics; time-on-task in these learning activities was positively correlated to achievement. Peterson, Swing, Stark, and Waas (1984) also used this variable in relation to cognitive processes as an indicator of classroom learning during mathematics instruction. Most research in synchronous learning networks have not studied how this variable (time-on-task) could affect student's learning outcomes.

Students engaged in synchronous online discussions are equally faced with the challenges of time, which is a valuable and limited resource; there is a need to allocate the right amount of instructional time (discussion time in this case) for learning to occur, or for critical thinking processes to materialise in this case. The process of learning involves cognitive processing which operationalizes critical thinking and this could be dependent on time. Meyer (2003) states that critical thinking occurs in time and that time may be crucial to improving one's thinking. In the light of this hypothesis, we decided to investigate how the concept of time-on-task could affect students engaged in a synchronous online discourse; the aim was to investigate the relationship between time-on-task and critical thinking. For instance, do students manifest higher levels of critical thinking when they spend more time on the task (i.e. discussion activities)?

While a given amount of time is required for critical thinking skills in a synchronous discourse, our study focused on detecting the relationship between time-on-task and higher phases of critical thinking. Therefore, investigating the 'right amount of time' required to achieve high levels of critical thinking in a synchronous discuss just before a decline in learning outcome is beyond the scope of this thesis. Our interest in this particular time variable is influenced by the nature of instant messaging discussions

and the instructional material provided; instructional time seems to be the time variable most applicable to the use of instant messaging in this case. Considering that ALT and time-on-task are two important portions of instructional time, the instructional material was not designed with the appropriate level of difficulty in mind, thus our focus is on 'time-on-task'.

Time-on-task could influence either the development or manifestation of critical thinking skills in an online discourse. The concept of time-on-task can also be used in relation to cognitive processes as demonstrated by Peterson et al. (1984); their results indicate that time-on-task and cognitive processes could be a better indicator of learning outcomes or student's achievement. The concept of time-on-task can therefore be extended beyond the physical behaviour of engaging in learning tasks to include internal thinking constructs that may not be physically observable (Peterson et al.,1984). This project uses the concept of time-on-task and levels of critical thinking as a way of estimating student's achievement in this synchronous discourse.

Even though studies have shown a positive correlation between time-on-task and student's achievement, there is a need to recognise other factors that are capable of influencing student's achievement and learning outcomes, for instance, student's aptitude, student's ability, and quality of instructional material, can also be a contributing factor to learning outcomes and achievement. While results from this study provide preliminary insights into how time could be used to teach or improve critical thinking skills in a synchronous discourse, it has not taken student's aptitude, student's ability, and quality of instructional material into account, and thus should be interpreted with caution.

In conclusion, instant messaging is relatively new to the educational environment, but has promising prospects. Although a few drawbacks are stated, studies have unveiled its promising benefits. For promoting critical thinking in a discussion forum, IM technology would support real-time communication that could be of an advantage. The growing popularity of this technology among today's students is a call for its acceptance as an educational tool. This medium of communication (IM) that has been embraced by the younger generation should be used as a starting place for their educational experience. We predict a larger percentage of its usage in higher education in the years ahead.

The next chapter is focused on the methodology (design and methods) of this thesis: the participants and settings, discussion activities, the procedure, and coding methodologies are discussed.

3 RESEARCH METHODOLOGY

Garrison et al. (2001) developed the practical inquiry (PI) model discussed in Chapter 2 for assessing critical thinking in a reflective discourse. This model is based on Dewey's (1933) conceptualization of critical thinking as a reflective process that centres on experience and resonates with the constructivist approach to learning, in which students negotiate meaning and construct knowledge through self-inquiry in a learning environment. This thesis is grounded in the above conceptual framework.

In order to perform an in-depth analysis of results obtained from the initial analysis of transcripts and thereby gain more insight into critical thinking processes in IM discussions, we adopted a second model that conceptualises critical thinking in a slightly different approach from the PI model. This second model, known as 'model of critical thinking processes', was developed by Perkins and Murphy (2006) for identifying and measuring critical thinking processes in online discussions. Derived by evaluating previous definitions and descriptions of critical thinking constructs in online contexts, Perkins and Murphy's (2006) model focuses more on the cognitive behaviours manifested in the process of critical thinking. In contrast, the PI model (Garrison et al., 2001) focuses less on cognitive behaviour, but more on the quality (levels) of critical skills demonstrated in the process.

Perkins and Murphy (2006) initially applied their model of critical thinking processes to the content analysis of transcripts from eight participants in asynchronous

online discussions. This thesis adopted the use of this model in an innovative way by analysing 303 messages in selected transcripts. We used this model to assess individual engagement in critical thinking, and also identify the most frequently used critical thinking processes at the group level. Our goal was to seek insight for monitoring student or group progress and for enhancing specific thinking skills during IM discussions.

In order to operationalise the concept of critical thinking in this context more exhaustively, this thesis adopted the use of both the PI model and the model of critical thinking processes (Perkins and Murphy's, 2006). The PI model was used in detecting the various phases of critical thinking outcomes, and to conceptualize the hierarchy (or quality) of the critical skills manifested. Perkins and Murphy's (2006) model was used in identifying student's cognitive engagement as they transit through these phases of critical thinking. This model presents a deeper concept of critical thinking processes and provides a clearer picture on how students engaged in this process during IM discussions.

The two models, though somewhat similar, differ in specific but important aspects in their operationalisation of critical thinking in online environments. The taxonomies of critical thinking outcomes proposed by both models are conceptualised differently. Garrison et al.'s (2001) taxonomies focus on levels of critical thinking, while Perkins and Murphy's (2006) taxonomies focus more on cognitive behaviour; that is, the 'processes' involved as students operate in various levels of critical thinking. However, it is expected that these two models seem somewhat similar because they both conceptualise the same construct, though in different ways. For presenting a larger picture of critical thinking occurrence in IM discussions, these models were sufficient in their specific context of usage in this thesis.

This chapter focuses on the research methodology of the thesis. The first part focuses on ‘mixed methods’ as the strategy of inquiry and investigation. The second section discusses the participants and describes the settings under which the study was conducted. The third part describes the instructional material (article) that was used for the study. The fourth part narrates the entire procedure for conducting this thesis. The fifth section discusses the unit of analysis. The next three sections are focused on the coding methodologies. The last section discusses the correlation procedure of analysis.

3.1 Mixed Methods

The research methodology employed in this thesis is a mixed methods approach, combining qualitative and quantitative methods in conceptualizing and evaluating specific aspects of the study; the combined advantages from both methods provide a clearer understanding of the phenomenon under investigation. A mixed method approach is usually determined by the method of inquiry (i.e. mode of data collection), or the nature of the analysis (Creswell, 2003). The mixed method approach adopted in this thesis was largely driven by the nature of the analysis performed on the transcripts. Qualitative data were initially collected and analysed, then an in-depth analysis of the same data were further performed (quantitatively) to provide more insight, a model Creswell (2003) refers to as ‘Sequential Exploratory Strategy’. This strategy was adopted owing to the exploratory nature of this thesis; an initial analysis of a larger amount of qualitative data followed by a quantitative analysis to assist the interpretation of obtained results. In addition, selected transcripts were further analysed qualitatively using a second model of critical thinking taxonomies.

The nature of the research questions proposed in this thesis informed the decision on a mixed method approach. The first research question involved detecting critical thinking in instant messaging discussions. This question requires a strategy for analysing textual data to investigate the occurrence of critical thinking processes; therefore a coding methodology was adopted to categorise transcripts into phases of critical thinking using Garrison's et al. (2001) practical inquiry model. This method of inquiry is a qualitative approach because data were analysed through a coding process. Also in this study, detecting critical thinking in instant messaging discussions is exploratory in nature; there is little or no previous empirical research that has focused on this specific issue, thus a qualitative approach is necessary to provide insights.

As discussed in Chapter 1, the third research question emerged from the exploratory results obtained from detecting critical thinking; in order to further understand the occurrence of critical thinking in IM discussions, the relationship between 'time on task' and higher levels of this construct was investigated. This research question, which focuses on the relationship between these two variables, elicits a quantitative approach. Correlations between 'time on task' and higher levels of critical thinking may not be easily achieved qualitatively; hence a quantitative method of inquiry was adopted in response to this question. Using a statistical software package (SPSS), a correlation analysis was conducted for the dependent (critical thinking) and independent variables (time-on-task). The last three research questions are focused on identifying how the critical thinking processes manifested, hence another qualitative approach was further applied.

Our use of mixed methods was to fully explore the nature of critical thinking in IM discussions and provide a deeper insight into the occurrence of this construct in this context. This would enhance the current understanding of how IM can promote or sustain this critical thinking as an educational tool.

3.2 Participants and Settings

This study included 38 volunteer students (consisting of 24 males and 14 females) from Simon Fraser University Surrey campus; 22 of the participants were graduates, while 16 of them were undergraduates. Participants had the option of dropping out of the study at any time.

This study was conducted in the research laboratories; participants were seated in different parts of the lab during the discussions so as not to be able to see or hear each other (simulating a distributed environment). Students engaged in IM discussions using Yahoo Messenger as a software tool. The choice for Yahoo Messenger software tool was influenced by the statistical report from the literature review (Bakker et al., 2007); Yahoo Messenger was reported as one of the commonly used software tools. In addition, research ethics required data to be stored in a server within Canada; instant messaging user names were created on the Yahoo Canada server (e.g. im.user3@yahoo.ca).

3.3 Material

The instructional material selected for this study was a one-page article relating to the use of the internet in everyday context and the effect it had on people's lives; this material was based on real-life problems (See Appendix 1). An argument has been made

about whether the instructional object required to promote critical thinking should be based on abstract materials or real-life problems (Kennedy et al., 1991). Instructional materials based on real-life problems may be more practical and engaging for students and will promote critical thinking because students may be motivated to talk about it owing to a high level of interest in the subject matter or a quest for solution to that problem.

Interest and motivation is critical for a study in communication as it requires interaction between participants at a high level in order to study the nature of the interactions. During such discussions, students are not only motivated to think critically, but are also offered possible solutions from their peers who may be speaking out of experience. Abstract problems may not occur in real life and though they could also promote critical thinking, they may be less engaging for students and less practical.

This article was selected because its content deals with how the pervasive and ubiquitous nature of the internet is beginning to alter human behaviours in many aspects. In order to raise awareness on the impact of ubiquitous computing on human behaviours, the article reported that long and uncontrolled hours spent on the internet could have a negative outcome on individuals and ultimately the society. Depression, isolation, lack of exercise, internet addiction, etc, were mentioned as some of the results from uncontrolled use, and users were therefore encouraged to strive for balance and maintain a healthy lifestyle. With reports on the televisions and local news papers, this problem seems to be a major concern for the society. The resulting IM discussions of participants (centred on the article) served a dual purpose of promoting critical thinking, as well as creating awareness for today's students who are internet-savvy.

The study task was comprised of a set of discussion activities designed to provoke or motivate students to think critically in an attempt to solve real-life problems; students collaborated with peers in a one-to-one interaction. While the discussion activities were designed based on the PI model, the nature of instant messaging tool posed a challenge in integrating a 'teacher presence' as part of the community of inquiry. Thus four sets of open-ended questions (corresponding with the four phases in the PI model) were posed to the participants to substitute for the role of a teacher (i.e. to serve as a 'teacher presence') and guide the discussions through the different phases of critical thinking presented in the PI model (See Appendix 2 for the questions).

3.4 Procedure

The study was conducted in single sessions of peer-to-peer interactions that lasted for about an hour. In order to maintain confidentiality, participants were assigned usernames and passwords specifically created for the purpose of the study. The researcher presented a short training session on the use of Yahoo instant messenger at the start of each session, and also briefed the participants on the requirements regarding the study activities. They were advised to actively engage in the discussion activity and avoid time-wasting behaviours such as daydreaming, taking a nap, taking a break, or attending to any personal agenda. Participants were also advised to attempt all four questions after reading the article, and to refrain from browsing the internet for answers, clues, or ideas.

Participants were asked to read the article for about five to seven minutes after which they engaged in online discussions guided by the discussion questions provided. Participants were given a short questionnaire at the end of each session in order to rate

their level of confidence in written English as well as their familiarity with instant messaging usage. The researcher supervised each session of the study and provided clarifications when needed.

For identifying the critical thinking processes inherent in the discussions, 9 transcripts (consisting of 303 messages) were randomly selected from the 19 transcripts using random table numbers. The rationale for the random table numbers was to reduce research-bias from the principle investigator. Using the descriptors and indicators in Perkins and Murphy's (2006) model, messages from the randomly selected transcripts were coded into each of its four critical thinking processes: *Clarification, Assessment, Inference,* and *Strategies*. Some messages from the selected transcript that could not be categorised into any of the four processes in this model were discarded. Such messages comprised mostly of social exchanges such as *'Thank you for the nice discussion*', or '*We are chatting and we didn't know each other's name…I actually know it but forgot'*. Messages of a social nature do not fit into Perkins and Murphy's (2006) model, which was developed specifically for analysing course-related contents geared towards critical thinking. Messages in selected transcripts that were focused on moderating the pace of the discussion were not also categorised. For instance, messages such as *'We have to move forward quickly! Running out of time' or 'How about question 3'*? were not included in the analysis for the same reasons as mentioned above.

The data were collected over a period of three weeks. Early observations from the initial pilot study showed that asking students to choose their partners for discussion resulted in an extended time, thus the researcher randomly paired up participants. Transcripts were collected at the end of each session and later analysed.

3.5 Unit of Analysis

Instant messaging discussions differ in important aspects to other synchronous communications; instant messaging interactions are characterized by shorter utterances, frequent use of abbreviations, and less formality. These differences were taken into account in arriving at the unit of analysis selected for coding purposes. The unit of analysis selected was the message-level unit corresponding to the transcript posted by each participant at a given point in time. A smaller unit (e.g. sub-message level) would be somewhat irrelevant in this case because the length of the posts varied in each turn of discussion; some postings comprised three to five sentences while some comprised of only one sentence. A thematic message level (unit of meaning) would not be necessary because the intention of this study was to identify the presence of critical thinking and not to seek 'thematic patterns' or 'common threads' across messages.

A message-level unit is easily recognizable and multiple coders can agree consistently on the total number of cases. However, a message-level unit may sometimes contain contradictory categorization cues or evidence of multiple phases of cognitive presence. Garrison et al. (2001) developed two concepts for dealing with this challenge: the coding down concept (i.e. to the previous phase) was employed when it was not clear which phase is being reflected; and the coding up (i.e. to the next or later phase) was used when clear evidence of multiple phases were identified.

Despite the argument in favour of a message-level unit, there are trade offs. Consider the possibility of a message containing more than one instance of that critical thinking phase. For instance, in a single message, a participant proposes 'education', 'use of a limiting software', and 'behavioural-interventions' as a solution to internet addiction;

for a message-level unit, this would be classified as one instance of the “Resolution Phase’. If coding is based on a sub-message level, then we would rightly identify three instances of the “Resolution Phase”. However, the nature of instant messaging discussions restricts a sub-message level unit due to very short utterances; some messages comprised of only one sentence that could not be further broken down.

3.6 Coding

All the transcripts were collected and coded at the end of the study. The transcripts were initially coded and analyzed by the principle investigator; second coders who volunteered their time were later trained (Garrison et al., 2001 coding scheme) specifically for double coding the transcripts. In order to avoid influence, second coders were blinded to the initial transcript coding. Their results were obtained and evaluated for inter-rater reliability using the Pearson correlation coefficient. The Pearson correlation coefficient offers a percentage agreement based on the ratio between number of agreements and the total number of coding decisions. After coding all the transcripts, the results for the Pearson correlation coefficient of agreement between coders were 0.84 (for triggering event), 0.94 (for exploration), 0.79 (for integration), 0.81 (for resolution), and 0.97 (for others). On average $r = 0.87$ which shows a strong positive correlation between coders.

The reason for identifying critical thinking processes was to assess student’s cognitive engagement and not to establish hierarchical outcomes of critical thinking skills; hence, the 9 transcripts randomly selected for the second analysis were not second-coded for inter-rater reliability. These randomly selected transcripts for identifying

critical thinking processes were coded by the researcher using Perkins and Murphy's (2006) model of critical thinking processes.

3.7 Coding Methodology (Detecting Critical Thinking)

As mentioned in Chapter 2, Garrison et al. (2001) developed a set of descriptors, indicators, and social cognitive processes that would aid categorization. The descriptors are adjectives that characterize the processes occurring in that particular phase. The indicators are classic examples of how the social cognitive processes of each phase are manifested in the messages. For instance, a 'sense of puzzlement' (an indicator) could be manifested by 'asking questions' (a social cognitive process).

Tables 2 to 5 present the descriptors, indicators, and social cognitive processes of each of the four phases. Following each table is an excerpt from transcripts detailing the coding methodology and categorisation into that particular phase. Please note that all the transcript excerpts representing categorization into each of the four phases of critical thinking are discreet messages and not pairs.

Table 2 Triggering Events

Descriptor	Indicators	Social Cognitive Processes
Evocative	• Recognizing the problem • Sense of Puzzlement	• Presenting background information that culminates in a question • Asking questions • Messages that take discussion in a new direction

As mentioned in chapter 2, *Triggering Event* is the lowest phase of the practical inquiry model and is usually manifested when there is a dilemma or problem emerging from experience. The following excerpts are examples of messages classified as '*Triggering Event*s':

> *im.user 7: Hmmm…. so educate people to let them know that being sedentary and online 24/7 is bad for them?*
>
> *Im.user9: What is MUD???*
>
> *Im.user11: Considering what we have just discussed, what would be the most negative impact on the society?*

These messages are evocative in nature in terms of conceptualizing the problem or issue being discussed. 'im.user 7' is presenting the background information in form of a question, which is one of the social cognitive processes associated with triggering events. 'Im.user9' is showing a sense of puzzlement by asking a question; this is one of the indicators and social cognitive processes in triggering events. 'Im.user11' is simply asking a question that elicits an answer and thus is evocative in nature.

Table 3 Exploration

Descriptor	Indicators	Social Cognitive Processes
Inquisitive	• Unsubstantiated Agreement • Unsubstantiated Contradiction • Divergence within online community/single message • Selection of relevant information • Information exchange • Suggestions for consideration • Brainstorming	• Many different ideas/themes presented in one message • Personal narratives/descriptors /facts • Contributes to established points but does not systematically defend/justify/develop addition • Offers unsupported opinions.

Exploration is the second phase in the practical inquiry model and next to the triggering events. This phase is usually characterised by a large amount of information exchange as students engage in brainstorming activities. Having conceptualized the problem, students are able to explore relevant information from the material. As table 3 suggests, this phase is also categorised by unsubstantiated agreements or disagreements. Here are transcript excerpts of messages coded as "*Exploration*':

> *im.user 7: Yes, I guess the authors do try to show the other side of the story but their own bias is obviously under the 'socially isolating' camp.*
>
> *im. User8: I've never had any interest in being someone other than myself online. And I hate it if someone else I was interacting with did so.*
>
> *Im.user 11: So those seem to be the two central points in the article: the web simultaneously provides the possibility of connecting with people*

along certain valences (common interest, cultural background, etc), but threatens actual human connection.

'im.user 7' has grasped the nature of the problem and selected relevant information for discussion; this message is exploring the ideas presented in the material, which is one of the indicators and characteristics of an exploration phase. 'im. User8' is presenting a personal narrative; this is a social cognitive process associated with the exploration phase as this type of message could lead to a vast exchange of information. 'Im.user 11' has also identified the crux of the argument presented in the material; this has established relevant points, but has not made attempt to justify or defend this position. This message offers an unsupported opinion, or unsubstantiated agreement, hence it is categorised as '*exploration*'. The common pattern in these messages is an inquisitive approach towards the exploration of ideas.

Table 4 Integration

Descriptor	Indicators	Social Cognitive Processes
Tentative	• Substantiated Agreement • Substantiated Disagreement • Convergence among group members/single message • Connecting ideas • Synthesizing ideas	• Building on/adding to another's ideas • Justified, developed, defensible, yet tentative hypothesis • Integrating information from various sources (e.g. textbooks, articles, etc)

'*Integration'* is a higher phase of critical thinking based on the practical inquiry model. While in this phase, students begin to construct deeper meaning from ideas, and are able

to make connections, thus synthesizing information. This phase is also categorised by substantiated agreements or disagreements as students support (from various sources) or defend their positions/arguments. Here are transcript excerpts of messages coded as "*Integration*':

> *im.user 11: The metaphor I've always used is that internet socializing is like the 'Junk food' of social interaction…It is 'delicious', but full of empty calories. You spend all the day online chatting, blogging, etc and it's like spending a day eating cheetos and cookies and soda…but eventually your social life dies of malnourishment.*

> *Im.user 3: I think that people can be addicted to the internet / online gaming, but this is the same problem as any other kind of addiction, not a new phenomenon. People with addictive personalities will get addicted to things; I'm not convinced that the internet "causes" addiction. I think it is possible to form communities online, but if none of the participants ever meet in real life, there will be a lack of overall cohesiveness to the group. I think that online communities that occasionally get together, or where at least some of the participants interact in small groups, are much more rich than purely online ones. I also think that there is a danger in only hanging out with people who reflect your own view points. It becomes very enclosed & narrow-minded quickly.*

> *Im.user 10: The internet is competing with the actual society, and many people convert from living in the actual society to the virtual world, and some others are forced to convert cuz the previous ones. People become addicted to the internet cuz internet offers a wide range of communication, and also, internet offers people things people wanna see, but unable to see in the real society. Internet is like some type of drug that creates illusion for people, or an escape from the real society; and as more and more people join the internet, their friends and relatives convert o internet due to peer pressure.*

> *im. User7: Right….so are saying that it isn't a problem?...Not that I disagree really, but did you hear about that Korean guy who was online for a ridiculously long time and had a seizure which led to his death?*

The message posted by ‘im.user 11’ is a substantiated argument that offers a supported opinion. This message also shows a connection of ideas and presents a higher conceptualization of the issue by making a tentative hypothesis, and these are indicators and social cognitive processes associated with this phase of critical thinking. ‘*Im.user 3’* is taking a position that questions the main argument presented in the material. This message is further clarified by a substantiated opinion that attempts to balance the view of online communities and real-life relationships. These are characteristics of the *integration* phase because information is well synthesized and a tentative hypothesis is implied. The message posted by ‘Im.user 10’ is making connections among ideas by identifying some other factors (not mentioned in the material) that contribute to the massive use of the internet and comparing the use of the internet to some type of drug that creates illusion for people. This is an indication of the *integration* phase; connection of ideas is clearly evident. ‘im. User7’ is showing a substantiated disagreement that uses information from an external source to back up the argument; this is a typical social cognitive process relating to this higher phase of critical thinking.

Table 5 Resolution

Descriptor	Indicators	Social Cognitive Processes
Committed	• Vicarious application to real world • Testing solutions	• Defending solutions

‘*Resolution*’ is the highest phase of critical thinking identified in the practical inquiry model. This phase is usually characterised by a commitment to a solution and application to a real world. Here are transcript excerpts of messages coded as “*Resolution*’:

> *im.user 2: I recommend the cognitive-behavioural approach because it could help if people are educated on how not to get addicted to the internet. It would be interesting if human resource department of companies will conduct sessions for staff on having set times to check e-mails in a day and if workplaces remove the "ACT FAST" syndrome to emails that require staff to respond to emails within seconds/minutes of receiving such. I do agree that there is no clear-cut solution to the problem but psychological approaches coupled with factual presentations about how much time we lose each day when we get addicted to the internet might help re-orientate people in the best possible way to solving this problem. I suggest this approach because from anecdotal and research evidences, people are best solvers of their own problems. Although having a software that curbs internet usage is good, the software can become another addiction if people are not brought into a central role in solving this problem. Our 2 cent.*

> *Im.user 11: I think that the only real solution to any issue of "moderation" is going to happen at the social level, however…so there are simple "quick-fixes" (like limiting people's time online), and there are magical sci-fi solutions (like ubi-comp), but ultimately, the way to preserve the balance between face-to-face interactions and online interaction is to learn how to integrate it into our daily behaviours…which means waiting for several generations, while our society catches up with our technology.*

'im.user 2' is proposing a solution from the cognitive-behavioural point of view, and has attempted to defend this argument by making reference to research evidence (although not cited) that supports this opinion. This message further recognises that the proposed argument is not an ultimate solution but could contribute to the problem of internet addiction. This participant is proposing a solution to be applied in real life situations (e.g. in workplaces), and is further defending solutions based on research observations. This shows a high sense of commitment and thus an indicator of the *resolution* phase. 'Im.user 11' also shows a commitment to a solution by offering two solutions that attempt to resolve the issue under discussion; '*limiting people's time online*' and '*balance*' are two

solutions offered in this contribution. This is one of the characteristics of this highest phase of critical thinking as per the practical inquiry model. Generally, the theme for these messages categorised as resolution is a commitment to a solution and an attempt to apply ideas in the real world.

3.7.1 Coding Up and Coding Down

As discussed in chapter 2, the 'coding down and coding up' principle was developed by Garrison et al. (2001) for categorizing messages that contained contradictory cues or showed evidence of multiple phases. We adopted this method in our study; messages that contained contradictory cues as per what phase is evident was coded down to the previous or earlier phase; messages that clearly contained evidence of multiple phases was coded up to the next or later phase. See examples below:

> *Im.user 5: Really? Because I don't agree with 'the more time spent online also means less time offline interacting with family and friends' I use internet to enhance our friendship, and that's with people I already know in real life.*

By stating the issues presented in the article 'Im.user 5' has grasped the nature of the problem and selected relevant information for discussion. This is one of the characteristics and indicators of the '*exploration*' phase. However, this message has also presented a counter argument that 'the internet can serve as a means for enhancing relationships that already occurred in real life'; this could be interpreted as a connection of ideas or a tentative hypotheses, which is an indicator and social cognitive process in the '*integration*' phase. Therefore the categorization of this message is unclear as it

contains contradictory cues. Applying the code down principle, this message was 'coded down' as *'exploration'*.

> *Im.user 11:I think that finding ways to bridge social relationships across both digital and face to face communications is important….I think that ubiquitous computing is going to help solve a lot of these problems…the reason that online socialization is seen as this "spectre" is that right now, being online means being alone in a room. As soon as we're wearing our computers, we get a whole new digitally mediated social model.*

The message posted by 'Im.user 11' contains evidence of *multiple* phases of *'resolution'* and *'integration'*. By proposing a bridge between social relationships and face to face communication, as well ubiquitous computing, this message has attempted to resolve the issue, or rather, is committed to a solution. This is a clear indicator of the *resolution* phase. Furthermore, this message has synthesized information by stating that 'socializing online right now is like being alone, however, this view would change as soon as everyone becomes involved'; this is like a tentative hypothesis. Thus, this message also contains indicators and social cognitive processes associated with the *integration* phase. Based on the 'code up' principle, this message was categorized as a *'resolution'*.

3.8 Coding Methodology (Identifying Critical Thinking Processes)

Perkins and Murphy's (2006) model consists of four critical thinking processes for identifying and assessing individual's critical thinking in online discussions. As mentioned earlier, the four critical thinking processes are as follows: *'Clarification'*, *'Assessment'*, *'Inference'*, and *'Strategies'*. The first process, *Clarification*, involves all aspects of stating, clarifying, describing, or defining the issue, as well as identifying the

underlying assumptions. The second process, *Assessment*, covers various types of judgments such as using evidence to support or refute a claim, and evaluating assumptions. The third process, *Inference*, deals with the process of connecting ideas and various types of thinking skills such as inductive and deductive reasoning, and hypothesizing. The fourth process, *Strategies*, does not mean the use of tactics (such as the use of algorithm) to analyse the problem, but is defined as a 'plan for action', or 'a proposal' for dealing with the issue. *Strategies* therefore include proposing solutions, or evaluating possible actions (Perkins & Murphy, 2006). The following subsections presents excerpt from transcripts detailing the coding methodology and categorisation into each of the critical thinking processes.

3.8.1 Clarification

Clarification is the initial process of trying to understand the problem and its underlying assumptions. This process recognises an issue or problem that arises from experience, and kicks off the initial phase of critical thinking by studying the problem and asking questions. Table 6 on the next page, present the descriptors and indicators for *clarification* as a critical thinking process.

Table 6 Clarification

Descriptor	Indicator
All aspects of stating, clarifying, describing, or defining the issue under discussion	• Proposes an issue for debate. • Analyses, negotiates or discusses the meaning of the issue. • Identifies one or more underlying assumptions. • Identifies relationships among statements. • Defines or criticizes the definition of relevant terms.

The following excerpts are examples of messages classified as '*Clarification*' along with the coding methodology that informed classification for that process: Please note that all these transcript excerpts representing categorization into each of the four critical processes are discreet messages and not pairs.

> *im.user 4: I think the paper is mostly about conveying the idea that internet use leads to reduced social involvement and psychological well being.*

'im.user 4' is stating the issue, and has also identified an underlying assumption as 'reduced social involvement and psychological well being'. These are descriptors and indicators of the *Clarification* process.

> *Im.user10a: I agree, but I also want to add something like…the internet is distorting the society in a way that turns the society into a virtual space, or something like that.*

'im.user 10a' is defining, and describing the relevant term that represents the crux of the argument. This participant has demonstrated an understanding of the issue, and identified an underlying assumption in the argument.

> *Im.user8: So what do you think is the most crucial issue? I think it is the question of whether the internet is considered a real community or not and whether internet people are 'real' social contacts or not.*

By asking 'what do you think is the most crucial issue?', 'im.user 8' is proposing an issue for debate. 'im.user 8' further clarified the issue by stating an opinion of what is considered crucial in the article, and concludes with a description of the relevant term.

> *Im.user10b: Hard to say, really. The article seems to be steering towards adopting social isolation as its primary issue, but I'm not sure if that's the way to go. Definitions in that area can be tricky, and they have set it up so that any analysis will be pretty one sided.*

'im.user 10b' also offers an opinion regarding a 'tricky definition' of term and the presentation of argument in the article. This participant has identified relationships among statements by stating that "definitions in that area can be tricky".

The common theme in all these messages is the process of clarifying, defining, or describing the issue under discussion. Clarification could be regarded as one of the low level processes of critical thinking during which students observe or study the problem. It is therefore not unusual that this process is characterised by questions in an attempt to grasp the nature of the problem. However, it becomes easy to engage in other thinking processes when students have fully understood the issue with its underlying assumptions. Therefore clarification though a low level processes could be a facilitator for higher thinking processes.

3.8.2 Assessment

Assessment is the second critical thinking process identified in this model. This process involves evaluating some aspects of the debate, making judgement, and taking positions (Perkins & Murphy, 2006). Table 7 presents the descriptors and indicators for *assessment* as a critical thinking process.

Table 7 Assessment

Descriptor	Indicator
Evaluating assumptions, making judgments, providing evidence, links with other issues.	• Provides or asks for reasons that proffered evidence is valid or relevant. • Specifies assessment criteria, such as the credibility of the source. • Makes a value judgment on the assessment criteria or a situation or topic. • Gives evidence for choice of assessment criteria.

Here are transcript excerpts of messages categorised as "*Assessment*' along with the coding methodology that informed classification for that process:

> *im.user 10: I don't think that's what they are trying to do: I think they are overcompensating for their position. All of the things that they present as against internet are all from "other people's" points of view. While the pro-internet stuff is presented as being factual.*

'im.user 10' is evaluating the assumptions underlying the argument presented in the article. By stating that 'the article is based on other people's ideas and not on facts', 'im.user 10' is making a judgement about the validity of the claims presented in the article, and specifies assessment criteria that questions the credibility of the source of

argument presented in the article. This level of reasoning are descriptors and indicators of the 'Assessment' process.

> *im. User8a: Yes...and I think the core issue is – does that matter? Is it a problem that they are not 'physical'? They are certainly social entities…like the issue being, why is physical socialization considered 'better'?*

'im. User8a' is also evaluating the assumption underlying the argument promoted in the article and takes a position that social connection should be paramount, and not the medium. By questioning the promotion of physical socialization over online socialization, 'im.User8a' suggests that physical or online socialization does not matter as long as there are social entities. These descriptors and indicators informed the categorization of this message as 'Assessment' process.

> *Im.user 8b: I would if TV were any good. Electronics are much fancier nowadays, but programming has deteriorated. Not good enough for me to want to replace our two old TVs with a flat screen….anywho…a solution that could be tested?*

'Im.user 8b' makes a judgement about the quality of electronics nowadays, and uses 'deteriorated programming' to back up this claim. This participant is also specifying assessment criteria for categorizing electronics as being 'good'.

> *im.user 13: They can help you. Like say this guy is emotional, people online can feel sorry for him and give him encouraging words.…but that's a matter of preference, some people may prefer to have people comfort them online.*

‘im.user 13’ is evaluating the assumption presented in the article and also makes a counter-argument that favours the positive contributions of the internet. ‘im.user 13’ attempts to provide evidence for this claim by stating how the internet could prove useful in some cases.

> *im.user 4: That’s an interesting observation. However, I feel the author is directing the discussion toward the negative a little too quickly, for example, how does internet use compare to say using the telephone?*

‘im.user 4’ is evaluating the argument presented in the article. By posing a question that provokes thoughts as to how the internet compares with the telephone, im.user 4 is further using this evidence to refute the claims in the article, and make a counter-argument to the negative effects of the internet.

The common themes in theses messages are evaluating the assumptions underlying the argument in the article and making judgements that question either the validity of the argument or the credibility of the source of argument. *Assessment* can be regarded as a higher-level process when compared to *clarification* because it also evaluates the choice of assessment criteria. This level of processing can only occur when underlying assumptions have been identified and well understood. Thus, *assessment* requires a deeper level of processing than *clarification*.

3.8.3 Inference

Inference is the third critical thinking process identified in Perkins and Murphy’s (2006) model. This process covers various thinking skills, including making

generalisations. Table 8 presents the descriptors and indicators for *inference* as a critical thinking process.

Table 8 Inference

Descriptor	Indicator
Connecting ideas, appropriate conclusions by inductive or deductive reasoning, hypothesizing.	• Makes appropriate deductions or inductions. • Makes appropriate inferences. • Arrives at a conclusion • Deduces relationships among ideas. • Makes generalization that shows other thinking skills

Here are transcript excerpts of messages categorized as "*Inference*' along with the coding methodology that informed classification for that process:

> *im.user 15: Well…I think that people are depressed because they see or hear others and believe that the other people are doing better than them on the internet, but really what's happening is the same to many of the other people on the other end of the internet.*

The message posted by 'im.user 15' shows a connection of ideas. This message has deduced relationships among ideas and stated an opinion about why people may get depressed using the internet. Connecting and deducing relationships among ideas are characteristics of the 'inference' process.

> *Im.user 7: Kids teens: at the least you can monitor their activities, unlike RL (real life) because all online interactions leave a trace. I also believe that the whole stalker/predator/evil stranger out to get you and your kids online thing is a bit of a 'mean world syndrome' case spun by the media.*

‘Im.user 7’ has made connections among ideas, and also deduced that online activities leave a trace with which parents can monitor kid’s activities, unlike real life. This participant also arrives at the conclusion that online strangers are not always dangerous in all cases as promoted by the news.

> *Im.user 2: One reason why people become addicted to the internet is that their lives entirely depend on the internet. Imagine a workplace scenario that has the internet server down for a day. What could the workers do? They have become so’ addicted’ that almost nothing gets done without the emails, without postings done through the internet and many other activities. Meetings take place there. Its quite amazing how our lives depend so much on this tool. Marshall McLuhan said that we shape out tools and our tools in turn come back to shape us.*

‘Im.user 2’ arrives at a conclusion by stating that people’s lives depend on the internet both in workplaces and in other sectors. The message posted by ‘Im.user 2’ is also characterised by inductive reasoning, stating that ‘humans shape their tools (the internet in this case), and those tools in turn come back to shape us’.

> *im. user1: To me, I have seen the effects of internet cause damage to one’s social life. An internet addict does not have the experience of interacting with others in real life if most of his relationships are based on online communication because he may not be able to accurately react to facial expressions, etc.*

‘Im.user 1’ makes generalisations stating that ‘internet addicts do not have the experience of interacting with others in real life’. ‘Im.user 1’ also arrives at a conclusion that internet addicts may not be able to react to facial expressions. Further more ‘Im.user 1’ hypothesizes that the internet could cause damage in someone’s social life. These indicators informed the categorization as *inference* processes.

> *im. User3: Yea, and its hard to predict people's beliefs and thoughts from online because we are not dealing with them in real life. Yes, that's true, people when addicted to computer, they spend most of their time at home and eventually they will encounter depression because they isolate themselves.*

'Im.user 3' has deduced relationships among ideas, and arrived at a conclusion that 'someone's beliefs and thoughts are hard to predict in online conversations.' 'Im.user 3' also showed inductive reasoning by voicing the opinion that 'people who spend most of their time on the internet eventually become depressed'.

Common themes in all these messages are deductive and inductive reasoning, connections among ideas, generalisation, and hypothesis. *Inference* as a thinking process could be said to involve in-depth processing or high level thinking skills. Students who engage in this thinking process are not only evaluating assumptions, but can also deduce related issues, which may not necessarily be mentioned in the instructional material. In addition, the ability to engage in inductive reasoning not only shows a connection of ideas, but also demonstrates a thorough understanding of the issues and other related aspects.

3.8.4 Strategies

'*Strategies*' is the fourth critical thinking process described in Perkins and Murphy's (2006) model. This process identifies practical proposals for dealing with the issue being discussed. Table 9 on the next page, presents the descriptors and indicators for *'Strategies'* as a critical thinking process.

Table 9 Strategies

Descriptor	Indicator
Proposing solutions, discussing solutions, or evaluating possible actions	• Takes action. • Describes possible actions. • Evaluates possible actions • Predicts outcomes of proposed actions

Here are transcript excerpts of messages categorized as '*Strategies*' along with the coding methodology that informed classification for that process:

> *im.user 14please: You can give people drugs, or a shrink maybe, or regulate hours when the internet works. Or you can filter content on the internet so that people are less likely to get attached. Make it less fun, like TV.*

'im.user 14please' is proposing solutions to deal with the issue. This participant is promoting the idea of giving people 'drugs' to deal with the addiction. Furthermore 'im.user 14please' describes another solution of 'regulating hours on the internet', or 'filtering contents to make it less fun'. This participant has equally predicted the outcome of the proposed solution by stating that 'people are likely to get detached from the internet'.

> *Im.user 8: What is the solution? I guess I would say awareness and education being one part, so people don't feel like internet is the ultimate word on everything…so they know to question and not completely trust; so to always supplement their experience with talking to real physical people and communities, not to say that real communities or people are always right either!*

'Im.user 8' is suggesting 'awareness and education' as a solution to internet addiction. This participant has described the potential effects of the proposed solution by

predicting the outcome that ‘people would learn to supplement their internet experiences with that of real-life’. ‘Im.user 8’ further evaluates the proposed solution by stating that ‘people in real life are not always right either’.

> *im.user 7a: Definitely, educating people is important. But another issue is addiction. It’s hard to overcome it even by education.*

‘im.user7a’ evaluates the solutions proposed by ‘im.user8’, and suggests that ‘addictions are hard to overcome, even with education’. In other words, this participant is suggesting that ‘education’ alone may not be sufficient for overcoming internet addictions. These are all strategies for dealing with the issue and indicators of this process.

> *im.user 7b: Limitations might work. Like limiting the available amount of online time/bandwidth that you can actually use in a day before your IP connection is closed…..or other deterrents like charging by the hour. These might work; but I’d be furious.*

‘im.user 7b’ is also suggesting solutions for dealing with the issue under discussion. Limiting available amount of time online is a proposed strategy for dealing with internet addiction. Another solution proposed by this participant is ‘charging by the hour’; these are possible actions for dealing with the issue.

> *im.user 3: I think schools can have important role. They create courses, which let students to improve their social skills, and help students to deal with real life…yea that’s true, if they design and offer some courses which compel students to hang out with other students and deal with real life, students won’t run away from other people.*

‘im.user 3’ offers a solution that involves the intervention in school curriculum. This participant describes how this idea would benefit students in real life communications, and further predicts an outcome that may be associated with this solution. These are descriptors and indictors of ‘*Strategies*’ as a critical thinking process.

The common theme in these messages is an attempt to resolve the issue, which is a characteristic of ‘*Strategies’*. ‘*Strategies’* is also a process that requires high level thinking skills. A commitment to a solution would evaluate possible actions and in some cases predict expected outcomes. The ability to engage in this level of reasoning could be facilitated by a prior evaluation of assumptions along with other related aspects of the issue, and a connection of ideas. This suggests that *assessment* and *inference* are necessary to motivate a *strategy*. These four thinking processes could occur in any order (not necessarily sequentially), however, it could be a difficult cognitive task to switch directly from *clarification* to *strategies* without engaging in *assessment* or *inference* to aid the process.

Descriptors and indicators aided the coding of transcripts into each of the critical thinking processes in Perkins and Murphy’s (2006) model. However, the processes discovered in this context of IM usage are limited only to the four processes identified in this model. There are several other critical thinking processes excluded from this model; it is therefore possible that there could be other un-identified critical thinking processes that did occur in the IM discussions, but were not categorised because they did not fit into the structure of Perkins and Murphy’s (2006) model.

3.9 Investigating Correlation (Time-on-Task & Critical Thinking)

As previously mentioned in chapter 2, there are speculations regarding the potential abuse of IM technology when used for learning purposes. This may pose opposition to its acceptance as an educational tool in higher education. In order to establish a stronger educational benefit derived from the use of IM technology in a learning environment, we investigated how time (a valuable educational resource) relates to critical thinking (a crucial educational construct) when IM is the mediating tool. If time is positively correlated to critical thinking, then IM stands a chance as a potential educational tool in higher education.

It is important to note that the intent of this study is to investigate correlation and not to establish causality; hence, a control group was not necessary. Nevertheless, this would be an interesting direction for future research. A two-group experimental design would compare critical thinking outcomes with a face-to-face condition to establish the mediating effect of IM technology. However, for the purpose of this study, there is no need for a control condition in response to research question three in chapter one. Therefore a single group design is an exploratory attempt to see if critical thinking components were apparent in the mediated discussions, and if so, what role time-on-task plays in the observed outcome.

Instant messaging software time-stamped each message and clearly differentiated the postings by assigning usernames to each post; each transcript had a time-stamp of the first message up to the last message posted. This time stamp was used in calculating the duration (or the length) of each discussion after which a correlation analysis was

performed. The results obtained and the corresponding discussions are presented in the next chapter.

4 RESULTS & DISCUSSIONS

As discussed in chapter 3, a mixed method approach was employed in obtaining and analysing results for this thesis. In response to the first research question for detecting critical thinking in IM discussions, the qualitative data obtained from the transcripts was analysed manually by coding; textual data were categorised into different phases of critical thinking using the practical inquiry model. Coded results were organised in an excel spreadsheet for clarity. The third research question seeks to investigate the relationship between time-on-task and critical thinking. In response to this question, the same transcript was analysed quantitatively using Pearson's correlation analysis. In response to the last three research questions focused on critical thinking processes, selected transcripts were coded qualitatively using Perkins and Murphy's (2006) model.

As initially mentioned in section 3.4, participants were given a short questionnaire at the end of each session in order to rate their fluency in written English, their level of interest in the instructional material, their prior knowledge of the subject under discussion, and their familiarity with instant messaging usage. The questionnaire would aid the interpretation or analysis of observed critical thinking outcomes. Discussions in this chapter are focused on the obtained results. The first part presents results obtained by applying the PI model to the coding of all transcripts. The second section presents the results from correlation analysis. The last two sections are focused on the results obtained

by using the model of critical thinking processes to code selected transcripts both at the individual and group level.

4.1 The Practical Inquiry (PI) Model

This section presents the results and corresponding discussions obtained from the analysis of data. Qualitative results (from the PI model) obtained from coding all transcripts (1,091 messages) are presented in table 10. Following this table is a discussion on these qualitative results. Quantitative results obtained from a correlation analysis of time and critical thinking are presented in table 11. Discussion of quantitative results follows immediately after. Furthermore, the qualitative results obtained from coding 303 messages using Perkins and Murphy's (2006) model are also presented in table 12; discussion follows after.

Table 10 Coding Results after Transcript Analysis using the PI Model

	Results
Trigger	64
Exploration	327
Integration	347
Resolution	55
Other	298

In order to compare the results obtained in this study with other studies, the number of occurrence of each phase of critical thinking was analyzed based on percentages. Integration and Exploration were observed to be the largest phases of critical thinking at 32% and 30% respectively. The smallest phases were observed to be Resolution and Trigger at 5% and 6% respectively.

Transcript messages that could not be categorized into any of the four phases were coded as 'other' and this comprised 27% of the posted messages ; these were mostly messages consisting of socio-emotional interactions (e.g. '*hello*', '*are you ready*', '*see you later*', '*nice talking with you*'). The potential explanation for the large occurrence of the 'other' phase can be traced back to literature on instant messaging. Instant messaging (IM) is mainly used to enhance and maintain social connection (Kim et al., 2007; Pew Internet, 2001); it is therefore not surprising that 27% of responses fall under this category.

The triggering phase occurred only during 6% of the entire messages. A possible explanation could be that participants had a high prior knowledge of the topic being discussed. Students indicated a high level of prior knowledge in the questionnaire, thus they may have readily recognized the problem and showed less sense of puzzlement that resulted in a low triggering phase. The exploration phase occurred in 30% of coded responses; this implies that a huge amount of responses occurred in this phase. This is the phase where people freely share their insights and contribute information based on their prior knowledge or previous experiences. Participants engage in brainstorming activities and vast exchange of information. It is therefore expected that a high frequency of responses would fall under this phase of critical thinking.

Figure 4 is a graphical representation of the occurrence of each phase. The highest phase of occurrence was the integration phase consisting of about 32% of the coded messages. A possible reason could be that students readily integrated knowledge and connected and synthesized ideas. Generally, more than half of the discussions (62%) occurred in the exploration and integration phases of critical thinking. Only a small portion of the discussion (6%) occurred at the resolution phase, which is the highest phase of critical thinking.

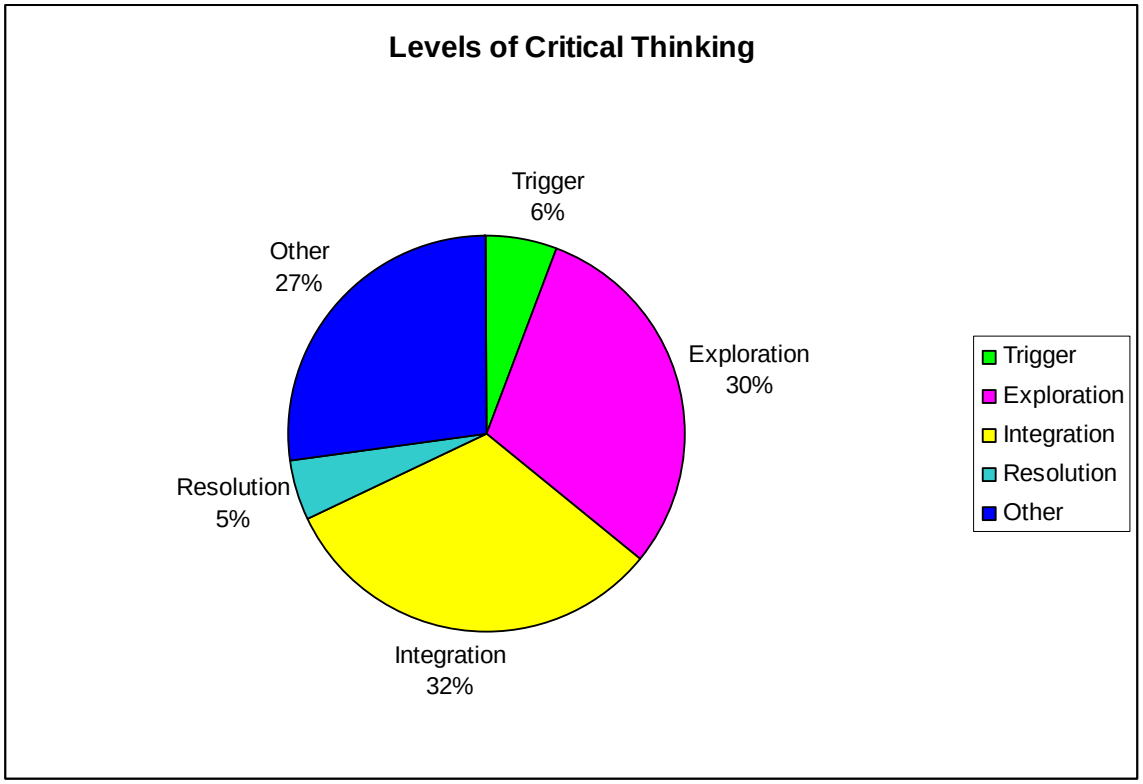

Figure 4 Percentage Occurrences of Phases of Critical Thinking

As stated above, integration was observed to be the largest occurring phase of critical thinking (32%); this seems to be an improvement over the first application of the practical inquiry model to online transcripts by Garrison et al. (2001). In the first application of this model in asynchronous environment, the largest phase of critical thinking occurred in the exploration phase being 42%, but integration was only 13%; while Garrison et al. (2001) offered possibilities that could be responsible for the low occurrence of the integration phase, this issue remained a concern. Attaining higher levels of critical thinking is often the objective in most learning contexts, therefore any educational tool or medium of facilitation should be capable of promoting high levels of critical thinking (usually integration and resolution) and ultimately higher-order learning outcomes.

The higher occurrence of the integration phase obtained in this study is a relatively better result when compared to other studies that have applied the practical inquiry model to online transcripts. For other studies, Garrison et al. (2001) reported integration at 13% of coded responses; Fahy (2005) at 14.1% of coded responses; Stein et al. (2007) at an average of 21.5% of coded responses. A possible explanation for the better result obtained in this study could be related to the instructional object used which was based on real-life issues. Level of interest, level of engagement, and prior knowledge are all factors usually associated with an instructional material, but could have a great impact on student's learning outcome. As observed from the questionnaire, students indicated high levels of interest, and prior knowledge in the instructional material adopted in this study. In addition, anecdotal evidence (from generated messages, and time spent on discussion) suggest that their level of engagement was equally high. This factors

relating to instructional object may have contributed to the better result observed in our study. In contrast, the instructional objects used in other studies were based on course materials in specific subject domains, facilitated by asynchronous tools (that did not support real time discussions) which have been less engaging and of less interest to students.

For this result, the issue of most concern is why such a small portion of the discussion occurred at the 'resolution' phase. While this is consistent with other studies, the issue is worthy of consideration. The observed low occurrence of the 'resolution' phase in this study could be due to several factors. The possibilities responsible for this result may be associated with the instructional design, the material used, and the facilitation. The discussion activity that would facilitate the resolution phase was the very last in the set of questions. It was observed that participants spent a large amount of their time on the first three questions, and since the maximum time for discussion was 60 minutes, they never really had enough time to tackle the last question (Question 4) which was targeted at facilitating the 'resolution' phase. This was confirmed by some of the comments received after the discussions; most participants complained of not having enough time to attempt the last question and engage in the highest level of critical thinking; they complained of being 'pressured' for time.

Another possible explanation for the low occurrence of the 'resolution' phase could relate to the type of material used. As mentioned in section 3.2, the material was a one-page article relating to the use of the internet in everyday context; it could be that this material or the topic under discussion did not lend itself to the highest level of critical thinking associated with the practical inquiry model. In addition, it should be noted that

due to the nature of instant messaging software, a proper ‘teacher presence’ could not be incorporated into this community of inquiry; thus there were clear deficiencies in the facilitation process in terms of guiding and shaping the discourse towards higher levels of critical thinking. Teaching presence is a critical element in a community of inquiry to provide leadership and direction towards a meaningful educational experience (Garrison, Anderson, & Archer, 2000). It is therefore possible that a higher occurrence of the resolution stage may be observed when participants are not restricted by time constraints during discussions and when teacher presence is available to guide and shape discussions towards higher levels of critical thinking.

The above qualitative results provide preliminary evidence of critical thinking processes in IM discussions and hence answer the first research question. These results show that instant messaging is capable of supporting and sustaining critical thinking processes in a critical discourse. With the highest frequency of messages occurring at the integration phase, this technology could prove a valuable educational tool for promoting higher-levels of critical thinking provided that the instructional material is well designed and students are not constrained by time.

4.2 Correlation Analysis

Results obtained from the statistical analysis of all the messages exchanged during the course of the study are presented the table below. These results provide evidence for a strong educational benefit that may accrue to the use of IM technology in higher education.

Table 11 Quantitative Results from Correlation Analysis

Correlations

		Time on Task	trigger	exploration	integration	resolution	other
Time on Task	Pearson Correlation	1	.013	.068	.427**	.372*	.245
	Sig. (2-tailed)		.939	.685	.008	.022	.137
	N	38	38	38	38	38	38
trigger	Pearson Correlation	.013	1	.512**	.121	.109	.269
	Sig. (2-tailed)	.939		.001	.469	.515	.102
	N	38	38	38	38	38	38
exploration	Pearson Correlation	.068	.512**	1	.099	.110	.658**
	Sig. (2-tailed)	.685	.001		.555	.510	.000
	N	38	38	38	38	38	38
integration	Pearson Correlation	.427**	.121	.099	1	.548**	.078
	Sig. (2-tailed)	.008	.469	.555		.000	.641
	N	38	38	38	38	38	38
resolution	Pearson Correlation	.372*	.109	.110	.548**	1	.096
	Sig. (2-tailed)	.022	.515	.510	.000		.567
	N	38	38	38	38	38	38
other	Pearson Correlation	.245	.269	.658**	.078	.096	1
	Sig. (2-tailed)	.137	.102	.000	.641	.567	
	N	38	38	38	38	38	38

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

*. Correlation is significant at the 0.05 level (2-tailed).

Pearson's correlation of 'time-on-task' and 'critical thinking' were statistically significant for integration (r =.43, p = .008), and resolution (r =.40, p = .022), showing that time is positively correlated to higher phases of critical thinking. This means that the more students actively engage in the discussion activity, the higher the levels of critical thinking they achieved. The implication of this result is centred on the portion of the instructional time allocated to discussion activities for promoting critical thinking using instant messaging. As previously mentioned, a large portion of the instructional time is recommended if higher thinking skills are to be observed.

Time-on-task could be a crucial variable for promoting critical thinking skills, however, educators should bear in mind that there is a point beyond which more time could result in lower thinking phase, either because the students are exhausted from the

extended discussions or have run out of ideas. Thus, time-on-task should be used with caution and educators should ensure proper balance.

The above quantitative result provides insight into the relationship between time-on-task and critical thinking and hence an answer to the third research question. These results echo the notion that time plays an important role in any educational experience. Specifically for teaching critical thinking, time is an essential variable worthy of consideration. It is possible to observe higher phases of critical thinking when instructors give enough time for high-order thinking skills to materialise.

However, there is a need to exercise caution with the generalisation of these quantitative results owing to a small sample size (N=38). Trochim and Donnelly (2007) noted that a large sample size would imply a broader generalizability of conclusions. The implications of this quantitative results may not hold true for all students in other learning contexts because other exogenous factors such as student's ability, educational setting, or even the duration of the study could be at play. In any case, it would suffice to say that time-on-task was positively correlated to higher levels of critical thinking in this context. This green light should attract the attention of future longitudinal studies that would further improve the external validity of these conclusions. Controlling for other exogenous factors would establish the causal effect of time-on-task on critical thinking skills.

Instant messaging would be a valuable educational tool for teaching specific skills. In the context of teaching or promoting critical thinking skills, instant messaging would prove a useful tool for structured discussions. Instructors can pose structured questions (i.e. questions targeted at higher thinking skills) relating to real-life problems,

and design the discussion activities to allow enough time for higher thinking skills to manifest. In other contexts, instant messaging could be used in combination with other educational tools to enhance learning. For instance, while the main educational tool may be another synchronous or asynchronous tool, students could be assigned discussion topics that require collaboration via instant messaging.

The mixed methods approach employed in this thesis proved a valuable method of inquiry for detecting critical thinking and investigating the relationship between time-on-task and critical thinking in IM discussions. The results obtained confirm the notion that instant messaging offers promising benefits as an educational tool and should be more frequently adopted in higher education.

4.3 Model of Critical Thinking Processes (Individual Results)

In order to assess individual engagements in critical thinking and identify the critical thinking processes that were most frequently used, data obtained from the transcripts were analysed manually by coding. Coded data were organised in an excel spreadsheet for clarity, and summarised in table 12 on the next page. Following this table is a discussion on individual engagements in critical thinking processes during the IM discussion.

Table 12 Summary of Individual Critical Thinking Processes

Participants		Clarification	Assessment	Inference	Strategies	Totals for each student
A	im.user1	2	5	5	2	14
B	im.user2	3	4	7	2	16
C	im.user3	3	4	13	0	20
D	im.user4	2	4	10	0	16
E	im.user7	6	8	11	3	28
F	im.user8	3	8	6	3	20
G	im.user9	5	8	7	4	24
H	im.user10	8	16	5	2	31
I	im.user7	1	7	3	3	14
J	im.user8	3	7	4	2	16
K	im.user10	3	3	6	4	16
L	im.user13	3	4	4	3	14
M	im.user14please	5	8	9	2	24
N	im.user15	4	2	8	1	15
O	im.user9	2	3	4	0	9
P	im.user16	3	2	5	2	12
Q	im.user2	1	2	2	1	6
R	im.user3	2	2	3	1	8
	Totals for each category	59	97	112	35	303
	Percentage Totals	19.47%	32.01%	36.96%	11.55%	

At the individual level, starting with participant A, this student engaged primarily in *Assessment* and *Inference* processes (71% of coded messages), and engaged least in *Clarification* and *Strategies*. The following example demonstrates how participant A used *Assessment* to evaluate relationships and make judgements regarding people's attraction to the internet: "*Relationships are very important, to me, in the real world. And if a person is hindered in being able to build a relationship its hard to trust and support one another as you have mentioned…I would think a cause for the attraction of the internet is that others you are communicating with cannot not physically see yourself.*

Perhaps their real world social life is not so great, but can find friendship more easily online". This second example also demonstrates how this participant used *Inference* to make deductions: "*Very nice, that seems like the way to go. Another point, each individual may have a different reason for their addiction, and may need assistance on a one on one basis"*.

Participant B engaged mostly in *Inference* (44% of coded messages), less in *Assessment*, but least in *Strategies*. An example can be noted when this participant deduced relationships among ideas in the following statement: "*This is serious because when we look at the context of real addiction, people become addicted to something when they cannot but do without that thing. The same goes for Internet addiction too. Researchers have also observed different reasons why people become addicted to the Internet. This is usually moderated by gender"*.

Participants C, D, and E used mostly *Inference* in their critical thinking processes. Participant C engaged in *Inference* in 65% of the coded messages for this student. There were many instances where this student deduced relationship among ideas and made appropriate deductions and inductions. One such instance can be seen in the following statement: "*However, it also devalues the strength of relationships in general. For instance, if I know that I can go online now and talk to any of 100 people, I may not care that much about the person that I talked to yesterday. The value of the individual is diminished. Or people could try to improve their reputation by having more friends than someone else, a phenomenon I have seen on Facebook and Ourspace"*.

Participant D engaged in *Inference* in 63% of his or her coded messages. This inference-related behavioural pattern is evident in the following statement that

demonstrates inductive reasoning: *"yes. Perhaps the authors are just using this term to dramatize the condition of a particular subset of individuals who have some particular social pathology "Internet Addiction" is an expression of that pathology, and the Internet is a convenient and popular vehicle to somehow identify characterize the behaviours and interactions of these individuals"*. Over half of the critical thinking processes for participants C and D comprised of *Inference*. Thus these students showed similar behavioural patterns in this context.

Participant E also engaged in *Inference* in 39% out of his coded messages. Compared to participants C and D, this student used fewer instances of *Inferenc*e in his critical thinking processes. The following statement demonstrates how this individual used deductive reasoning to support an argument: *"yes anonymity bolsters confidence also, you can be one of many facets/fragments of your identity - be someone else, or rather, be who you want to be"*.

Participant H's method for engaging in critical thinking is quite different from all of the above. In 52% of her coded messages, this student used *Assessment* to engage in critical thinking. This *Assessment*-related behaviour is evident in the following statement that evaluates assumptions and uses evidence to make an argument: "*The same people who believe anything on the net were the ones believing everything from books who were the same ones believing everything in newspapers who were the same ones believing everything from their priests. What about the suicide story?"*

The result for individual engagement in critical thinking processes obtained in our study is an improvement over the initial application of this model by Perkins & Murphy (2006). From the above results, students primarily engaged in critical thinking processes

using *assessment* and *inference*. In contrast, Perkins & Murphy's (2006) results revealed that students primarily engaged in critical thinking processes using *clarification*. The reason for this improvement is not known, however, individual characteristics and preferences could be an explanation. For instance, about 88% of the students indicated a high ability to express and communicate ideas in written English. This may have contributed to the frequent use of high thinking processes such as *assessment* and *inference*. It was also noted from the questionnaire that 94% of students had a prior knowledge of the contents of the article used as instructional material. This as well may have facilitated the use of higher-level processes as opposed to students who had no prior knowledge and would have naturally engaged mainly in *clarification* processes to understand the contents of the instructional material. Kennedy et al. (1991) reported studies upholding the notion that student's familiarity with the subject matter plays an important role in student's performance.

The 'presence awareness' feature of IM technology that informs users of their friend's availability online could serve a role in influencing critical thinking outcomes. IM technology provides a 'buddy list' where users add the names of all their friends for easy access. Users are periodically informed on their friend's availability for chats. Thus students using this technology have control over who they wish to discuss with. This could motivate a 'free flow' discussion in a friendly manner that may result in a quality discussion, unlike most asynchronous discussions where there are no 'buddy lists' or 'presence awareness' features. However, as mentioned in chapter 3, due to time constraints students participating in this study did not have the luxury of choosing partners for discussion.

4.4 Model of Critical Thinking Processes (Group Results)

We were interested in looking at the overall group results in order to determine more clearly how well the Perkins model might be applied to gaining insights into critical thinking in a group discourse . Due to a 'synergising or additive' effect, group discussions may have an effect on manifested critical thinking outcomes. If this is the instructor's objective in a particular learning context, Perkins' model may serve a good role in achieving this objective . However, identifying an additive effect from group discussions is not the purpose or objective of our study. Rather we attempted to determine if Perkins and Murphy's (2006) model would be useful for group mentoring as it relates to critical thinking. Figure 5 is a graphical representation of the percentage occurrence of each critical thinking process at the group level. Following this figure is a discussion on the critical thinking processes that were mostly used by the group during IM discussions.

At the group level, it can be observed that the most frequently used critical thinking processes were *assessment* and *inference* being 32.01% and 36.96% respectively; *strategies* was the least used.

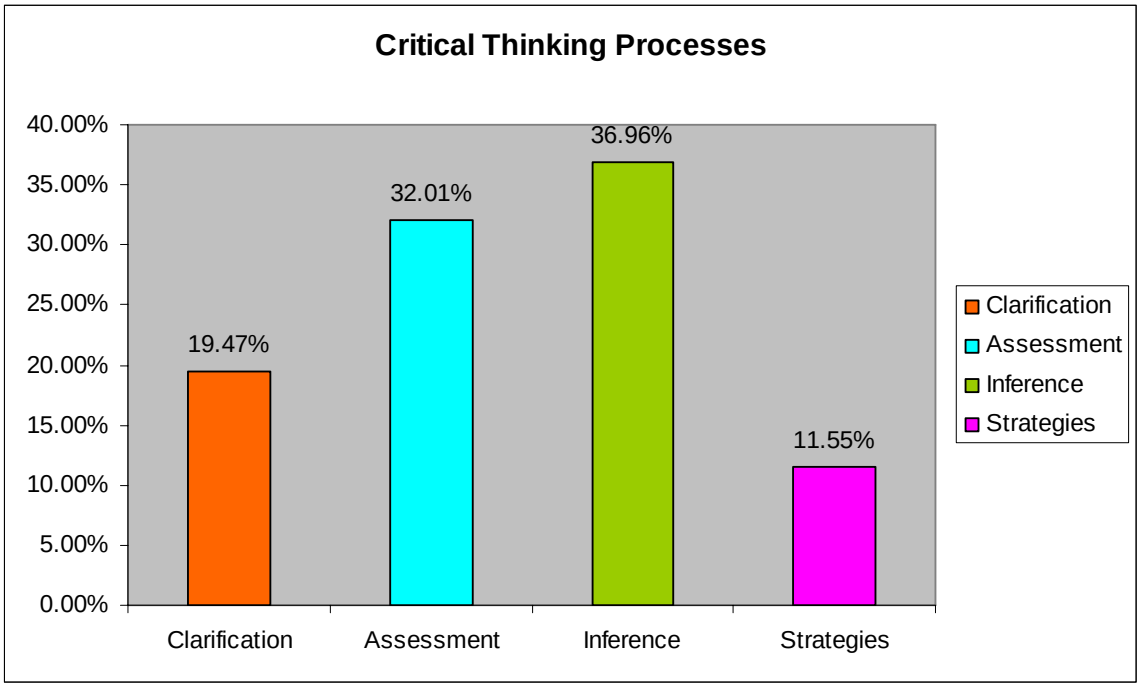

Figure 5 Percentage Occurrence of Critical Thinking Process (Group Level)

A possible explanation for this result could stem from personal preferences and individual differences among students. For instance, a student who is comfortable evaluating assumptions may not wish to make deductions or could be incapable of doing so. Therefore, individual differences in critical thinking skills affect the overall performance of the group. Another possible explanation could be that the instruction material did not lend itself to the frequent use of *strategies*. Furthermore, discussion activities may have favoured the use of judgements, hypotheses, deductive, and inductive reasoning as opposed to proposing actions for solutions. When certain thinking skills are required for particular subjects or courses at the group level, the instructor may wish to engage the group in specific thinking processes. Analysing transcripts at the group level would prove beneficial to achieving this aim.

Table 13 Descriptive Statistics of Group Critical Thinking Processes

	N	Mean	Std. Deviation
clarification	18	3.2778	1.77584
assessment	18	5.3889	3.51700
inference	18	6.2222	3.00109
strategies	18	1.9444	1.25895
Valid N (list wise)	18		

Table 13 is a descriptive statistics of the group critical thinking process and confirms the result of the frequency distribution. Even though results at this group level indicate that high-level processes such as *assessment* (32.01%, mean = 5.39) and *inference* (36.96%, mean = 6.22) were primarily used during this IM discussion, it is also evident that *clarification* (19.47%, mean = 3.28) was utilized more than *strategies* (11.55%, mean = 1.94). A further improvement of this group result would be to engage the group more in *strategy*-related behaviours and less in *clarification*. In other words, the group's objective in another context of IM discussion could be to show higher commitment in resolving the issue by proposing more solutions, describing or evaluating possible actions, and predicting more outcomes from proposed actions; Perkins and Murphy's (2006) model would be useful for monitoring critical thinking processes in this regard.

Perkins and Murphy's (2006) model proved useful and sufficient for identifying and assessing critical thinking processes in IM discussions both at the group level and at individual level. Recall that Perkins had previously used this model for the content analysis of eight participants in an online asynchronous discussion to identify and assess

individual's critical thinking processes. Our study extended this model to the content analysis of eighteen participants in online synchronous discussion, not only at the individual level, but also at the group level. The results confirm that it is possible to monitor or assess critical thinking processes during IM discussions to gauge student's progress. Instructors are able to determine a student's level of performance (in the context of critical thinking) which would inform necessary improvements for that particular student.

For instance, participant H who demonstrated primarily *assessment*-related messages is weak on *inference* as a process. Since *assessment* and *inference* are high level thinking skills, participant H can further improve by also engaging more in *inference*. Thus a combination of these two processes (*assessment* and *inference*) would further sharpen this student's thinking skills. In addition, identifying individual thinking processes reveal that participant O did not demonstrate *strategy*-related behaviours at all. This would not have been noticed if individual transcripts were not analysed. In this case, the instructor has obtained necessary information on participant O's critical thinking performance and can offer improvements in the right direction. Critical thinking is made up of several processes, and students can engage in this construct via one or more of these processes. However, encouraging the use of a broader range of processes (i.e. a combination of more than one process) would be an improvement over the use of a single process.

For monitoring group performance (in the context of critical thinking) in IM discussions, course designers or instructors could structure or moderate the discussion in a manner that facilitates a more frequent use of *assessment, inference* and *strategies*. For

instance, this study suggests that the use of probe questions would be effective for achieving these high-level processing skills. The probe questions targeted at specific thinking skills proved that it is possible to engage students in higher thinking practises with the use of structured questions and hence answers research question two. As students responded to each of the questions, it was clear that the result of the IM discussions could have been different if a probing method was not used, and questions were not structured. However, an important observation worthy of note lies in the order of structured question when there are time constraints. Questions targeted at high level thinking skills should be given priority in the order, and should be the first sets of questions. The probe questions required to facilitate very high-level thinking skills were not given high priority in this study's order of questions, being the last set of questions; hence, students did not have the required time to attend to them. The implications of using IM in higher education are discussed further in chapter five.

The engagement of cognitive processes such as critical thinking is the desired outcome in higher education, but the method for determining or assessing such engagement in the context of synchronous discussions is not quite defined (Perkins & Murphy, 2006). Since IM usage in higher education is gaining recognition, it is necessary to understand the role of this technology in different leaning contexts. Evaluating the quality of learning in IM discussions would unveil the contributions of this technology. Analysing transcripts for the assessment of critical thinking processes is one of the ways to understand the contributions of IM technology in the context of critical thinking.

The purpose of further analysing selected transcripts was to gain a deeper insight into how students engaged in critical thinking during IM discussions. This was necessary

because IM technology is relatively new in higher education. The results obtained further confirm our notion that IM technology does not only support critical thinking, but can also support high-level processing skills. It is also evident that IM can be used to improve or enhance thinking skills by identifying and monitoring critical thinking processes. Perkins and Murphy's (2006) model can be used to achieve this purpose both at the individual and group level.

Further analysing transcripts using Perkins and Murphy's (2006) provided more insight into the occurrence of critical thinking in IM discussions by identifying the most frequently used processes in this context. As discussed earlier, instructors who wish to improve critical thinking skills through IM discussions would need to monitor student's progress by frequently assessing critical thinking processes. Analysing IM transcripts for critical thinking processes could equally inform teaching strategies necessary for developing specific thinking skills as a required outcome, and further enhance the use of this technology as an educational tool. Paul and Elder (2007) also support assessing critical skills in order to improve teaching strategies

In conclusion, Garrison et al. (2001) proposed that the extent to which critical thinking is either encouraged or hindered in an online context is partly dependent on the mediating tool. It would seem that the manifestation of high-level critical thinking skills was not hindered by IM technology. What is uncertain at this point is whether IM technology actually encouraged (aided) the occurrence of this construct. While this thesis is not focused on investigating the latter, future research could shed more light in this regard.

5 SUMMARY & CONCLUSION

To date there has been scant empirical evidence regarding the role of Instant Messaging technology in learning environments. Bakker et al. (2007) propose that IM technology is an educational tool that has not been exhaustively explored. Our studies focused on the potential for IM specifically relating to critical thinking. We investigated the use of IM in promoting or enhancing critical thinking skills during synchronous online discussions.

This chapter provides a summary of the research and findings from the study. The first section re-visits each of the research questions and discusses how these questions are answered by the obtained results. The second section is a reflection on the adopted models as it relates to the categorisation of messages and applicability in larger contexts. The third section focuses on the implication of the results. The fourth section provides suggestions on how IM technology can be integrated in various learning contexts. The fifth section presents guidelines for using IM as an instructional tool. The sixth section discusses challenges and limitations, while the seventh section provides recommendations for future research.

5.1 Research Questions Revisited

The first research question that guided this study was: *Can we detect critical thinking in synchronous online discussion mediated by IM?* The rationale for this

question was to establish evidence of critical thinking processes in IM discussions. The extent to which critical thinking is either enhanced or hindered during online discussion is largely dependent on the media of exchange (Garrison et al., 2001); we investigated whether IM would hinder critical thinking. Using the practical inquiry model developed by Garrison et al. (2001), we detected four phases of critical thinking as follows: *Triggering Event, Exploration, Integration,* and *Resolution.* As discussed in chapter 2, critics of IM offer unsupported arguments regarding the potential misuse of this technology in learning environments. With *Integration* as the highest level of critical thinking, our results suggest that IM would add valuable pedagogical benefits to the teaching of critical thinking in higher education.

The second research question is as follows: *Is it possible to achieve high levels of critical thinking skills with the use of structured questions in IM discussions?* The nature of the instructional material is a factor that could affect students' thinking skills, as mentioned in chapter 2. In this study, we investigated the possibility of promoting critical thinking in IM discussions by the use of structured questions. The higher phases of critical thinking observed in the results confirm that this method of instruction would be effective for promoting critical thinking skills (mediated by IM technology) in higher educational practises. This resonates with the notion proposed by Kennedy et al. (1991), Dillon (1984), and McMillan (1987) regarding the use of 'discussions' in promoting critical thinking skills.

The third research question was: *What is the relationship between time-on-task and critical thinking during IM discussions?* Having detected critical thinking, we observed that the discussions occurred at varying lengths of time (duration). As seen in

chapter 2, the importance of time in learning cannot be over-emphasized. Meyer (2003) proposed that time plays a crucial role in higher-order thinking. The positive correlation between time-on-task and critical thinking as obtained in our results offer a counter argument against the notion that IM could be either time wasting or distracting. This result suggests that while using IM technology, students are able to achieve higher levels of critical thinking when they actively engage in the discussion activity. Therefore, IM discussions, as a method of instruction, would prove effective for enhancing critical thinking skills and valuable as a good use of instructional time. In addition, this result emphasize the importance of time in teaching critical thinking and is consistent with prior studies (Stallings, 1980; Peterson et al., 1984) on the relationship between time and learning.

Our fourth research question was: *By what processes did students engage in critical thinking during this context of IM usage?* The rationale for this question was to further gain insight into the occurrence or nature of critical thinking during IM discussions. Identifying critical thinking processes would assist the instructor in making informed decisions on processes that may need to be strengthened either individually or as a group. Using a model of critical thinking processes developed by Perkins and Murphy (2006), we identified the following critical thinking processes: *Clarification, Assessment, Inference,* and *Strategies.*

The fifth research question asked: *What critical thinking processes did individual students most and frequently engage in?* Critical thinking is made up of several processes and students can engage in this construct using any of these processes. However, the ability to engage in two or more processes would enhance individual critical thinking

skills. Coded data were analysed on an individual basis to identify the least and most frequently used critical thinking processes for various students that participated in this study. Specifically, it was observed that participant O who seemed to relatively engage in high critical thinking processes did not for once engage in *strategies*-related behaviour throughout the IM discussion. This student could include the use of *strategies* in addition to the use of *inference* as an improvement of his/her critical thinking skills.

The sixth research question asked: *At the group level, what is the least and most frequently used critical thinking process during this context of IM usage?* The rationale for this question is same as discussed above; instructors could use this information to be able to moderate discussions to facilitate the use of other critical thinking processes for group or collaborative learning in an online community. Coded data analysed at the group level revealed that the group engaged primarily in *assessment* and *inference.*

Making 'inferences' involves deducing relationships among ideas, arriving at generalised conclusions, and making appropriate inductive and deductive reasoning; this would seem to require high level cognitive processing. The high frequency of 'inference' usage in the context of our study is consistent with the notion that IM would be a valuable educational tool, as stated by prior studies. Our findings from investigating student's cognitive processes further validate IM as a potential educational tool.

5.2 Applicability of the Models

As mentioned earlier, the models were effective for detecting the occurrence of critical thinking as well as student's cognitive engagement in IM discussions. However, due to the structured nature of these models, some other critical thinking occurrences that

may be manifest in the discussions were probably omitted. These models presents only four taxonomies for classifying critical thinking outcomes, and this does not suggest an exhaustive categorization. The challenge of adopting structured models is that it limits the categorisation and findings of this study and excludes other important aspects of the construct that may be critical. A model that presents a wider categorization may be more appropriate for observing a deeper occurrence of critical thinking outcomes in IM discussions. Speculatively, Perkins and Murphy's (2006) model and the PI model would be sufficient for exploratory studies (such as ours) that seek to establish an occurrence of this construct, but not for studies that seek deeper meaning in a larger context.

For the PI model, there were few instances of messages not fitting into the proposed categories. For instance, a message that concurs with a previous idea but does not offer support or basis for the agreement is an 'unsubstantiated agreement'. An example is "*Ah…that is very true"*. This message has grasped the nature of the issue and is exploring ideas but does not offer basis for belief. We therefore extended the indicators of the *exploration* phase to include 'unsubstantiated agreements' since 'unsubstantiated contradictions' is already one of the indicators of the *exploration* phase.

In addition, indicators for the *integration* phase (PI model) were extended to include 'substantiated disagreements'. This is to accommodate messages that disagree with previous ideas, offering substantiated arguments in support of their opinion or position. An example is "*That does seem to be the author's belief, but seem to assume technological determinism that people are not in control of their decisions. There are also anti social people that aren't on the net. I am wary when the idea of internet addiction is thrown around. I think that people can be addicted to the internet/online,*

gaming, but that is the same problem as any other kind of addition, not a new phenomenon. People with addictive personalities will get addicted to things. I'm not convinced that the internet 'causes' addiction". This message offers a substantiated argument against the author's belief and therefore classified as a 'substantiated disagreement' in the *integration* phase.

Perkins and Murphy's (2006) model did not make a concrete allowance for messages showing evidence of multiple critical thinking processes. Analysis of transcripts shows that it is possible to have *'assessment'* and *'inference'* occurring in a single message. For categorising messages with multiple critical thinking processes, the authors of this model recommend coding the process that appears most important in that context. This approach can easily introduce researcher bias that may affect the validity of obtained results, thus, we did not adopt this method. Messages with multiple critical thinking processes were coded up to the later critical thinking process. Only few messages fell into this category. The coding up principle originated from the PI model for classifying messages showing clear evidence of multiple cues. This technique aided categorisation of messages, but could also be an indication of a higher-level critical thinking occurrence being omitted in the models.

As stated previously, both models offer taxonomies for classifying critical thinking outcomes, thus social messages did not fit into the categories proposed in these models. Social messages are important for creating and sustaining a sense of community, but are clearly not an analysis or thoughtful consideration of the issue under discussion. Hence, social messages were omitted for reasons that do not alter or affect the findings of this study.

Garrison et al. (2001) presents the practical inquiry as a hierarchical model in which the processes are logical and sequential. That is, students move from *triggering events* to *exploration* to *integration* and then finally to *resolution*. Practise has shown that while the processes are logical, they are not necessarily sequential. It is possible to switch from *exploration* directly to *resolution*. For instance, during analysis, it was observed that the progression or switch from one phase to the other did not follow a particular order or sequence. These illustrations are evident in the message below:

> *im.user 8: That takes us to question 3. Is it a damaging thing or nourishing to have an online community? You could say that people gain new communication skills by having to communicate online and maybe they loose some other ones that they have to use in person.*
>
> *im. User7:I think that's your point about balancing physical and virtual communication.*
>
> *Im.user 8: So the solution I guess is say 'awareness and education' being one part so people don't feel like the internet is the ultimate word on everything…so they know to question and not completely trust. So to always supplement their experience with talking to real physical people and communities, not to say that real communities or people are always right.*

Looking at the pattern of communication in the above messages, the first message posted by 'im.user8' is occurring at the *integration* phase because it shows a connection of ideas and a tentative hypothesis. The next message posted by 'im.user7' is an *exploration* because it is an unsubstantiated agreement or argument. 'im.user8' responds again with a commitment to a solution occurring at the *resolution* phase. Thus the pattern

of communication in this case is from *integration* back to *exploration* and then up to *resolution*.

The implication of this analysis is that the adoption of the PI model in the operationalization of critical thinking in IM discussions does not guarantee that students would always make an upward progression through the phases proposed in this model. Instructors should not solely rely on this model, but may have to combine other strategies (instructional materials, probing efforts, delivery methods) in achieving the desired objective of the course. In addition, a study on the pattern of critical thinking would be appropriate to fully grasp and understand the nature and occurrence of this construct in IM discussions. These would serve a lager purpose of exposing deeper insights that would promote the teaching and enhancement of critical thinking in IM technology.

5.3 Implication of Results

The qualitative results obtained by detecting critical thinking in IM discussion suggest that this technology has the potential to support critical thinking. As stated earlier, students engaged mostly in higher thinking skills such as *integration*; this suggests that IM technology did not hinder critical thinking in this context. These findings echo the notion that IM technology is an effective educational tool depending on its usage in a particular learning context. In higher education, IM would be effective for promoting higher levels critical thinking when discussions are appropriately structured and monitored by the instructor. Dillon (1984) argued that discussions as an instructional method call for higher cognitive skills and are effective for promoting critical thinking skills. Our study confirms that structured questions targeted at specific thinking skills

would promote critical thinking skills in IM discussions; however, questions calling for high-level thinking skills should be given priority in the order of questions to achieve the desired outcome.

Quantitative results obtained after a correlation analysis of time-on-task and critical thinking imply that an adequate portion of the instructional time is needed for the manifestation of higher thinking skills. Academic learning time (ALT) and time-on-task is a pivot upon which student's achievement stands (Berliner, 1990). If the objective in the context of a particular course is to teach critical thinking skills using IM discussions, instructors would need to give enough time for higher phases of critical thinking to manifest.

As discussed in chapter 2, Stallings (1980) proposed that there is a point in time beyond which a decline in learning outcome is observed. This study did not investigate the time beyond which critical thinking becomes impaired during IM discussions, but rather emphasizes the importance of time in teaching critical thinking skills. Therefore, the 'length of time' required in this context calls for further investigation. The duration of time-on-task could be varied, and corresponding achievements noted; this may be a good strategy for determining the 'length of time' required for achieving high-level critical thinking skills in the context of IM discussions.

The ability to engage in high critical thinking processes could be a function of student characteristics such as prior knowledge and intellectual ability. Kennedy et al. (1991) argue that prior knowledge, and intellectual abilities are some student's characteristics that affect the learning of critical thinking skills. After analysing data at the individual level, it was observed that different students engage in critical thinking

through different processes, and some students exhibited higher levels of processing skills than others. This finding has important implications for the enhancement of individual's critical thinking skills using IM; instructors would need to analyse transcripts periodically to obtain student's level of performance. IM discussions can successfully be used to strengthen individual's thinking skills by identifying and monitoring each student's critical thinking processes so as to determine what processes would need to be improved. If the educational objective is to improve particular thinking skills at the group level, identifying the least and most frequently used processes would also provide the needed information for improvement. Analysing transcript data at the group level has implications for group learning.

5.4 Integrating IM Technology in Various Learning Contexts

As commonly cited in the literature, the adoption of IM technology in higher education is relatively slow despite its increasing popularity among the younger generation. A possible explanation for the slow adoption could be that instructors are either unaware or uninformed about the possibilities of integrating this technology into various learning contexts to achieve instructional objectives. Acceptance of IM technology as an educational tool may be facilitated by providing suggestions on integration strategies in the process of a course design. This session is intended to provide ideas on how the educational benefits of IM tool may be harnessed, as well as promote awareness regarding the application of this technology in different educational contexts.

(1) Class Discussions: In the context of online courses or distance learning, IM technology can be used to promote subject-specific discussions. Instructors could assign

questions or discussion topics relating to course objectives. Discussions can be focused on brainstorming activities, deeper processing of course related contents, promotion of subject-specific critical thinking skills, or a test of student's understanding of instructional materials. The use of discussions in promoting course-related critical thinking skills is consistent with previous studies (Wang & Beasley, 2005; Bullen, 1998; Newman & Cochrane, 1995) and IM could be a supporting medium for exchange. Secondly, some students are more comfortable discussing certain sensitive topics online (Cunliffe, 2005), therefore IM can also be used as a supplement for traditional classrooms discussions. In addition, the adoption of IM discussions as an in-class activity in a traditional or face-to-face classroom would be beneficial in promoting discussions in the context of a time and space where such topics, concepts, or questions are readily explored (Kinzie et al., 2005). The traditional in-class discussion could be mediated by IM technology for an efficient use of instructional time, elimination of noise associated with speaking, and provision of archived messages for further or future references. Kinzie et al. (2005) support this notion.

(2) Virtual Office Hours: IM is available anytime and anywhere and thus could be used in web-based education or distance learning to replace the traditional faculty office hours. Students would have access to their instructors as scheduled and this allows for a faster response as opposed to e-mails. Using IM technology for virtual office hours would be an effective strategy that is convenient, time-saving, and efficient (Jeong, 2003). Using IM for virtual office hours is supported by Farmer (2003) and Jeong (2003).

(3) Support for educational activities: Cunliffe (2005) reports the growing shift from using IM solely as a social medium to one that supports schoolwork activities. In the context of online courses or traditional classrooms, IM could be used as a support for various educational activities such as homework related tasks, course readings, sharing of files/resources, and reflection on fellow student's work. This could be set up as a student-to-student or student-to-teacher exchange. Using IM as a support for educational activities has proved successful in previous studies (Bakker et al., 2007; Hsieh & Hsu, 2005; Pew Internet, 2004; Hrastinski, 2006; Sotillo, 2006; Murphy & Rodriguez-Manzanares, 2008).

(4) Communication medium: The use of IM as a real-time communication medium can be adopted throughout the duration of a course. This would be highly beneficial for quick clarifications, rapid questions, and immediate feedbacks. Sotillo (2006) found immediate feedback to be a valuable asset to language acquisition. Instructors can provide corrective feedback on assignments and course work in a timely manner. The instant communication afforded by IM technology is a great asset when students are working with time-sensitive tasks on tight deadlines (Jeong, 2003).

(5) Team Projects: Another integration strategy for IM technology in a learning environment is that of a collaboration tool for team projects. This would be effective for project-related activities such as scheduling face-to-face meetings, making plans, or taking quick decisions on the next line of action for team members. This approach has

been tested in previous studies (Hrastinski, 2006; Sotillo, 2006; Eisenstadt, Komzak, & Dzbor, 2003; Hansen & Damm, 2002; Veerman & Veldhuis-Diermanse, 2001).

(6) Increase Participation: IM could be used to increase participation for students in a traditional classroom. This would expand student's comfort zone and particularly benefit timid students. The course curriculum could be organised to include a debate session where students would pair up and debate on assigned topics relating to the course content. Participation would be mandatory for all students. Such an approach would be a less intrusive way of encouraging class participation in the context of a traditional classroom. This notion has been proved by previous studies (Hrastinski, 2006; Jeong, 2003).

(7) Online Community: Community fosters a sense of connectedness, deeper exchange of ideas, increased risk-taking, and negotiation toward common learning goals (Duemer, Fontenot, Gumfory, Kallus, Larsen, Schafer, & Shaw, 2002, p. 7). IM technology would be beneficial for creating and maintaining a sense of online community for students in web-based education or distance learning. Students can exchange pleasantries and greetings that would have naturally occurred in a traditional classroom. Unrestricted casual discussions would establish a rapport among students and in some cases the instructor. In addition, an online community would promote the social presence necessary for learning to occur as cited and proven by previous studies (Garrison et al., 2001; Fahy, 2005; Newman, Webb, & Cochrane, 1995; Rovai, 2002; Murphy & Rodriguez-Manzanares, 2008).

(8) Peer-to-Peer mentoring: For educational purposes, IM can be integrated as a technology tool for peer-to-peer mentoring when students are geographically distributed. Students would receive instant help from relevant peers or fellow students. Instructors can equally use this tool to support mentoring activities.

(9) Blended Learning Environments: As discussed in chapter 2, the use of IM technology may be combined with a traditional face-to-face classroom; combining these two learning environments may provide a richer or greater educational experience. A course curriculum can be split between traditional classroom activities and IM activities depending on the nature of the learning context. In the literature review, Farmer (2003) stated that the use of IM technology would significantly increase the educator's workload due to ubiquitous access to the instructor's time. Blending IM with traditional classrooms would not only harness advantages of both learning environments but could be a strategy for reducing 'increased educator's workload' as proposed by Farmer (2003). The promise of a blended environment reduces the constraints of time and space such that cash-trapped schools can offer programs to a greater number of students than usually possible. The decision on implementing IM technology in the process of a course design and the choice on which implementation strategy to adopt is largely dependent on the instructor. Students' learning needs, and 'the learning contexts' are some considerations worth noting before settling on an implementation strategy. However, providing the above awareness and suggestions would facilitate the instructor's decisions in this regard.

5.5 Guidelines for Adopting IM for Educational Purposes

Based on anecdotal and empirical evidence, the use of IM for instructional purposes should be accompanied with some guidelines to ensure the successful integration of this tool into mainstream educational contexts. The following suggested guidelines represent a preliminary attempt to guide instructors and designers in integrating the technology into their practice environments.

(1) Teacher Presence: One of the challenges of using IM as an instructional tool is to constantly ensure that students are on-task (Murphy & Rodriguez-Manzanares, 2008, p.13). From our experience and as commonly cited in the literature, there is a high tendency for students to engage in off-task activities or discussions that defeats the purpose of an instructional tool. The responsibilities of a teacher presence, among other things, is to keep the discussions on-task and within schedule. The primary goal is to guide the discussion towards desired outcomes. A teacher presence also stimulates discussions when necessary, adds pedagogical statements, and constructively critiques contributions (Garrison et al., 2001).

If the objective of the discussion is to promote critical thinking skills, for instance, a teacher presence would guide discussion towards higher level thinking skills. For our study, we used a set of questions to simulate the role of a teacher presence, as discussed in chapter 3. The instructor or a student moderator (chosen by the instructor) can fulfil the roles of a teacher presence, which means that the instructor or moderator is also online and actively involved in the discussion. When student moderators are acting the role of a teacher presence, it is advisable that the instructor is periodically available online to

provide help on-demand. A teacher presence is highly recommended for integrating IM in various learning contexts. Previous studies (Garrison et al., 2001; Jeong, 2003; Maushak & Ou, 2007; Wang & Beasley, 2006; Murphy & Rodriguez-Manzanares, 2008) have benefited from the use of teacher presence in online communities.

(2) Prioritize Questions: It is suggested that questions or discussion topics are prioritized when IM is being used to promote critical thinking. Questions targeted at higher level thinking skills should come first in the order. This way, students would have enough time to attend to these questions and manifest the expected results.

(3) Balance Time: Extended discussions over a long period may result in negative outcomes (Stallings, 1980). Jeong (2003) found it rewarding to schedule breaks at intervals of 1 hour. As stated in previous studies (Garrison et al., 2001; Fahy, 2005) and this study, discussion times ranged from 20 min to 1 hour. Balancing instructional time for IM discussions is delicate because 'enough' time is required to maximize the benefits of IM discussions, as discussed in chapter three. However, intervals or breaks should be scheduled so that discussion sessions do not exceed 1 hour per session.

(4) Structure activities: Using IM for instructional purposes demands well-planned discussion activities. Part of the planning process could include picking out relevant topics for discussion, determining the length of time to allocate to each topic, provide specific instructions regarding the discussion, and having clear expectations guiding the discussion. For instance, Wang and Beasley (2005) provided specific instructions and students were expected to read assigned topics, summarize the topic,

provide constructive critiques on topics, and give examples on applications beyond the classroom. All these discussions occurred within the IM environment. Previous studies (Hrastinski, 2006; Jeong, 2003; Kinzie et al., 2005; Maushak and Ou, 2007; Green et al., 2005) have benefited from structured activities.

Secondly, IM in-class activities should not occur simultaneously with lecture presentations. This could cause distractions such that students are unable to attend to both activities at the same time. Kinzie et al. (2005) observed that running IM in-class activities and lecture presentations concurrently resulted in split or divided attention. Students experienced difficulties synthesizing IM tasks and instructor's presentations.

(5) Teaching Presence & Defined Objectives: By 'teaching presence' we refer to all the various elements of course work preparation, e.g. selecting course contents, developing learning modules, and creating learning activities. An organised teaching presence would facilitate a structured implementation of IM for better results. Casual and unstructured implementation IM may encourage more off-task activities and defeat the purpose of an instructional use. Wang and Beasley (2005) suggest that activities should be planned and organised prior to using IM technology. Therefore learning activities to be mediated through IM technology should be organised. Prior to the use of IM, instructors should determine the task(s) to be supported by this technology, and schedule instructional time slots if these task(s) are in-class activities. Each task should be accompanied with corresponding objectives expected from the use IM technology as a mediating tool. For instance, depending on the learning tasks, the objectives could be to promote a higher rate of participation among students, extend discussions on classroom

lecture, promote subject-specific critical thinking skills, or to enhance a particular thinking disposition required for success in that course.

(6) Familiarity: Encourage familiarity among peers prior to use of IM technology. Have students get to know each other before engaging in IM interactions. Interactions with unfamiliar peers may produce undesired or low quality discussions. Jeong (2003) noted that IM communications between unfamiliar peers were often misunderstood or misinterpreted because students had no frame of reference or body language to read more meaning into communicated messages. An initial face-to-face or social meeting is recommended where possible so students get to know each other (Maushak & Ou, 2007; Garrison et al., 2001). If a face-to-face meeting is not possible, consider promoting causal and social discussions (using IM) not related to course contents within the first few days of class. Feedback from one of the participants in our study addressed the need to pair up students who are already familiar with each other.

(7) Training Sessions: Consider having a brief training session prior to using IM technology. Educating students about IM's intended role would help ensure its success. A brief training session may help eliminate the stress and discomfort of using a new technology for first-time users. The training session should cover the basics of using IM technology such as loading and downloading files, creating buddy lists, sharing resources, and so forth. Wang and Beasley (2005), Jeong (2003). Lu et al. (2006), and our study found the use of training sessions effective and beneficial.

(8) Choice of IM Software: IM software companies are beginning to address inter-operability issues; Yahoo and MSN have developed a common platform such that Yahoo IM users can now communicate with MSN IM users (Kaly, 2007). However, some third-party programs still do not allow communication across different IM services (Jeong, 2003). Therefore, the choice of IM software would be an important consideration for instructional purposes. Since various students use different IM programs running on different platforms, it is suggested that common IM software be used. Some online IM programs such as Yahoo Messenger, Windows Live Messenger (MSN), American Online messenger (AIM), and Google Talk are recommended. IM online programs eliminate the extra layer of installing new applications on students' computers, which is often met with resistance as confirmed by Jeong (2003). For our study, we used the Yahoo IM program; there was no installation of any software since it can be accessed online and 95% of the participants reported ease of use and no technical issues.

(9) User Names: For instructional purposes, it is suggested that students keep a separate IM username from their regular IM usernames. That is, the IM username to be used for the duration of the course work should be different from other social or regular IM usernames. Students should be informed that the course IM username is strictly for course work and not for social activities. This strategy would aid in the reference of archived messages for study purposes or other course related activities, and may also reduce the tendency to engage in off-task related behaviours. Our study assigned new IM user ids to participants; content related messages were readily identified. A separate IM username is not necessarily compulsory, but a good practise.

(10) Combine Audio and Visual Components: Combining audio and visual components of IM when possible would provide the necessary cues required to aid communication. For instance, an audio feature would provide a tone of voice that simulates a face-to-face interaction. Web cams could be used to communicate 'body language' and support visual cues (Jeong, 2003; Sotillo, 2006).

(11) Group Size: A small group size is recommended when an IM tool is being used as a collaboration tool for group activities. It may be challenging to keep up with the discussion when students have varying typing skills; a maximum of three students per group is suggested (Maushak & Ou, 2007; Sotillo, 2006).

(12) Scheduled Availability: IM is a synchronous and ubiquitous communication tool. Student and instructors can be connected anytime and as frequently as possible, thus increasing the expectation of ubiquitous access to instructor. This could add an extra layer to the instructor's workload and may be time consuming; Farmer (2003) refers to this as an "educator's nightmare". It is easy for instructors to become burnt out when they are involved in all IM discussions or activities outside of their regular class hours. A possible solution is not to get involved in all the IM activities or to run a scheduled availability. Have time slots for specific IM activities and inform students so that they are aware of the instructor's availability. This would reduce the instructor's workload and time demands.

5.6 Challenges and Limitations

As discussed in chapter 3, the practical inquiry (PI) model was applied to the content analysis of transcripts. The initial application of the PI model by Garrison et al. (2001) occurred during a 13-week course where asynchronous discussions occurred in a natural setting and students were not pressured for time. Students chose their discussion partners as would have naturally occurred in 'real life'. A teacher presence was also available to monitor, guide and shape online discussions to reflect different phases of critical thinking.

In contrast, our study, which was conducted as a controlled laboratory experiment, had a maximum allowable time for discussions and participants had a limited amount of time to engage in all the discussion activities and were therefore pressured for time. This could have an effect on the quality of the discourse. Secondly, during our study, in order to avoid loss of time, participants were not given the privilege of choosing their partners, but were paired up by the researcher prior to the discussion. Pairing participants with unfamiliar peers could also affect the quality and nature of the discourse.

Our major challenge in the use of the PI model was the lack of a proper 'teacher presence'. Teacher presence is an important element in the communities of inquiry needed to stimulate, moderate, monitor, and guide discussions towards required outcomes (e.g. towards higher phases of critical thinking). The nature of IM software adopted in this study would not accommodate a teacher presence; hence, the discussion questions provided to act in the role of a teacher presence might have been incapable of monitoring

and shaping discussions towards the highest levels of critical thinking achievable by the group.

Most quantitative experiments are designed with large sample groups to increase the external validity of results. The quantitative analysis investigating the relationship between time-on-task and critical thinking is limited by small sample size and this has implications for the external validity of the obtained results. While this study has provided insights into the use of time during IM discussions designed to promote critical thinking, caution should be exercised in the generalization of obtained results to other learning contexts.

The lack of a control condition is another factor that limits the generalization of the conclusions. Our results provide evidence that critical thinking can be enhanced with the use of IM discussions in a controlled environment; how these results compare with face-to-face discussions is not known. For instance, would it be more effective to promote critical thinking with IM discussions as opposed to face-to-face discussions? Alternatively, would a blend of both conditions synergize the enhancement of critical thinking skills? Though limited by the nature of the study design and currently beyond the scope of this project, these questions are worth investigating.

The two models adopted in both studies impose a major limitation to this study. Garrison et al.'s (2001) PI model is limited to only four phases of critical thinking. Critical thinking as a construct is a vast domain in educational research, it is therefore evident that the PI model is not exhaustive, and excludes other important phases or aspects of critical thinking. Similarly, Perkins and Murphy's (2006) model identifies only four critical thinking processes, thus the categories identified in our study were limited to

only those four processes. In addition, Perkins and Murphy's (2006) model did not provide a category for classifying all messages that could not fit into the model, unlike Garrison et al. (2001) model where such messages were categorised as 'other'. Hence, messages that could not fit into Perkins and Murphy's (2006) model (e.g. messages of a social nature) were not categorised, and does not alter the findings of this study. Social messages are important for building a sense of community among online students (Perkins & Murphey, 2006; Garrison et al., 2001), however, they do not represent an analysis of the subject or issue under discussion and thus cannot be categorised as critical thoughts.

5.7 Future Research

As stated in chapter 4, the low sample size (N=38) in this study limits the generalization of our conclusions. Although we noted a positive correlation for time-on-task and higher levels of critical thinking, future research would further improve the external validity of the results with the use of a large sample. Speculatively, 'more time' may not always produce higher phases of critical thinking; the effect of time-on-task on critical thinking may decline over time due to factors such as cognitive fatigue, extended discussions, etc. Future research could investigate the point in time beyond which a decline in critical thinking outcome occurs as proposed by Stallings (1980). This would establish the specific amount of instructional time required for achieving high level thinking skills during IM discussions.

Discussions are not homogenous in a group over a period. The categories dominating in the beginning may change along the discussion producing an interesting

pattern that may need to be investigated. It is possible that the discussion starts with social greetings and then move on to task-oriented discussions with divergence of opinions within groups, and then finally proceeds to problem solving efforts that reflect convergence of ideas. In addition to time-on-task, it would be interesting to study crude time series and stages of discussion as an outcome. Say for a discussion that lasted for about one hour, break down the time into series of twenty minutes (three stages) and observe the pattern emerging from the discussion. This would also have implications for group learning using IM technology.

As mentioned in chapter 4, the design of our study is exploratory in nature, therefore no control condition was set up to compare the quality of critical thinking processes with other educational tools or a face-to-face condition. However, a future design of a two-group experimental study, where one group uses IM discussions and the control group is, for example, a face-to-face condition would compare the level of critical thinking skills or quality of cognitive processes manifested in both conditions. This would test the idea that critical thinking might be impaired in mediated communications due to the absence of verbal cues. In addition, the pedagogical benefits of IM technology as it relates to critical thinking could be further established by comparing IM with other educational tools.

Our research objective was to establish the evidence of critical thinking processes and to gain some insight into the occurrence of this construct in IM discussions. In the future, we would like to investigate further the occurrence of critical thinking processes in IM discussions without the limit of structured models. This would shed more light on the contributions of IM discussions to the promotion of critical thinking. As observed

from the questionnaires, about 81 % of students indicated high levels of prior knowledge and interest in the instructional material adopted in this study. These variables along with level of engagement are factors that could affect the outcome of critical thinking in IM discussions and should be investigated. Student's intellectual ability, fluency in the language of communication, and familiarity with IM are other factors that can also influence the outcome of critical thinking in IM discussions. In addition, the effects of various instructional methods and materials on critical thinking in the context of IM discussions need to be clearly understood.

Since our study was conducted in a controlled environment with time constraints, a replication of this study in a more natural setting as part of the curriculum in a semester course with a 'teacher presence' would be appropriate. This could reduce the effects of time constraints and further guide the discussion to higher phases of critical thinking such as *'resolution'*.

Individual differences and student characteristics could be a factor that affects engagement in critical thinking. In the future, a detailed quantitative experiment should be conducted to determine the effect of these variables on critical thinking during IM discussions. This would shed more light into the occurrence of this construct in IM discussions.

Our results at this point suggest that IM discussions promote critical thinking skills; however, specific IM feature(s) that contributed to this outcome are not known. The context-embedded, spontaneous nature of IM discussions may have played a role of facilitating real-time explorations of content that resulted in the high levels of critical thinking observed. While our study does not expand on this, specific IM features that

facilitate critical thinking skills should be investigated.

As of today, the contributions of IM technology in higher education are not well understood. The learning outcomes that could emerge from the use of this technology in various learning contexts require further investigation. Some instructors are sceptical about the use of this technology because they are unaware of its benefits. There is therefore a need for future studies to investigate other potential roles of IM in other learning contexts.

5.8 Conclusion

This study provides preliminary insight into the use of IM technology in the promotion or enhancement of critical thinking skills. IM is an educational tool that can be used to foster critical thinking skills in the context of online learning, provided discussions are appropriately structured, properly ordered, and monitored to allow for teacher presence.

Our results provide a promising line of research in the area of IM usage in higher education specifically for teaching critical thinking. As discussed in chapter 2, there are reservations regarding the benefits of IM in higher education arising from speculations characterised by little or no empirical evidence. Results from our study provide additional empirical evidence against such criticisms of IM technology as an educational tool. Although research on IM usage in educational environments is relatively low as of today (Murphy & Rodriguez-Manzanares, 2008; Bakker et al., 2007), we conclude that our findings are encouraging; therefore this technology is worthy of further investigation and deserves more attention from educational researchers.

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APPENDICES

Appendix 1: Article (Instructional Material)

The Internet's Effect on Personal Lives

Retrieved from: http://cse.stanford.edu/class/cs201/projects-00-01/personal-lives/index.html

Authors: Christian Cárdenas, Sara Jasper, Kristen Parton, Jed Rose and Luke Swartz (2001)

The Internet has the unique ability to connect any user with any other user, according to any quality possible — relationships, beliefs, viewpoints, goals, problems, identity, or interests. For example, using email and chatting software, connecting with family and friends who are far away geographically is cheaper and easier than calling or writing letters. A person with a panic disorder syndrome living in a rural area can logon to a panic disorder web site, email and chat with other people with the same disorder, and read up on the medical facts, even though there may be no one suffering from the same disorder within a hundred miles of the person. Using a combination of the World Wide Web, chatting software, email, and discussion groups, minority groups that may have been ignored by traditional media have come together online to share information, support each other, and organize events.

However, critics of the Internet believe that Internet use, while connecting more people virtually, makes people more isolated socially because the more time they spend online, the less time they spend interacting in real life.

Critical forecasts of the future of the Internet, for example in the movie The Net, show people whose only friends are online buddies, whose real names are not even known. In these distopian worlds, social relationships are not even based on reality, but on the façades of other online users, whose anonymous interactions can be untruthful and unreliable. These people work from home, so there is no interaction with fellow

employees, and their social lives are mingled with their work, which both revolve around the Internet. These distopian views are countered by utopian views of a global village, where anyone can reach out to anyone else and geographic barriers are nonexistent, because the Internet allows users to be always connected.

The dream of a global village, however, is tempered by the possibility of fragmentation and isolation. The newfound online support groups come at the expense of more personal, physical interactions, as more time spent online also means less time offline interacting with family and friends and attending fewer events outside the home, according to the SIQSS study. Spending more time in an online community means spending less time in the real community, so as a user is more drawn to a group, he or she is less involved in the mainstream culture or geographic community.

The two opposing viewpoints about the Internet have been debated extensively in the past few years, in part because several studies have recently emerged to support the viewpoint that Internet use has a negative effect on personal lives. These studies concluded that, among other things, the more time people spend on the Internet, the less they interact with family and friends physically and over the phone, the smaller their social circles become, and the more they feel depressed. Kraut, primary author of the Carnegie Mellon HomeNet study, thus titled his paper "Internet Paradox: a social technology that reduces social involvement and psychological well being."

Kraut’s "Internet Paradox" is exemplified in the Internet addict: he or she uses the social tools of the Internet (email, chatting, MUDding, online gaming) so much that he or she loses contact with the real world, thus becoming very anti-social. However, unlike average net users, Internet addicts often claim that they feel more connected to their online virtual friends than friends do in reality.

Appendix 2: Questions for Discussion

Activities (please attempt questions 1 to 4)

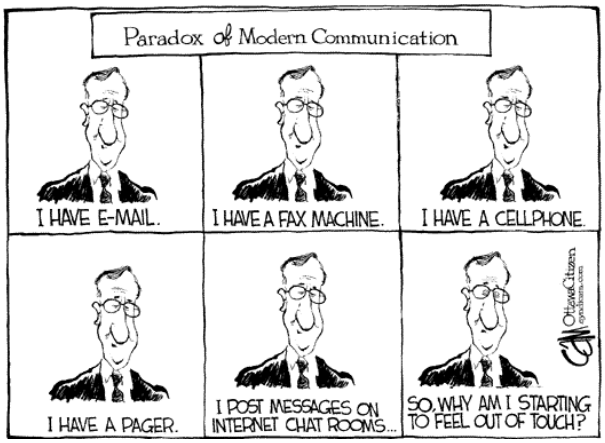
1. (a) Discuss the most crucial issue(s) in the article with you peer. (b)Which do you believe would have the most negative impact on the society?

2. Collaborate with your colleague and suggest some reasons why people may become addicted to the internet.

3. Is having an online community a nourishing or damaging life style? Discuss elaborately with your colleague taking opposing viewpoints.

4. Collaborate with your colleague and suggest one or more solutions to the problem of internet addiction. Please give reasons why your proposed solution would work OR how it can be tested.

The brave new world of cyber-glop will be an increasingly lonely, isolated and dehumanized word. It will be a place where you can order anything you want online, but you don't know your neighbors, where your children and your parents will spend evening hours logged into the Net, talking to distant strangers rather than each other." … -Clifford Stoll, author of "Silicon Valley Snake Oil"



Appendix 3: Sample Transcripts

3:11:19 PM **im.user11:** Yo!

3:11:33 PM **im.user12:** hello

3:11:55 PM **im.user11:** I'm going to read the article through once...I'll let you know when I'm finished.

3:12:00 PM **im.user12:** sure

3:14:53 PM **im.user11:** okay...I've read it.

3:14:59 PM **im.user12:** alright so first question

3:15:13 PM **im.user11:** right.

3:15:16 PM **im.user12:** which do you believe would have the most negative impact on the society..

3:15:56 PM **im.user11:** Well, first, what were the critical issues in the article? I think that the notion of the interntet paradox was at the heart of it.

3:16:34 PM **im.user12:** basically that time spent online makes people less social outside

3:16:56 PM **im.user11:** Yeah, the whole "socializing online will be the end of real-world social contact" hysteria.

3:17:21 PM **im.user12:** is there more than one point in the article?

3:17:46 PM **im.user11:** I think there is a second big idea, tho, which is the notion that geographical distances can be eliminated via online communication.

3:18:12 PM **im.user12:** It seems there is also an arguement at the beginning.. yes exactly. It can provide more information to people who are in issolated areas

3:19:25 PM **im.user11:** so those seem to be the two central points in the artice: the web simultaneously provides the possibility of connecting with people along certain valences (common interest, cultural background, etc), but threatens actual human connection.
3:19:37 PM **im.user11:** or at least has the potential to.

3:19:46 PM **im.user12:** I think this is more along the lines of actualy physical connection

3:20:19 PM **im.user12:** I think the internet provides a lot of options for those peole who can't connect to others over long distances or because of physical disorders..

3:20:39 PM **im.user11:** absolutely. I don't necssissarilly buy the argument
3:20:42 PM **im.user11:** oops....
3:20:55 PM **im.user11:** that the web is endangering social connection.

3:21:24 PM **im.user12:** yeah, so maybe it is more along the lines that people can get too addicted to spending too much time online that they forget about other ways of connecting with people

3:21:25 PM **im.user11:** but that does seem to be the most "negative impact" on society, according to the article.

3:22:10 PM **im.user12:** Or they don't build social skills outside of talking to people online. Maybe they are more comfortable with having an indirect form of communication

3:22:59 PM **im.user11:** the metaphor I've always used is that internet socializing is like the "Junk Food" of social interaction...it is "delicious", but "full of empty calories"
3:23:05 PM **im.user12:** Chatting online can sometimes seem easier for people as they can think about what to write before they say it

3:23:37 PM **im.user12:** haha yes

3:23:45 PM **im.user11:** internet socializing doesn't come with the same social obligations that having real life friendships comes with either...you don't have to pick up your internet friends when their car breaks down.
3:24:13 PM **im.user11:** but as a result, the freindships are superficial, since you don't really mean anything in a functional way to each other.

3:24:24 PM **im.user12:** You can sign off and not talk to people easily, without caring about feelings or emotions
3:24:31 PM **im.user12:** yeah exactly

3:24:41 PM **im.user11:** (this idea comes from an interesting article online which I can't recall the name of atm...but it's great)

3:24:56 PM **im.user12:** what is the idea?

3:24:56 PM **im.user11:** so...this moves us into question two I think.

3:25:11 PM **im.user12:** I think we are already sort of discussing question 2

3:25:14 PM **im.user11:** The idea of obligations to real world friends being at the heart of friendships.

3:25:21 PM **im.user11:** yeah...we are. :)
3:25:30 PM **im.user11:** ugh...animated smileys.....

3:25:51 PM **im.user12:** ah, yeah, so maybe the online relationships are not as emotionally real
3:26:39 PM **im.user12:** back to question 2.

3:27:01 PM **im.user11:** Right, it's the junk food thing...you spend all day online chatting, blogging, etc. and it's like spending a day eating cheetos and cookies and soda....but eventually your social life dies of malnourishment.

3:27:01 PM **im.user12:** what are some reasons that people may become addicted

3:27:12 PM **im.user11:** because cheetos are delicious!

3:27:17 PM **im.user12:** haha.. yes they are.
3:27:24 PM **im.user12:** and everyone likes junk food

3:27:29 PM **im.user11:** but bad for you in large quantities.

3:28:13 PM **im.user12:** I think people may become addicted, because its an easy way to communicate to multiple people all the time at the same time.. throughout every day

3:28:37 PM **im.user11:** So, the arguement we're making is that the same impulse that leads people to become obsese leads people to get addicted to online socialization?

3:29:00 PM **im.user12:** hmm.. never thought about it that way
3:29:02 PM **im.user12:** maybe..
3:29:11 PM **im.user12:** is it a laziness thing?

3:29:31 PM **im.user11:** I agree... being able to communicate with multiple people is the illusion of being more popular then you probably are....100 superficial conversarions instead of 2 really important ones.

3:30:05 PM **im.user12:** once you start having a little bit, you try to get more connected having more people online.. and it gives the illusion of feeling popular?

3:30:07 PM **im.user11:** It's like Andrew Glassner's "Work to Fun" ratio.

3:30:11 PM **im.user12:** haha
3:30:28 PM **im.user12:** yes.. the more friends on facebook I have the more popular I am
3:30:38 PM **im.user12:** even if I don't know 1/3 of them

3:30:54 PM **im.user11:** A close friendship might be more fulfilling then an online friendship, but it's so much more work....much easier to just have lots of facebook friendships.

3:31:35 PM **im.user11:** also, there's something to be said for the "one-to-many" nature of facebook, and LiveJournal, and the like...you don't need to have a conversation with each of your 50 friends, you can just make a single post, and it's up to them to read it.

3:31:36 PM **im.user12:** And because everyone else is on there, you feel that you're not in the loop of things if you don't go online and check out what is happening with everyone else

3:31:43 PM **im.user11:** exactly!

3:32:01 PM **im.user12:** So it becomes an addition that way

3:32:35 PM **im.user11:** right...in the same way that doing drugs can be addicting....the work to fun ratio for drugs is out-of-control!

3:32:44 PM **im.user12:** Does this make it a damaging lifestyle though?
3:33:04 PM **im.user12:** if it works for people.. is it really distroying our society?
3:33:21 PM **im.user12:** I think it is just changing the way that people communicate

3:33:38 PM **im.user11:** I'd make the arguement that anything taken to excess is a damaging lifestyle....but I doubt that online communication really is taken to excess by most people.

3:34:04 PM **im.user12:** Yeah, I think people still have some balance of both, and if they don't then it can be damaging

3:34:12 PM **im.user11:** Just because I like chips, doesn't mean that I don't eat other things, and just because chips are bad for me, it doesn't mean I can't have them every now and then.

3:34:23 PM **im.user12:** yeah, good analogy
3:34:30 PM **im.user12:** mmmm junk food..
3:34:35 PM **im.user12:** were doing it right now

3:34:36 PM **im.user11:** now i'm getting hungry
3:35:10 PM **im.user11:** so for three, which position do you want to take....I think I can make an argument for either of them

3:35:41 PM **im.user12:** hmm.. I think it is nourishing

3:36:06 PM **im.user11:** Fair enough...I think it's the end of all human connection!
3:36:40 PM **im.user12:** It gives people an easy way to stay connected to multiple people, which may not have been as easy if they were connected face to face or through other ways
3:37:47 PM **im.user12:** It also gives people ways to communicate with many people at the same time, from long distances.. It saves time in that sense

3:37:51 PM **im.user11:** I think that especially, as bandwidth and media become cheaper and easier to use that eventually it will not be neccessarry to leave the house in order to have a complete relationship. And as soon as people start staying in their houses, they stop getting to know the people in their community.

3:38:08 PM **im.user12:** unless they are online

3:38:11 PM **im.user11:** Not knowing your neighbors breeds suspicion, and paranoia...
3:38:54 PM **im.user11:** right, but why would you be friends with a neighbor with noting in common with you when you can pick from all of humanity online...the only reason people get to know their neighbors is that they have no other choice.

3:39:24 PM **im.user12:** but like we said earlier, people would have to have a balance of online communities and offline ones

3:39:36 PM **im.user11:** so soon, we'll all be living inside little pods, and when we go outside, we'll be surrounded by strangers!

3:40:04 PM **im.user12:** haha, but what about all the people from accross the world you could connect to that you wouldn't be able to connect to otherwise
3:40:18 PM **im.user12:** it makes the world smaller in this sense..

3:41:16 PM **im.user11:** True...but what happens to national boundaries, and national identities when suddenly social groups are not bounded by geography....I mean, how does a country maintain a cultural sense of self, when people can socialize freely across borders from their own homes?
3:41:56 PM **im.user11:** Suddenly, we all live in a homogenised meta-culture with no character of its own

3:41:59 PM **im.user12:** perhaps it could unite the world, while everyone can learn to communicate and understand other cultures
3:42:29 PM **im.user12:** it would be a way of respecting others nationalities
3:42:43 PM **im.user12:** if the discussions were positive of course
3:42:45 PM **im.user12:** ;)

3:42:49 PM **im.user11:** by absorbing them into the unified, melting pot of culture!
3:42:56 PM **im.user11:** Globilization FTW!

3:43:16 PM **im.user12:** Ok. I think we should move on to question 4
3:43:23 PM **im.user11:** so yeah....internet clearly = end of civilized society as we know it!
3:43:27 PM **im.user11:** moving on....

3:43:32 PM **im.user12:** haha
3:43:52 PM **im.user12:** or.. joining together cultures and have world peace :D

3:44:18 PM **im.user11:** we ARE the world! we ARE the children!
3:44:25 PM **im.user11:** etc.

3:44:37 PM **im.user12:** ok, so what are some solutions to the problems of internet additions

3:45:25 PM **im.user11:** I think that finding ways to bridge social relationships across both digital and face to face communications is important.

3:46:09 PM **im.user12:** Yes.. maybe in schools where there are a lot of people who are connected online, should have events which are face to face..
3:46:28 PM **im.user12:** sort of how facebook has invitations for social events .. i think that is a good way to balance both

3:46:33 PM **im.user11:** also, I think that ubiquitous computing is going to help solve a lot of these problems....the reason that online socialization is seen as this "spectre" is that right now, being online means being alone in a room. As soon as we're wearing our computers, we get a whole now digitslly mediated social model.

3:46:59 PM **im.user12:** yes, becoming more mobile will help, so you can stay connected while being outside

3:47:25 PM **im.user11:** if the layer of digital information can be used to annotate actual social encounters, it makes for more meaningful face-to-face interactions.

3:47:28 PM **im.user12:** integrating them, connecting whole classrooms together from different countries or different locations..

3:47:36 PM **im.user11:** exactly

3:48:18 PM **im.user12:** so anything else.. we have 5 mins..

3:48:34 PM **im.user11:** when you meet someone, their profile is visible on a HUD, and you can instantly see whether or not they are single, dating, married, etc. You can use the digital information to enhance the analog world.

3:49:02 PM **im.user12:** its like online dating or something.. you don't know if you will really like the person unless you meet them in person
3:49:10 PM **im.user12:** but you can evaluate their stats online
3:50:01 PM **im.user11:** right....or think about going to a conference and being able to know how many citations someone you meet has...that way you don't make an ass of yourself in front of a leader in your field.

3:50:47 PM **im.user12:** ah, so knowing information about people.. but using it in social situations

3:51:14 PM **im.user12:** having value to this type of information, or encouraging using this type of information in real social situations
3:51:54 PM **im.user12:** how about changing the way that im work, to being more vocal
3:52:06 PM **im.user12:** and using videos instead of text

3:52:46 PM **im.user11:** I think that the only real solution to any issue of "moderation" is going to have to happen at the social level, however...so there are simple "quick-fixes" (like limiting people's time online), and there are magical sci-fi solutions (like ubi-comp), but ultimately, the way to preserve the balance between face to face interaction and online interaction is to learn how to integrate it into our daily behaviours...which means waiting for several generations, while our society catches up with our technology.
3:53:10 PM **im.user12:** sounds like a good solution to me

3:53:12 PM **im.user11:** You tube seems like a good example of video-instead-of text.

3:53:42 PM **im.user12:** but live video and audio, so we are socializing the same way we could be during a face to face conversation

3:53:50 PM **im.user11:** right.
3:54:18 PM **im.user11:** I use skype to video conference with our parents pretty regualrly...but it is by no means the standard at the moment.

3:54:19 PM **im.user12:** ok, so i think we are done

3:54:26 PM **im.user11:** right! I'll head back over

3:54:34 PM **im.user12:** can you lock the computer and bring the article
3:54:42 PM **im.user12:** :)

9:48:52 AM **im.user3**: Are you available?

9:49:00 AM **im.user4**: Hello
9:49:02 AM **im.user4**: Yes

9:49:02 AM **im.user3**: Hi
9:49:17 AM **im.user3**: Did you already finish the article?

9:49:20 AM **im.user4**: Yes

9:49:22 AM **im.user3**: me too
9:49:40 AM **im.user3**: So what do you think the most crucial issue in the article is?

9:50:54 AM **im.user4**: I think that the paper is mostly about conveying the idea that Internet use leads to reduced social involvement and psychological well being

9:51:56 AM **im.user3**: I would agree. I think one of the most interesting findings that they point out is that internet addicts actually feel like they are more connected than they actually are.
9:52:11 AM **im.user4**: yes, that's an interesting observation
9:52:34 AM **im.user4**: however, I feel like the author is directing the discussion toward the negative a little too quickly
9:52:51 AM **im.user4**: for example, how does internet use compare to say using the telephone?

9:53:19 AM **im.user3**: I agree. And the authors don't describe how they evaluated social connection

9:53:26 AM **im.user4**: yes, that's true

9:54:05 AM **im.user3**: They seem to give preference to local social circles as being more healthy
9:54:48 AM **im.user4**: also, the author suggests that some how social interactions through the internet are "not even based on reality", and that the anonymous interactions can be untruthful, etc
9:54:58 AM **im.user4**: however, the same holds true in physical reality

9:55:10 AM **im.user3**: They write "spending more time in an online community means less offline time for interacting with family and friends and ettending fewer events outside the home."
9:55:53 AM **im.user3**: Yes, they seem to create arbitrary categories of interaction.

9:56:29 AM **im.user4**: yeah, the bias toward physical interaction seems a little too much here.
9:57:16 AM **im.user4**: ok, assuming that despite this apparent biasing, what aspect of the negative impacts that the authors point out do you think are the most significant?
9:57:43 AM **im.user3**: Online communities are just as valid as communities. And like yu mentioned, phyical interaction is just as prone to deception as online ones are. The fact that people are connecting seems to be the important aspect of community, not where they meet (real-world vs. virtual world)

9:57:59 AM **im.user4**: yes, I agree

9:59:04 AM **im.user3**: If there really is a proven corellation between excessive internet use and depression than I think this would both give their argument credence and be a very significant finding.

9:59:17 AM **im.user4**: true
10:00:21 AM **im.user4**: so, it seems like Kraut's "Internet Paradox" has to become a lot more specific in the sense that some particular subset of Internet users would suffer from it
10:00:28 AM **im.user4**: versus it being a general phenomenon
10:01:01 AM **im.user4**: ok ... well, they are differentiating "average net users" from Internet addicts
10:01:04 AM **im.user4**: ...

10:02:03 AM **im.user3**: Right. There is a string of causal events that lead to this depression, but it seems like they could be related to other spects of a person's life. The quote is "The more time people spend on the internet, the less they interact with family and friends physcially and over the phone, the smaller their social circles become, and the more they feel depressed."

10:02:54 AM **im.user4**: yes. the choice to use a computer to communicate could stem from some other personal problem

10:03:03 AM **im.user3**: Internet addicts may be just like any other addict and may be much more prone to the negative effects of the internet

10:03:16 AM **im.user4**: exactly

10:03:31 AM **im.user3**: It looks like we may be on to question 2

10:03:42 AM **im.user4**: ok, so what are some reasons that an individual could become addicted to internet use

10:04:42 AM **im.user3**: They may in fact already be depressed, or as the authors note, may have a "panic disorder syndrome" so the internet provides an a safe and comfortable way to interact.

10:04:56 AM **im.user4**: they just might not have any social outlets in physical communities
10:05:42 AM **im.user3**: In the panic disorder case intenet use may actually become a problem because it provides such a conventient alternative to real-world interaction.

10:05:50 AM **im.user4**: yes

10:07:21 AM **im.user3**: I think on the negative side, the internet does allow people to enage in fantasy which can be addictive, especially if it has positive results for someone

10:07:30 AM **im.user4**: if we were to compare the degree of difficulty in establishing communication through physical vs internet means, there may be less of an impediment to doing so online
10:07:38 AM **im.user4**: true

10:09:36 AM **im.user3**: Absolutely. The internet can be accessed quickly without requiring a significant level of work. If you are trying to meet people in the real world you have to physically transport yourself and try to find a way to meet a similar group of people. Which can be difficult. Not eveyone wants to go to a bar.
10:09:54 AM **im.user3**: Which is where a lot of people hang out
10:10:26 AM **im.user3**: And that kind of behavior has an addictive quality for a number of reasons.
10:10:35 AM **im.user3**: So lets look at question 3

10:10:40 AM **im.user4**: ... the bar example also leads me to think about the quality of the relationships that can be found through different means

10:11:29 AM **im.user3**: Did you want to elaborate on that?

10:11:32 AM **im.user4**: it may be that people experience or interpret their online communications as being more genuine that those they can encounter through physical communities
10:12:33 AM **im.user4**: for example .. following from the "ease of access" argument, I think there is also an argument to be made about the impediments to people basically speaking freely, or telling the truth

10:12:34 AM **im.user3**: Especially if you feel that the people you are communicating with are more similar to yourself because it is easier to enter a specific communicty on the internet than it is in the physical world

10:12:44 AM **im.user4**: right

10:13:29 AM **im.user3**: Right, anonymity allows for more open communication
10:14:34 AM **im.user3**: The interesting thing is that the anonymity is only your physical self, your ideas and your virtual representation do have their own identity on line

10:14:54 AM **im.user4**: that's an interesting point

10:15:30 AM **im.user3**: Especially if you use a standard Username
10:15:57 AM **im.user3**: So do you think having an online community is nourishing or damaging?

10:16:34 AM **im.user4**: it seems to be a question that would have to begin with the individual, and their disposition or motivation toward the community

10:18:12 AM **im.user3**: But overall would you say they are generally a positive influence or a negative infuence?

10:18:22 AM **im.user4**: generally positive
10:18:39 AM **im.user4**: it provides a venue for a significantly larger range of conversations
10:18:47 AM **im.user4**: that can occur continuously
10:19:43 AM **im.user4**: I wonder if there is a physical correlary to "internet addiction"

10:20:27 AM **im.user3**: However, it also devalues the strength of relationships in general. Fo instance, if I know that I can go online now and talk to any of 100 people, I may not care that much about the person that I talked to yesterday. The value of the individual is diminished.
10:21:42 AM **im.user3**: Or people could try to improve their repuation by having more friends than someone else, a phenomenon I have seen on Facebook and Ourspace

10:22:04 AM **im.user4**: I would interpret that as being a case where computing mechanisms are amplifying your abilities but also making your limitations as a human more apparent

10:22:15 AM **im.user3**: That's an interesting question about a physical correlary....

10:22:41 AM **im.user4**: ...as an individual, you just can't empathize with large masses of people
10:23:53 AM **im.user3**: Perhaps the danger of internet addiction stems from what you wrote above "amplifying your abilities but also making your limitations as a human more apparent." Maybe there is a danger in having abilities that outwiegh our limitations to handle them.

10:24:30 AM **im.user4**: yes, that would be a really interesting question to look at. What are your social limitations?
10:24:48 AM **im.user4**: and how does the computer alter the boundaries?

10:25:20 AM **im.user3**: I think the physical correlary might be someone who is the life of the party and knows everyone but has no close friends to confide in. He seems happy on the surface, but underneath may be quite depressed.

10:25:39 AM **im.user4**: yes, that's a really interesting example
10:26:01 AM **im.user3**: So, how do you think we could solve some of these problems with internet addiction?

10:26:49 AM **im.user4**: our sense is that the underlying sentiment of a term like "internet addiction" is that people don't like the idea of machines mediating social interactions on a large scale
10:27:31 AM **im.user4**: which is interesting, since nobody seems to have a problem with telephones
10:28:28 AM **im.user4**: otherwise, why don't we have terms like "coffee shop addiction"

10:28:39 AM **im.user3**: Yeas. There is an implicit (maybe explicit) bias towards the way thing "used to be done." A nostalgiic yearning for some imagined ideal past. And your telephone example personifies this perfectly.

10:28:42 AM **im.user4**: or "gossip addiction"

10:29:58 AM **im.user3**: I think one aspect that the paper leaves out too is that it does not have to be all or nothing. Some people do actually meet up with people from online communities in the real world. So they get the benefits of both types of interaction. The telephone is used in the same way. Sometimes we want to chat for hours, other times we use it to make plans. THe internet can be used in the same way.

10:30:55 AM **im.user4**: yes. Perhaps the authors are just using this term to dramatize the condition of a particular subset of individuals who have some particular social pathology
10:31:56 AM **im.user4**: "Internet Addiction" is an expression of that pathology, and the Internet is a convenient and popular vehicle to somehow identify characterize the behaviors and interactions of these individuals

10:32:02 AM **im.user3**: or maybe the problem is actually stemming from a larger social problem...that people have less time to get out and meet people because or work lives take up so much time. So online activities are actually just band-aids.

10:32:10 AM **im.user4**: yes

10:32:13 AM **im.user4**: definately
10:32:47 AM **im.user3**: Susan is here and wants to round up things.

10:32:50 AM **im.user4**: ok
10:32:52 AM **im.user4**: ltr

10:32:57 AM **im.user3**: byw
10:33:00 AM **im.user3**: bye

1:56:40 PM **im.user4:** hi?

1:56:43 PM **im.user3:** yup
1:57:03 PM **im.user3:** ready to talk about the article?

1:57:16 PM **im.user4:** this is the first time i've used MSN

1:57:31 PM **im.user3:** yeah, i usually use google chat
1:57:38 PM **im.user3:** and not through a web browser

1:58:00 PM **im.user4:** ok too work

1:58:13 PM **im.user3:** so, what did you think was the most crucial issue?

1:59:06 PM **im.user4:** addiction/ social isolation seems to be the focus of the argument

1:59:48 PM **im.user3:** yeah, i think the crux of the matter is the claim that more time online = less time interacting with real people

2:02:07 PM **im.user4:** that is that does seem to be the author's belief. but seem to assume technological determinism. that people are not in controle of their desisions. there are anti-socal people that aren't on the net

2:02:38 PM **im.user3:** this is true. I am also always wary when the idea of internet addiction is thrown around
2:03:25 PM **im.user3:** i think that people can be addicted to the internet/online gaming, but that this is the same problem as any other kind of addiction, not a new phenomenon. People with addictive personalities will get addicted to things
2:03:55 PM **im.user3:** i'm not convinced that the internet "causes" addiction

2:04:26 PM **im.user4:** true. it come down to escaping.
2:05:06 PM **im.user4:** but i think a definition of social interaction is needed as well.

2:05:42 PM **im.user3:** yes, very true. a lot of studies of this assume that internet communication is bad/non-social and real world is good/social

2:06:28 PM **im.user4:** i but also if your famly is spred around the world then being on the net doesn't take away from your time with them. is the net a typ of social activity

2:06:57 PM **im.user3:** yes. Since moving here from san diego, i do a lot more of our communication with close friends online.

2:07:53 PM **im.user4:** so back to question one. i'm not convinced of the argument of negetive impact on society

2:09:38 PM **im.user4:** as for reasons to become addicted, as you mentioned earlier addiction of all forms follows a similar pattern. self estem, abuse, etc.

2:10:46 PM **im.user3:** right. i think that addressing addiction problems has less to do with curtailing any particular addictive substance (alcohol, gambling, internet) and more with supporting mental health & self-reflection

2:12:41 PM **im.user4:** i have a question. the article brings up the issue of online communities and support groups. first do you believe that community exists on line. and is it possible that because it is easy to finds others with your views, that there is less need to temper your views with those of others?

2:14:55 PM **im.user3:** i have a couple of reactions to this. I think it is possible to form communities online, but if *none* of the participants ever meet in real life, there will be a lack of overall cohesiveness to the group. I think that online communities that occasionally get together, or where at least some of the participants interact in small groups, are much more rich than purely online ones. I also think that there is a danger in only hanging out with people who reflect your own viewpoints. It becomes very enclosed & narrow-minded quickly
2:15:57 PM **im.user3:** i guess we're kind of on question 3 now...do you have a position on the nourishing vs damaging? I could argue either side.

2:18:56 PM **im.user4:** for me they are balence in your last statement. i do think it is too easy to be with like minded people when you can chose from the world, still any group, if enough people get involved will have disenting ideas. this is one reason why communes can only grow so larg ans stay for around 7 years.
2:19:58 PM **im.user4:** i'm even moreinterested in your comment on groups that get togewther physicaly. what is different and is this somehow "needed" by humans??

2:21:38 PM **im.user3:** i think there's a fundamental assessment of other people that happens when you physically meet that cannot be conveyed via other means, and then some form of this vouching is necessary to sustain a community
2:22:46 PM **im.user3:** for example, I play WOW with a group of people, many of whom i have never met. But there's conferences on gamign that many of them go to, and various subsets of the community meet at these and then report back on it, post pictures, etc. Having those phsyical interactions strengthens the group as a whole

2:23:07 PM **im.user4:** if we can find groups online that we wouldn't find otherwise and still keep those communities ballanced in diversity and communication modes (i was typing this at the same time as you were.

2:23:23 PM **im.user3:** no problem
2:23:58 PM **im.user3:** i think that's the main benefit of online communities; connecting those who ordinarily would not have support; ie. the panic attack example in the article
2:24:32 PM **im.user4:** communication modes is very important and our thesis is about looking at these modes on stage.

2:24:44 PM **im.user3:** or connecting people globally to promote cross-cultural awareness (although then we get into issues of technology access & the homogenizing effect of globalization)

2:25:32 PM **im.user4:** thereis definitly a place for these comunications but as we are seeing now....if ind it hard to keep in line with the conversating without a body to react to.
2:26:25 PM **im.user4:** sorry...I have a nother meeting at 2:30 so i'm going to have to rap up

2:26:35 PM **im.user3:** turn taking is hard without clues; although the little "typing" notation helps. But still, it's hard to sit and just wait for the other person to finish typing; it's much more awkward than talking
2:26:41 PM **im.user3:** ok

2:27:06 PM **im.user4:** do we need to address question 4?
2:27:37 PM **im.user3:** we did address addiction earlier; i maintain that global addiction support is more important than internet-sspecific interventions
2:28:24 PM **im.user3:** i.e. learningn how to recognize signs & symptoms of addictive behavior & how to maintain mental health

2:28:56 PM **im.user4:** ii agree i also think your comments on ballence is a key, however i have no idea what that ballance is and believe that it is different for each individual.

2:29:06 PM **im.user3:** true.

2:29:12 PM **im.user4:** i should go
2:29:32 PM **im.user4:** talk to you later

Appendix 4: Questionnaire

Cognitive Presence, Critical Thinking & Instant Messaging

(Questionnaire)

My name is Susan Olubunmi from the graduate school of Simon Fraser University. This questionnaire is part of my thesis research which investigates cognitive presence and critical thinking in instant messaging environment.

You may call my supervisor (778-782-7482) to verify my identity.

The data collected would be used for the purpose of analysis **ONLY**.

Please **do not** indicate your name on the questionnaire.

Participation is **optional**; you may drop out at anytime.

Please fill pages 1 to 4

Part A

1. On a scale of 1 to 5 (**where 1 is the lowest and 5 is the highest**) please rate your fluency in written English language.

   1 2 3 4 5

2. Please rate your level of interest in the topic under discussion (where 1 is the lowest and 5 is the highest).

   1 2 3 4 5

3. Please rate your ability to communicate and express ideas in written English Language (where 1 is the lowest and 5 is the highest).

1 2 3 4 5

4. What instant messaging software do you use?

Yahoo messenger

Windows Live (MSN messenger)

American Online (AOL)

Google Talk

ICQ

Other (Please specify) ----------

None

5. How frequently do you use instant messaging?

Everyday

Several times a week

Once a week

Several times a month

Once a month

Other (Please specify) ----------

Never

6. How many years instant messaging experience do you have?

< 1 year 1-2 years 2-3years 3-5 years >5 years

7. Yahoo instant messenger is easy to use and navigate.

Strongly Agree Agree Neutral Disagree Strongly Disagree

8. It takes too much effort to communicate my ideas using instant messaging.

Strongly Agree Agree Neutral Disagree Strongly Disagree

9. Technical issues with instant messaging software interfered with my thought process.

Strongly Agree Agree Neutral Disagree Strongly Disagree

10. I had enough time to express my thoughts and communicate my ideas

Strongly Agree Agree Neutral Disagree Strongly Disagree

11. What features of instant messaging did you find most helpful for this exercise?

Emoticons

Avatars

Audibles

Sound effects

Chat rooms

None

Others_____

12. On a scale of 1 to 5 **(where 1 represents 'no prior-knowledge' and 5 represents 'high prior-knowledge')**, please rate your prior knowledge in the topic under discussion.

1 2 3 4 5

Part B (Demographic information)

Gender

(i) Male (ii) Female

Education

First year Second year Third year Fourth year Fifth year

Masters PHD

Please indicate your age bracket

Below 15 15 – 17 18 - 20 21 - 23 24 – 26 27 - 30

31 – 35 36 – 40 above 40

Thank you for taking the time to complete this survey.