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Computer-mediated communication in graduate engineering classroom: a study of the relationship of online discourse and classroom discourses in two engineering classes

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COMPUTER-MEDIATED COMMUNICATION IN GRADUATE ENGINEERING CLASSROOM: A STUDY OF THE RELATIONSHIP OF ONLINE DISCOURSE AND CLASSROOM DISCOURSES IN TWO ENGINEERING CLASSES

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DEDICATION

To my daughter, Teddy, follow your heart and your head will follow! To my husband, Terry, without you none of this would have been possible! To my parents, especially dad, who encouraged me to "take a class and see what happens"! To my brothers and sisters (by birth and by marriage) and my long time friends, this was not an independent endeavor. I could not have done it without each and every one of you.

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PREFACE

This study was set up to address the following research questions: 1) What was the rate and content of student participation in course-related online discussions in a graduate engineering course in which CMC was employed? 2) What factors associated with the context of this course, in which CMC was used to supplement face-to-face discussion, might have affected the rates and nature of student participation in course-related online discourse? How might student's perception of CMC have affected their online participation? 3) How did the online discourse relate to face-to-face discourse?

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CHAPTER 1

INTRODUCTION

Teaching and technology have developed dramatically over the years. From the early inclusion of slides in the classroom to the acceptance of television and now the development of the World Wide Web (WWW), teaching has rapidly incorporated new methods and technologies. An evolutionary process has influenced the way information is utilized in the learning environment.

Interaction within the classroom has also changed. Most classroom interaction involves one of three kinds of communication structures: one to one, one to many, or many to many (Althaus, 1997). Historically, classroom instruction follows a one-to-many model. The instructor can guide the class discussion to be collaborated yet can control the class so that the students are largely kept from interacting with one another. In contrast, on-line discussion is naturally interactive and collaborative, because it can become a discussion of many-to-many participants. The asynchronous discussion also gives students more time to read messages posted by others, reflect on them, and compose thoughtful responses. Althaus (1997) reported that students average classroom response was 12 words long, while in e-mail discussions the average message length was 106 words. This represents a dramatic increase in the amount of communication.

Computer mediated communication is having dramatic impacts on the students and teachers not only during class time but also outside. Little is known

however about this new challenging technologies affects on classroom discourse. Is there a relationship building between CMC and traditional teaching formats? Does the class setting influence CMC? This study focuses on electronic discourse and face-to-face discourse by analyzing how CMC was used.

Previous Research

Yagelski and Grabill (1988) study will be used as a model for the present investigation. They examined "the relationship between electronic discourse and face-to-face discourse in two undergraduate university writing classes in which CMC was employed to supplement regular in-class lecture and discussion" (11). More specifically, they examined the possible influence of in-class discourse on later use of CMC. Their findings indicated complex relationships between CMC and in-class discourse. For example, the students rate of participation of CMC and the nature of that participation was related to factors such as.

- nature of their in-class lecture and discussion
- the structure of the course
- the way the instructor framed and managed the uses of CMC technologies
- the students perceptions of the importance of CMC technologies
- their own perceptions of their status as students enrolled in a University course.

Yagelski and Gragbill (1988) demonstrate the need to understand the complexity of classroom discourse as it relates to CMC in a university classroom. Their analysis of the undergraduate class will be applied to a graduate class in my study.

Review of Literature

In the literature review that follows, the research is focused on CMC within college instruction. Literature on CMC versus traditional case studies is presented. Videoconferencing, e-mail, virtual teams, on-line conferences, World Wide Web (WWW) and chat rooms literature will also be discussed because each was presented in the literature as a component of CMC.

The increased use in CMC creates an unexpected culture and sometimes a community. The dynamics of this new community are critical for the instructor to understand. Therefore, literature regarding netiquette, CMC, virtual communities is also examined.

The saying "if we build it they will come", does not necessarily hold true for CMC. Just because there is literature on CMC does not mean the literature is of any value. The literature on virtual communities for example is in its early development stages and is lacking in depth. However, a handful of case studies exist regarding CMC in the classroom.

Distance Learning vs. Traditional Learning

Many studies seek to identify differences between distance learning and traditional learning. For example, Yellen (1998) sought to determine if distant learning students were different from traditional students regarding their motivation, wants, and what they receive from their educational experience. The major difference was that distant learning students are less dissatisfied with what they receive from their educational experience.

Several factors influence a students enrollment decision. These include "availability of courses on campus, personal and class schedules, campus accessibility, desire for social contact, the comfort of study at home, the avoidance of a commute to campus, etc." (Witt & Wheeless, 1999, p. 153).

Research also demonstrates that distance learning is not bound by curriculum. Dean (1998) for example reports that the University of Tennessee launched a path-breaking Executive MBA program for physicians in January, 1998 via distance learning. This particular program features three modes of delivery, four Residential Periods, 40 Cyber-classes, and asynchronous World Wide Web access.

Distance learning is proving to be a viable option for at least some contexts of higher education. Freitas, Myers, and Avtgis (1998) and McHenry and Bozik (1995) reported over half of higher education is using distance learning in some form or another. "Thirty percent of higher education institutions are currently engaged in some form of distance learning; 28 percent are planning for it during 1994 and 1995" (p. 362).

McHenry and Bozik (1995) took a unique perspective and looked into the classroom to see what it is like to be a participant in a live, interactive television setting. Their findings indicated that distance learning maybe more suitable for graduate level versus undergraduate classes. Nevertheless, both studies concluded that if the teacher and the student work to make the best out of the distance learning experience, their efforts would be rewarding. However, their work cannot be effortless. They must be motivated to make it work. McHenry and Bozik (1995) argued there must be a sense of maturity amongst students.

Lynott (1998) came to similar conclusions. He reported that several colleges offered distance learning programs to meet the needs of the growing adult student population that traditional learning could not meet. For instance, Elmhurst College developed a distance learning program to increase their enrollment by targeting their decreasing student population of 18- to 21 year – olds. The report concluded that the success of such programs depend on first rate teachers. She concluded that "opportunities to reach students are severely limited, and instructors in accelerated programs must make the best use of every moment they have to interact with their class" (p. 5).

Distance learning classrooms vary from the conventional classroom in the sense that distance learning not only separates the instructor from the students, but students from other students as well. Courses are led by the instructor in the conventional classroom and simultaneously transmitted electronically to students enrolled at the distance learning site. As Freitas et al. (1998) pointed out, this is where problems occur – technological difficulties can arise at any point. The

malfunction of microphones, audio equipment, and video equipment can result in increased wait time. Students intolerance toward the technology, a lack of spontaneity surrounding classroom interaction, and a lack of interaction between students in attendance at the conventional classroom can far outweigh the benefits of the distance learning classroom (Comeaux, 1995; McHenry & Bozik, 1995).

Not bound by the traditional curriculum, distance learning can satisfy students as well as help increase enrollment in under-populated areas. Distance learning is best suited as a viable option in higher education, however, it demands attention where teachers and students efforts are needed to make it work.

Structure of Distance Learning

The literature discussed so far lays out basic differences between distance learning and traditional learning contexts. This next section demonstrates how distance learning is structured and used. Vehicles for distance learning, such as video-conferencing, e-mail, and the World Wide Web (WWW) are discussed.

Video-conferencing

The integration of video-conferencing technology or distance learning, in the classroom at first glance seems minimal. Most college classes are still taught in the traditional format of face-to-face instruction. However, studies as far back as Hitlz and Wellman (1987) used the term "virtual classroom" to describe an instructional project in which classes were delivered entirely online

using Computer Mediated Communication (CMC), or computer "conferences". Since that time, many universities have offered virtual classrooms as part of their delivery system.

The Plain Old Telephone System (POTS) has encountered rapid advances in telecommunications which enables considerable potential for the teachers/students (Dunnett, 1993). Over 40 years ago, the Education Department of South Australia introduced the "School of the Air" via live audio interaction through radio. In 1970, the department made another leap forward with the development and introduction of the Diverse Use of Communication Technology (DUCT). This group audio terminal allowed for interaction to be undertaken using telephone lines. However, teachers need to see their students and students want to see their teachers. DUCT Video-conferencing solved this issue for them. Video-conferencing, once a communication complexity and pricey hardware technology now offers the user the ability to communicate voice, full-color motion video, and data files over a single standard analogue telephone line (Dunnett, 1993). At the same time, callers can work jointly on documents, text and graphics.

The University of Ulster in Northern Ireland took up the challenge of video-conferencing in order to make professional development education assessable to the whole community (Abbott, Dallat, & Robinson, 1995). Live interactive video-conferencing was used as a medium to deliver three different modules to post-experience students over a five-year period. Practitioners, 75 in total, studied for their Postgraduate Diploma in Education (Professional Development).

Differences were both physical and psychological, as tutors and learners had to contend with sound-activated, technical equipment and the issue of distance. When separation occurs, there is a psychological and communication space that is crossed. This can lead to potential misunderstandings. As Abbott et al (1995) demonstrate however, students using this form of distance education can achieve results comparable to those taking conventionally delivered courses.

In a similar study, Jasasma and Koper (1999) investigated the relationship between immediacy, trust and student motivation and student-faculty Out Of Class Communication (OCC). Their findings indicate that verbal immediacy and student motivations are related to OCC. Students who engage in OCC with faculty showed greater academic and cognitive development, higher educational aspirations, greater levels of academic integration into the university, and increased feelings of affirmation, confidence, and self worth. Although Jaasma and Koper (1999) study focused on verbal communication, the need for non-verbal communication via e-mail or chat rooms, opens up additional areas of discourse that are not possible within the class.

In Finland, satellite television is used because of their geographical position, international culture, educational and linguistic exchanges make it difficult for traditional forms of delivery to occur without problems. Satellite-delivered programs are mainly used for the purposes of language teaching, but are also used in a broad range of subjects. Sirvio (1993) found the training of teachers lags behind and the use of the new media tests the abilities of teachers in many ways. The preparation work, such as transcribing, editing, and

compiling of satellite-delivered materials, requires extra work on behalf of the teacher prior to being used in class.

Sankar, Ford and Terase (1998) investigated the impact created by the use of video-conferencing technology in a large MIS class where, traditionally, lectures had been used. They found that the students in the section where video-conferencing was used perceived it to be more useful, challenging, attractive and clear compared to the section where video-conferencing was not used.

Perhaps Guerrero and Miller (1998) may be able to answer why the students in the Sanker et al. (1998) study perceived video-conferencing to be better. Guerrero and Miller (1998) investigated the relationship between nonverbal behavior and initial impressions of instructor competence and course content within the context of instructional videotapes used in distance education courses. Their results indicated that instructors who are viewed as expressive, warm, and involved are most likely to be judged as highly competent. Further, when instructors are expressive, warm, involved, and articulate, their course content is likely to be judged favorably, especially if they are not overly composed and fluent.

In summary, the historical and technological advances of video-conferencing over the years, offers the instructor the ability to communicate and achieve positive results at least in same contexts comparable to those taking conventionally delivered courses. The research also shows video-conferencing

to advantageous than traditional classroom instruction from the students perspective from language classes to MIS classes globally.

E-mail, On-line Conferences, Chat Rooms

In the classroom, students are limited in their amount of learning time CMC may extend the students learning time frame. However, as the research discussed earlier demonstrated, CMC requires that students take the initiative to communicate. CMC "links the student to the instructor encouraging them to become involved, which in turn teaches them to be responsible" (McComb, 1994, p. 165). Once the commitment to learn has been formed there are no boundaries to when and where the learning will take place. "Distance learning transcends geographic and temporal barriers." (Dasher-Alston & Patton, 1998, p 13). The use of e-mail contains no time restrictions and provides the students with an avenue to communicate such as asking a question after the class has met.

CMC includes e-mail, bulletin boards, and newsgroups, synchronous chat systems, computer conference systems group decision support systems, even world-wide web pages (Hiltz & Wellman, 1997) and interactive messaging (Barnes & Greller, 1994). The literature reflects a high level of use of CMC via e-mail including studies by Postmes, Spears, and Lea (1998), Althaus (1997), Brandon and Hollingshead (1999), Witmer (1998), Freitas et al.(1998), McHenry and Bozik (1995), McComb (1994), Hiltz and Wellman (1997), Kuehn (1994), and Scott and Rockwell (1997). Students, instructors, and student groups send messages to one another using private e-mail. Students may ask questions or

seek help with problems and the instructor may respond to questions or issue directions and guidance as presented by McComb (1994). Her study identifies the benefits of augmenting college-level courses with CMC. McCombs pedagogy approach sought to increase student responsibility and autonomy, which in turn demonstrated how CMC could be used to enhance communication among teachers and students. Yagelski and Grabill (1998) summarized six advantages commonly associated with CMC:

1. Electronic conferences are text-based environments in which participants are totally immersed in writing.
2. They provide real and expanded audiences for writers.
3. They encourage a sense of community.
4. They demonstrate a high degree of involvement on the part of participants.
5. They encourage equitable participation.
6. They can encourage a decrease in leader-centered communication (p.13).

Asynchronous discussion was cited throughout the literature as the primary benefit from the use of e-mail in the classroom. Althaus (1997) examined whether supplementing face-to-face discussion with computer-mediated discussion (CMD) enhances the academic performance of undergraduate students in large lecture courses. Althaus found that supplementing face-to-face discussions with on-line interaction can provide students with a learning environment superior to that of the traditional classroom.

Asynchroneity refers to the concept that "messages maybe staggered in time. senders, and receivers of electronic messages can read mail at different times. and still interact at their convenience" (Kuehn, 1994, p. 174). "It gives students more time to read messages posted by others, reflect on them, and compose thoughtful responses" (p. 160). Hiltz and Wellman (1997) claimed that asynchronous networks function best when they help create the feeling of a group learning together, which can be aided by getting-acquainted activities at the start of a project.

McComb (1994) argues that "asynchroncity enables this extra-classroom communication to occur at convenient times and places for all concerned" (p 165). It also increases the opportunity for learning to occur outside the classroom where the instructor can be a witness. Instructors can work at their own rate to respond to questions via e-mail, and still be available because of asynchroncity.

Bailey and Cotlar (1994) discuss the many benefits of e-mail use in the classroom:

> Faculty who hold electronic office hours and have on-line sessions with students report surprisingly better results. Most students participate and enjoy the individualized and personalized interaction with the faculty. Often information is shared that would be difficult to address in a face-to-face conversation. The opportunity to fill the role of mentor and coach is greatly enhanced via electronic communication. The flexibility and accessibility through e-mail systems allow each person the freedom to interact at their convenience and pace without interruption (p. 188).

CMC, therefore, may fill the learning gaps between class times. Besides the use of e-mail, CMC is also used for the following interactions:

> (1) instructors post official class notices on the bulletin board; (2) students read and post their own messages on the bulletin board; and (3) instructors make available shared disk resources like course syllabi, schedules, assignment and project formats, bibliographies, grading criteria, and other material (McComb, 1994, p. 162).

Kuehn (1994) summarized that "students find instructional CMC useful for expressing socio-emotional content as well as seeking and providing information" (177). They preferred to use the tool to discuss personal issues. Hiltz and Wellman (1997) argued the fact that students have a shared role in that they are students which enables them to form and sustain relationships and communities. However, "the emotional support and sociability often accompany these exchanges, such communication is secondary to specific tasks at hand, and relationships often remain limited in content and emotionally distant" (p. 2).

Orr (1998) discussed the many uses of an online conference, such as helping students late at night discuss their fears and ideas about writing. Orr claimed the on-line conference extended the depth and quality of the discussion, opening up areas of discourse that would not have been possible to cover within the traditional creative writing classes. Students in her study went beyond assigned topics to create and engage in their own discourse enriched by their diverse backgrounds and voices. Orr argues that the technology can even help create poets.

In summary, CMC is asynchronous in that it lifts the communication restrictions of traditional communication and allows the learning process to take place at convenient times and locations. This process creates a context for relationships to be nurtured and grow. Besides the socializing or relationship

building created when using CMC. It is also used for increased student responsibility, initiative, and participation (McCombs, 1994); enhancing pedagogy (Witmer, 1998); building and sustaining groups that work and find community together (Hiltz & Wellman, 1997); greater learning and higher grades (Althaus, 1997); and preparation of work groups such as virtual teams (Everat & Ahern, 1994, Lipnack & Stamps, 1997 (as cited in Brandon & Hollingshead, 1999).

World Wide Web Internet Studies

Herbert (1999), Stefansdottir (1994) and Orr (1998) have all referred to tools such as e-mail, conferences, and chat rooms as beneficial to the classroom. The literature however, also reports that web and Internet sites can be used effectively in the classroom (Rosenthal & Spiegelman, 1998; Bailey & Cotler, 1994; Swan et al, 1998; and Coker, Marsh, Pick, & Rasjan 1998)

Mathematics and physics classes, for example, often use technology to not only calculate solutions but to display student team projects on the web. In Coker et al (1998), faculty representing State University of New York Institute of Technology in Utica wanted to make the projects of students even more accessible. They asked the students building the projects to document their work incrementally on the web to show their progress. They claimed the students were then able to compare their progress with peers and were stimulated to put in additional efforts in order to excel.

In a similar study, Herbert (1999) describes CaseNet, an online professional development program where teachers analyze real-life case studies and learn from their analysis. The program is delivered via the Internet,

videotapes and print materials, allowing teachers to earn college credits by taking courses at their own school or at a participating university. Teachers also explore ways they might use the Internet to connect educators across the nation to deal with everyday classroom issues, such as through online discussion groups, video-conference, and e-mail.

Stefansdottir (1994) also discussed communication utilizing online tools such as e-mail, computer conference, and the search tool, Gopher. Stefansdottir discussion is based upon the story of the Icelandic Educational Network (ISMENNT). ISMENNT started in a small village, Kopasker, in North Eastern Iceland in 1986. ISMENNT was designed by a headmaster, supported by teachers, with the help of computer scientist. ISMENNT made it possible for people in educational institutions in Iceland to search for information in their field - all over the world via their computer. The vision of ISMENNT that once started in a small village is now a tool with which administrators, teachers, and students in the entire country conduct research

Other studies examine how users read information on the web. Swan, Bowman, Holmes, Schweig, and Vargas (1998) report on their ongoing research of how people make sense of the WWW-based information. The results are valuable to web designers who create graphics, icons, etc. in order to target reader's attention. This type of research is similar to how a reader engages the pages of a newspaper or magazine. The study of the mental processes engaged when interacting with the media is beneficial to not only educators and

communication theorists, but by psychologists and sociologists as well (Ebersole, 1997).

In summary, the WWW can be a gallery for collections of students work while allowing teachers a place to analyze case studies from around the world. It can serve as a virtual lecture board with listserves and chat rooms as a discussion forum. The web can serve as an accessible library and research tool.

Virtual Teams

The term, collaboration is often used to refer to either "cooperation-based (group members share the workload) or collaboration-based (group members develop shared meanings about their work) learning activities" (Brandon and Hollingshead, 1999, p. 111). Brandon and Hollingshead (1999) summarized and integrated into a model theory research from education, communication, management and information systems (MIS) and psychology. Their model demonstrates that the effective use of on-line groups in the classroom is dependent on interrelationships, between the nature of the collaboration, communication, and features of the social context.

CMC has built and sustained groups that work and create community for more than two decades (Hiltz & Wellman, 1997). Examples of the use of collaborative learning in the virtual classroom include "debates, group projects, case-study discussion, simulation and role-plying exercises, the sharing of solutions to homework assignments, and collaborative of essays, stories, or research plans" (Hitz and Wellman, 1997, p 5).

Nally (1995) outlined how on-line groups were justified in a course on computers and education on the basis that training in using computers to communicate with group members was needed for understanding of the course content. It is a matter of seeking the answers together. Brandon and Hollinghead (1999) also argue that groups working together online can lead to a better understanding of the course material. As McComb (1994) suggests, pedagogical methods, such as the conversations, imply that learning takes place outside the classroom as well as within.

Groups use CMC for the following interactions: "(1) students submit their group assignments online to the instructor, who comments on them and returns them. Students then revise the assignment until the instructor approves their move to the next standard agenda phase. (2) Groups send weekly reports on their progress to the instructor as private mail for his or her comment and guidance" (McComb, 1994, p.162). This process may enable independent student groups to maintain communication with the instructor to simulate a real-life group workstation.

Netiquette

Although responding to a user via the Internet appears to create anonymity, it is inherently a very public act. This is because so many people can read what has been written. Although users may be sitting in the comforts of his/her own home as they communicate in a chat room, they are in a sense writing for mass audiences. Moreover, just as in any organization, the Internet also has common practices, conventions, and expectations (Ellsworth &

Ellsworth, 1994). Therefore, etiquette is important to avoid conflict. Online etiquette is commonly referred to as netiquette (New Riders 1996). "With over 9000 discussions groups on the Internet, just about every topic imaginable is discussed" (Ellsworth & Ellsworth, 1994). The history of the Internet, the types of people who use it, the text-based nature of the communication, and the unique storage, search, and retrieval system available on the Internet have led to the development of unique customs and characteristics to the medium.

Many authors discuss netiquette with however, limited treatment. Rider World Wide Web Yellow Pages, a computer reference manual listing over 9,000 world wide web sites, dedicates several pages on understanding netiquette including warning sections discussing "do not be a Cyberstalker" (Fowley, 1996, p. 19). Topics also include signature, using a nickname instead of real names, sending news groups messages, flaming, dousing the flame, and posting messages are all addressed under the netiquette umbrella. Even popular get rich books such as "Making Money on the Internet" dedicate pages to netiquette (Chapter 4, Enter the Internet, p 71).

Users are most often identified by their user name, which can also be changed to a nickname. An equalizer effect is created based on the lack of information regarding the users gender, age, education, ethnic origin, appearance, handicaps, wealth, and social situation. Baym (1985) explains the cues filtered-out perspective in that the computer creates anonymity, which leads to a decrease in social inhibition and an increase in flaming. In other words, the responding user does not know who is communicating or what is meant when

responding user does not know who is communicating or what is meant by the communication, but with a few symbols attached, the technology can assist articulating feelings. For example, The Official AOL Tour Guide offers the following ten 'smileys' for communicating happy, smiling text:

1. }:^ "lil devil"
2. B) "wearing shades"
3. :c) "pig headed"
4. [:-I] "robot"
5. $-) "lotto fever"
6. I-) "cyborg"
7. @→→-- " a rose" (p.430).

The Internet Business Book also suggests similar symbols to convey feelings in the text:

Communication	Meaning
:-)	another basic smiley
:>	mischievous smile
:]	goofy smile
;)	wink
8-)	smile with glasses
:-1	blank look
:-o	surprise
:-O	shock
:-<	sad face

Once the symbols are incorporated into the text, the receiver can then better understand the meaning implied by the users. This greater range of expression significantly enhances the level of communication.

In summary, the literature covers the topic of netiquette without going into great depth. Netiquette was created from the combination of users around the world. Because users communicate by their name, which is sometimes changed to a nickname an "equalizer effect" is created. Users found the need to use symbols to communicate any emotions due to the lack of emotion in cues written text.

Flame refers to "sending an e-mail or make public postings with harsh, provocative tirades. This can result in flame wars and other negative consequences" (Ellsworth & Ellsworth, 1994, p.358). However, any communication outside of this norm will be taken into consideration to see if it reflects the classroom discourse. In the present study, one can assume students will not be flaming each other and will be using their own names.

Virtual Communities

Rheingold (1993) offers the following definition of a virtual community:

> When you think of a title for a book, you are forced to think of something short and evocative, like well, the Virtual Community, even though a more accurate title might be: "people who use computers to communicate, form friendships that sometimes form the basis of communities", but you have to be careful to not mistake the tool for the task and think that just writing words on a screen is the same thing as real community.

Rheingold (1993) explains that people in virtual communities do just about everything people do in real life, but leave their bodies behind. The richness and

vitality of computer-linked cultures is attractive and at times addictive. Tim Berners-Lee, known as the WWW creator, saw the simplicity of integrating and exchanging information held on different computers in often widely scattered places as the solution to what used to be a problem (Britainica Encyclopedia Online, 1998).

Much like the topic of etiquette, most of the literature citing virtual communities has yet to develop significant depth (Blumenstyk, 1997). Very few studies have focused on the virtual community or even the culture of a virtual community. Boczkowski (1999) was one and Baym (1995) was another.

Boczkowskis (1999) essay offered a unique analysis of what he calls a national virtual community based on the Argentina Mailing List. He refers to Baym (1995) among others as one of the few to attempt to understand the social dimensions of the phenomenon of people using the computer to communicate. Boczkowski (1999) concentrates on one aspect of these researchers framework: their treatment of the technology uses relationship. Boczkowski (1999) argues that a "mutual shaping perspective is best situated to capture the complexity, unpredictability, and recursively of the interactions among technological features and users discourses and practices" (1). He analyzes how technologies and users relate to each other. Shao (1999) and Blumenstyk (1997) also analyzed the use of technologies and users, but on a smaller scale. Choi (1999) analyzed the pattern of information, which is part of a virtual community of news groups.

In summary, the literature includes useful but relatively few examinations of virtual communities. More work needs to be done in this area for a better

understanding of the new phenomenon of Internet culture. Specifically, it is not clear how or if virtual communities will affect the classroom.

Significance of the Proposed Research

The literature indicates a number of positive potential outcomes when using CMC even though many factors may influence students participation online. However, the CMC relationship to participation is not fully understood. Factors such as course assignments, the online style of the teacher, their input during course discourse, the student perceptions of CMC and fellow student discourse may all play a part in the rate and nature of CMC.

CMC transcends geographic and temporal barriers and demonstrates that not only can the instructor and learner be in different locations, but that the learner can determine when and where learning will occur (Dasher-Alston & Patton, 1998; Mowshowitz, 1997). This then, forces changes in the way teachers teach, prepare and communicate with their students.

Myrdal (1993) explains that to rely solely on distance learning thereby eliminates variables such as human interaction, physical attention and immediate response. The traditional faith in the prescribed knowledge of the teacher and the printed medium can also be lost. The extension of subject matter, flexibility and transparency of the teaching and learning overshadows these deficiencies.

However, this can be confusing for the instructors who have questioned if they are adapting to a new media or trying to manage their curriculum? Issues become center stage such as, who controls the course materials who owns

course material why should networked computing environments change the nature of course material ownership are there differences, etc. (Lang, 1998).

Ben-Jacob (1999) felt it was her obligation as a teacher to "assure the success and integration of the new media and formats into the learning environments" (p. 117). The Ben-Jacob workshop for the distance learning educators, focuses on aiding "its participants and their institutions to deliver better online courses" (p. 117).

The new technology can also be very intimidating for the students as well as professors who may not be open to such drastic change. A new course design will mean more work for everybody. Students are also more familiar with a very passive role in their education where instructors direct the progress of the class And as for everyone, there will be additional administrative and institutional issues (Anderson, 1998).

The study proposed takes a deep look at CMC compared to face-to-face discourse to gain a fuller understanding of the factors associated with or affecting the student rate and nature of their CMC participation.

The present investigation examines CMC within the classroom. Specifically, the study seeks to understand issues of rate and nature of on-line communication and how it relates to classroom discourse. The method used for this investigation is described in the next chapter.

CHAPTER 2

METHOD

The findings to the research questions will generate insight in understanding the complexity of classroom discourse as it relates to CMC in a university classroom. An explanation for each initial question follows. Three research questions were asked in this investigation.

1. What was the rate and content of student participation in course-related online discussions in a graduate engineering course in which CMC was employed?

2. What factors associated with the context of this course, in which CMC was used to supplement face-to-face discussion, might have affected the rates and nature of student participation in course-related online discourse? How might students perceptions of CMC have affected their online participation?

3. How did the online discourse relate to face-to-face discourse?

The literature presented offers insight regarding the rate and quality of student participation in online context. For example, students in-class experience and the atmosphere of the classroom may effect their participation rate. The set up of the course web site and the ease of use may effect the rate and/or quality of the student participation. Last, how often and if at all, the teacher may ask or encourage students to participate can be expected to effect the student rate of participation.

Regarding the second research question, factors such as the structure of the course, or the teacher in-class communication with students may effect outcomes. Also, the way the instructor guides the class discussion to be a

student collaborated effort yet can control the student conversations in such a manner that the students do not interact with each other also effect outcomes. The difficulty of the course itself may effect the use and rate of the Question Board and or the web site. The ways in which CMC is incorporated into the classroom by the instructor and accepted by the students and the student perception of what role they play as a participant can also effect outcomes.

The third question addresses the relationship between online and class discourse. The literature has shown that students tend to do better when they fully participate in both online and in-class discourse. The question also addresses the nature of the discussions, such as if they are more chatty or more lively on-line versus in class, or, were they more personable during class versus on the Question Board.

Last, the student perception of CMC is also likely to impact their use. Factors such as fellow student uses, teacher comments and/or directions in class and again on-line, and classroom setting all play a part of the student perception that can either hinder the use of CMC or encourage the use. Other factors can include student experience with the medium, expectations of how to proceed once on-line, and familiarity with the medium of asynchronous CMC.

Both qualitative (field notes and interviews) and quantitative (coding sheets, the Question Board and its messages, and the survey data) techniques were applied to collect data related for both in class and on-line class discourse of two engineering management courses at a mid-western university during the fall, 2000 semester.

The first course, Production Management, is a 3 credit class that is required within the Industrial and Manufacturing Systems Engineering masters degree program. The class meets one night a week throughout the semester and is taught in a lecture hall on campus. Although a lecture-based course, two of the homework assignments require the use of LINDO optimization software.

The course description as advertised on their web site is as follows:

> Forecasting, inventory and scheduling activities in production systems. Topics in forecasting include regression method, Bayesian method, Box-Jenkins models, and adaptive control models. Continuous and periodic review of inventory models, deterministic and probabilistic cases. Dynamic and static job shop and flow shop scheduling problems are investigated using integer programming, dynamic programming, branch and bound method, and heristic models. Planning and scheduling for large-scale projects.

Field notes were taken and face-to-face in-class discourse were coded according to a scheme developed by Yagelski and Grabill (1988) (see Appendix A). I monitored the online discussions of the course and collecting all electronic messages as they are posted to the course Question Board. Student and instructor interviews were conducted to gain insight regarding their use of CMC in the class. Documents such as the syllabi, assignment prompts and various handouts, both in paper and electronic form, related to each course were also collected.

Qualitative Data: In-class field notes and Interviews

Field Notes

The first class meetings primarily involved observation to first understand the context of the course and then be able to describe and analyze the face-to-face discourse in each course thereafter.

Coding was conducted of the in-class discourse according to the attached scheme (Appendix A) adapted from Yagelski and Grabill (1998). The purpose of their scheme was to "provide data about the relative frequency of various types of face-to-face interactions that occurred in each of two classes they analyzed for their study" (18). The coding sheets enabled them to indicate which types of discourse were occurring at 30-second intervals (18). For example "TL" (teacher lecturing) indicates that the teacher is talking, explaining, providing information with no overt attempt to involve students. Whereas, "FSC" indicates a female student makes a comment, not in response to the teacher direct question, but unsolicited, perhaps as part of a classroom discussion. "MSC" indicates the male student is commenting. When there is a small-group discussion, "SMG" indicated the students are engaged in face-to-face discussion in small groups as part of a class assignment or exercise. When the teacher asks a direct question to the students as a group, expecting some sort of answer from a volunteer(s) this was indicated by "TQ1".

The coding sheets were calculated into percentages to characterize the discourse for the entire semester. The results of this study indicate what percentage of discourse was that of the instructor versus that of the students. This allowed for the determination of discourse patterns.

Interviews

An informal, voluntary interview with Assistant Instructor Z during the semester was conducted in regard to his course design, his intention for the use of CMC in his course, potential problems he may foresee, and his prior experience in using CMC technologies. Interviews with students will be conducted on a volunteer basis to gain knowledge to their experiences with and perceptions of the uses of CMC in their course (see Appendix D). These interviews were conducted either face-to-face or via e-mail.

Quantitative Analyses: Surveys

A survey was sent to the students once during the final week of the semester (see Appendix C). The data obtained helped determine factors such as student "prior experiences with CMC, their perceptions of its uses in their course, their assessment of its value in the course, and their attitude toward computers in general" (18). The quantitative data collected was calculated into percentages.

Ethnographic: Online Discussions Monitored

Electronic discourse on the class Question Board were monitored to determine the rate of student participation in the class. Totals of student individual participation and the number of posting per week were calculated. In order to understand the rate of student participation, the number of lines per individual posting as well as the averages were calculated.

A content analysis reflecting messag content on the Question Board was conducted at the end of the semester. The coding schemes of the messages

will depend on what the messages content describes (ie. assignments, personal, individual communication, etc). The results will indicate the percentages for each category for the entire semester as well as week-by week. Until the messages are posted on-line, it was not possible to determine what these categories would be.

Expected Results: In-Class Discourse

The second graduate engineering course, a production management course, covers very detailed, complex subjects such as aggregate production planning or inventory control planning. Students were anticipated to ask few, yet very specific or direct questions. I did not anticipate the questions to lead into many in-depth class discussions. I expected the teacher to lecture 65% of the time and the students to make up the remaining time with questions, class discussions, or group presentations.

On-Line Discourse

Unlike Yagelski and Grabill online chatrooms used in their study, this study analyzes the course Question Board on the course web site. The teacher encourages the students to post questions where the teacher then responds within the same day or two. Questions are visible to all students who visit the class web site. I anticipated heavy use of the Question Board for a number of reasons. First, university graduate-engineering students typically work full time and have access to computers at work. This makes it easy for them to refer to the class web site Question Board during the day where they may not have access at night. Second, because the class lectures have so much material to

cover and very detailed material. I anticipated the students to utilize the Question Board for topics they did not understand or when the class lectures run to the end of class and there is no time left for questions and answers. Last, because engineers typically work on computers daily, I expected that they would be more comfortable with the technology and therefore, use the Question Board. I expected the content of the questions to be primarily class related with some social use as well.

Surveys

The student surveys were distributed at the end of the semester. I anticipated a high rate of return because they were surveyed prior to the evaluations. I expected the results to indicate that students are very familiar with the use of computers and have no fear of using computers. I anticipated the same results from the instructor.

Conclusion

The interaction of classroom discussion and online discussion should have important implications for the future of technology use in the classroom. By testing for this relationship in a controlled setting, it will be possible to shed further light on the interaction between classroom and online variables of CMC use in the classroom. Moreover, it will be possible to determine the relative effects of teacher encouragement, differing levels of student experience and attitudes upon the use of CMC. Thus, it is possible to further understand the use of CMC in the classroom. The results of the investigation are presented in the next chapter.

CHAPTER 3: RESULTS

This study investigated distance learning and CMC within two graduate engineering classes. The following research questions were addressed:

1) What was the rate and content of student participation in course-related online discussions in a graduate engineering course in which CMC was employed?
2) What factors associated with the context of this course, in which CMC was used to supplement face-to-face discussion, might have affected the rates and nature of student participation in course-related online discourse? How might student perceptions of CMC have affected their online participation?
3) How did the online discourse relate to face-to-face discourse? This chapter presents the results of the data collected and answers these questions.

The results of the quantitative analysis such as (coding, data and presentations) are discussed, followed by a presentation of qualitative analysis results including survey, student and instructor interviews.

In-Class Discourse

Two courses were examined. The first, IMSE 580 taught by Instructor Z, consisted of 23 total students, 15 men, and 8 women. The class ran from September to December 2000. Results from the coding sheets indicate that 68% of all in-class discourse was teacher-centered. This consisted largely of the instructor lecturing, asking or responding to questions of the students and giving commands for assignments or exercises (See Appendix A for the coding scheme).

Instructor Z lecture (TL) alone comprised 52% of the in-class discourse (see Table 1 for percentage results of types of classroom discourse). The second largest category within the teacher-centered discourse was TQ1 (teacher question, 1; 7%). Here Instructor Z asked direct question(s) of the students as a group, expecting some sort of answer(s) from a volunteer(s). The reason for high percentage is largely due to Instructor Z's lecture style. TR1 (Teacher Response, 1), 7%, is also relatively high, probably for the same reason. TR1 refers to the teacher responding to a student answer to his/her direct question such as an evaluation or an elaboration.

One important fact found during the process of coding in-class discourse is how the instructor answered his own questions during class. This was coded as TR1. Following is an example of Instructor Z's response to his own questions and demonstrates why the TQ1 and TR1 were relatively close in percentiles. This response pattern typifies Instructor Z's style.

Table 4

Classroom Discourse Coding Results in Percentage

TEACHER-CENTERED DISCOURSE

	TL	TQ1	TQ2	TR1	TR2	TC
IMSE 580	52%	7%	1%	6%	1%	1%
AE 587	16%	16%	0%	25%	1%	1%

STUDENT-CENTERED DISCOURSE

	FSR	MSR	FSQ	MSQ	FSC	MSC	SMG	ST	SP	NVR
IMSE 580	2%	5%	1%	3%	0%	2%	0%	18%	0%	1%
AE 587	3%	12%	2%	10%	1%	11%	0%	0%	0%	0%

Note Code Descriptions for the percentages are as follows

Teacher-Centered Discourse

TL	Teacher Lecturing
TQ1	Teacher Question. 1
TQ2	Teacher Question. 2
TR1	Teacher Response. 1
TR2	Teacher Response. 2
TC	Teacher Command

Student-Centered Discourse

FSR	Female Student Response
MSR	Male Student Response
FSQ	Female Student Question
MSQ	Male Student Question
FSC	Female Student Comment
MSC	Male Student Comment
SMG	Small-Group Discussion
ST	Student Presentation
SP	Student-Teacher Discussion
NVR	Student Non-Verbal Response

TQ (Instructor Z) There are several reasons to hold inventory. One, to meet unexpected demand, two for economies of scale or three, uncertainties. Are there any questions?

TR (Instructor Z) Other reasons include transportation, smooth seasonal or cyclical demand.

In this example, Instructor Z answered his own question, a common practice throughout the semester. This pattern suggests the class is either not very communicative or the teacher is not allowing much time for the students to respond. He may also be communicating that he does not want them to answer his questions, perhaps by the way he phrases the question or by his tone of voice.

In another example,

TQ (Instructor Z) Are there any questions in regards to the Question Board or the email?

TR (Instructor Z) You can check the web to see results and solutions. If you have a question you can post it on the Question Board...

Again, Instructor Z consistent responses to his own questions occurred commonly throughout the lectures. This helps to clarify the patterns presented in Table 1. The remaining data on the coding sheets also reflect this pattern. The

coding sheets indicate only 1% comprised TQ2 (teacher question, 2) where the teacher asks a direct question to a particular student, perhaps in a follow-up to a student comment. Further, only 1% was comprised of TR2 (teacher response, 2) where the teacher responds to a particular student direct question. Another 1% was comprised of TC (teacher command) where the teacher gives students directions for an in-class assignment or exercise.

The remaining 14% of in-class discourse are comprised of student-centered discourse (See Table 1 for categories FSR, MSR, FSQ, MSQ, FSC and MSC). Student-centered discourse included questions, comments and responses by both male and female students. In this category, the MSR (male student response) comprised 5% of in-class discourse. Here, the male students responded to a question posed by Instructor Z (TQ1). Category FSR (female student responses) resulted in 2% which although low, is at least somewhat representative of the class male-to-female ratio, where this class is male-dominated.

Discourse initiated by the students such as direct questions and/or unsolicited comments to Instructor Z (FSQ, MSQ, FSC and MSC) comprised only 6% of in-class discourse. In regard to questions from the students, male students questions comprised 3% (MSQ) and females asked 1% (FSQ) of in-class discourse. A similar pattern describes the student comments. Males comprised 2% (MSC) and the females 0% (FSC) of comments during in-class discussions.

Only 1% of in-class communication was coded as of NVR (non-verbal response). The NVR category was difficult to code for a number of reasons. First, it was not possible to face each student in order to observe his or her facial expressions (which represent a non-verbal response). Second, it is difficult to assess non-verbal responses and take notes simultaneously. It is similarly difficult to assess non-verbal response from several students simultaneously. This result therefore, should be interpreted cautiously.

The result that the largest amount of class time was composed of teacher-centered discourse is explained as teacher lecturing (TL). Only during the last two weeks of the semester did Instructor Z lectures not make up the majority of the classroom discourse. Field notes indicate that Instructor Z lectured only for a few minutes during those last two days. The remainder of the time was comprised of students presenting their projects. This is reflected in the category ST (student presentation), which comprised 18% of total in-class discourse. Student presentations were one of three graded projects for the class. The students could choose from an application project, research paper, or a software development project.

For the majority of the semester, the field notes indicate that although the students were interacting with Instructor Z very little, the interactions were brief, more focused and to the point. For example, the following exchange was typical throughout the semester and lasted only a few short minutes:

TL (Instructor Z) You can look for the solutions on the web. Are there any questions?

TR (Instructor Z) The replenishment quantity is selected so that the total setup and carrying costs per unit time for the duration of the replenishment quantity are minimized.

MSQ Is this the Silver-Meal Heuristic model covered in the PowerPoint on the web?

TR (Instructor Z) Yes.

TL (Instructor Z) If the replenishment arrives at the beginning of the first period and it covers requirements through to the end of the 7th period, then the criterion function can be written as follows . . .

TQ (Instructor Z) Are there any questions?

TL (Instructor Z) According to the chosen criteria...

Instructor Z then continued with his lecture. The field notes indicate that the lectures very rarely had in-class discussions longer than the above example and even these limited exchanges were very infrequent. Overall, Instructor Z lectured the majority of the time, asked few questions and responded to his own questions. Students communication with Instructor Z was brief.

Second class: AE 587 Automotive Manufacturing Processes

The second class in this study was the graduate engineering class AE 587, Automotive Manufacturing Processes. This class ran January through April in 2001. For comparison purposes it is important to have similar class structures and topics. Therefore, this class was chosen because it was part of the same graduate degree program as IMSE 580 and the majority of the students were likely returning students from that class under study.

Unlike the IMSE580, the results of AE 587 were much different and indicate a very interactive as well as less structured class. The flow of communication was dynamic and two-way. The class consisted of 38 students, three female students and the rest male. Teacher-centered discourse (categories TL, TQ1, TQ2, TR1, TR2, and TC) comprised 59% of the total in-class discourse. One of the larger categories, TQ1 was 16% of the total in-class discourse. This is twice as much teacher-centered discourse as Instructor Z TQ1 (7%). Here, Instructor K asked a direct question to the students as a group, expecting some sort of answer from a volunteer. Thereafter, 25% of the total discussion was comprised of TR1 where Instructor K responded to a student answer to his direct question. Field notes indicate that this class communicated frequently. On other occasions, Instructor K responded to student direct questions to him, which comprised 1% and another 1% comprised Instructor K giving students directions for an in-class assignment or exercise.

Student-centered discourse in AE 587 made up the second largest category comprising 40% of the total in-class discourse. MSR (male student

response) comprised 12% and FSR (female student response) made up 3% of the total. The category of MSQ (male student question) comprised 10% of the in-class communication and FSQ (female student question) comprised 2%. The MSC (male student comment) comprised 11% and FSC comprised 1%. Field notes indicate that the students were very communicative and always seemed to make the final comment of the discussion(s). This would increase the amount of MSR and FSR and, therefore, indicate why the 11% was so high. Once that final comment was made, Instructor K would continue with his lecture. For example:

TL (Instructor K)	Because an automobile is made of thousands of parts that are made from different materials and produced using different manufacturing processes the selection of materials for a specific part can be difficult.
TQ	Can you tell me the general criteria for material selection for a particular component?
MSR	Like mechanical or physical properties?
TR1	Yes, and what else?
MSR	Chemical properties
MSR	Manufacturing properties such as formability or castability
TR1	Right, and since automotive components are typically mass-produced, they must meet several requirements including interchangeability, design specifications, and quality.

MSC And reliability.

TR1 Right, and the availability of supplies.

MSR Another is weldability.

TL Right. The course project will cover this area...

NVR (Student Non-Verbal Response) comprised .05% of the total in-class discourse and the other .05% was TQ2, where the teacher asks a direct question to a particular student, perhaps in a follow-up to a student comment.

Coding sheets and field notes both indicate this was a much more interactive class than Instructor Z class. The notes suggest a more friendly relationship between the teacher and the students. Instructor K often asked students about their own experiences in the workforce, primarily in the automotive industry. This would typically lead to a class discussion. At times, this pattern of exchange could be described as a case of reverse mentoring on a professional level. Students in-class responses indicated that many students were working for Ford Motor Company and one was working for the Chrysler Corporation. Instructor K style with the students was more relaxed, open and communicative. He had a sense of wanting to interact with the students in order to tie their knowledge into the classroom.

Differences between the two classes appear to be largely due to the instructor teaching style (see Figure 1 for comparison). AE 587 had greater interaction than IMSE 580, whereas IMSE 580 was dominated by the teacher lecturing. AE 587 can be characterized by less focus on straight lecturing, more interactions among the students and higher rates of student participation in the

classroom.

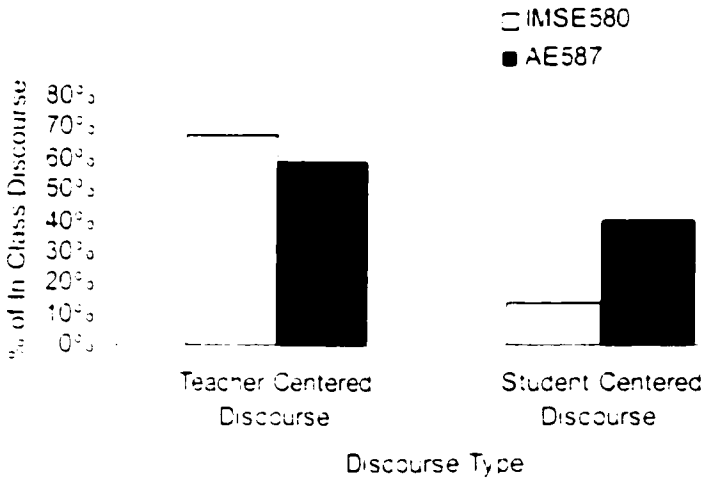

Figure 1 Comparison of In-Class Discourse between both classes: IMSE 580 and AE 587

The student involvement in the class discussion played a large role in the results. Moreover, Instructor K asked far more questions (16%) than Instructor Z (7%). In AE 587, Instructor K TR1 was 25% which is far greater than Instructor Z 6% in IMSE 580. As indicted earlier, this may be partly due to Instructor Z answering his own questions rather than allowing for student based interaction. More student-teacher interaction would increase the TR coding sheet data results. The AE 587 MSC were at 11% whereas in IMSE 580, it resulted in 2%. Finally, the student-centered discourse for AE 587 was 40% whereas the IMSE 580 results were only 14%.

Question Board

The flexibility and accessibility through email systems such as the Question Board used in these two classes allow each student the freedom to interact at their convenience and pace without interruption. CMC (in this case via the use of the class Question Boards) enables the student to fill in the learning gaps between class times. As the literature review indicates, faculty who hold electronic office hours and have on-line sessions with students report surprisingly better results in student grades. Most students participate and enjoy the individualized and personalized interaction with their faculty. Often, information is shared that would be difficult to address in a face-to-face conversation. CMC is asynchronous in that it lifts the communication restrictions of traditional communication and allows the learning process to take place at convenient times and locations. This process may create a "warm nest" for relationships to inquiry and exploration.

The literature review presented in chapter one discusses the positive benefits of CMC when used regularly by the students. Based upon these studies, one might assume the nature of in-class discourse might reflect the communication styles of the students and, therefore, be the same positive pattern for on-line communication. Further, I anticipated seeing more online communication in the AE 587 classes than for IMSE 580 because that was their pattern of in-class communication. The results demonstrate a higher rate however, the communication is not as in-depth as might be expected and is not statistically strong when compared specifically week-to-week and data-for-data.

Table 2 shows the number of questions posted to the instructor course web site and the percentage the instructor lectured for that specific week.

Table 2: Number of questions posted to each web site and percentage the teacher lectured for that same week.

Professor	# of Web Questions	# of Students	Class Date	% TL
Instructor Z	2	26	9/7/00	75
Instructor Z	3	24	9/28/00	85
Instructor Z	0	22	10/5/00	62.75
Instructor Z	2	22	10/12/00	40.7
Instructor Z	2	21	10/26/00	80.6
Instructor Z	0	23	11/9/00	43.75
Instructor Z	4	24	11/16/00	73.9
Instructor Z	2	17	11/30/00	9.5
Instructor Z	2	16	12/7/00	11.3
Instructor K	4	36	1/24/01	0.18
Instructor K	0	38	2/14/01	0.24
Instructor K	4	34	2/28/01	0.16
Instructor K	15	33	3/14/01	0.16
Instructor K	0	32	3/28/01	0
Instructor K	0	33	4/4/01	0.15
Instructor K	0	25	4/11/01	0.13

No. = 16

Rates of Participation

IMSE 580

IMSE 580 had a total of twenty-seven messages posted to the Question Board. Of the total twenty-seven, thirteen were from the instructor. Seven males and one female student posted the remaining 14 messages. Of the students, "IMSEQB-5" (this is an assigned student ID number) posted four messages, followed by "IMSEQB-1" who posted 3 messages and "IMSEQB-6" who posted 2. Individual students posted the rest. This is a relatively low number of postings from the 23 total students in the class (see Figure 2 for total postings per class).

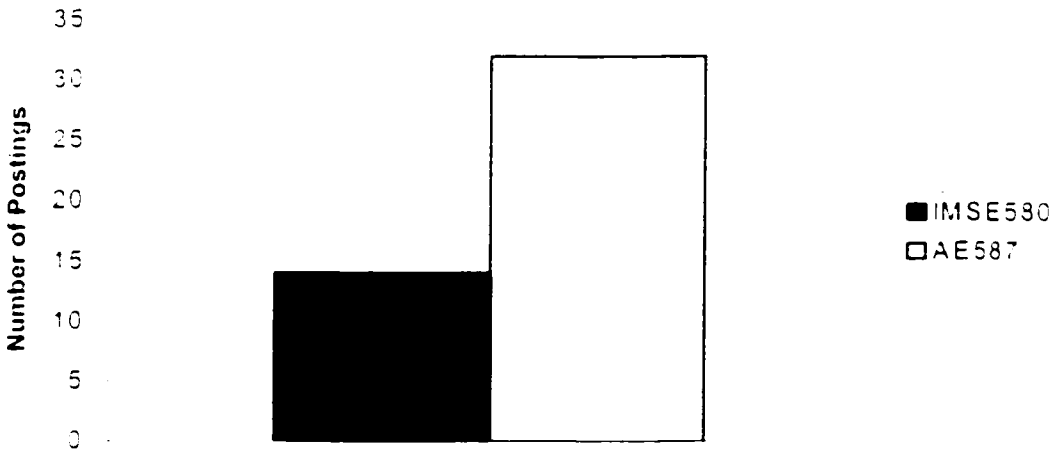

Figure 2. Total number of student postings to the class Question Boards

The third week into the semester and one week prior to the midterm exam, the majority of messages (four) were posted on the Question Board. The rest of the semester, the messages ranged from one to two messages a week.

AE 587

From the 38 total students in the AE 587 class, 15 students posted 34 questions on the Question Board of the 59 total messages. Instructor K responded 25 times. "AEQB-1" posted six messages, "AEQB-3" followed with five, "AEQB-2" had four, "AEQB-5" three, "AEQB-6" two, and the remaining ten from other students in the class.

The greatest number of messages posted in any given week happened two weeks prior to the midterm exam where 15 messages were posted followed one week later by another 12 messages. Another high week of postings was the week before the second exam where 15 messages were posted. Throughout the rest of the semester, messages averaged 2.1 per week (Figure 3) and might be considered a typical pattern.

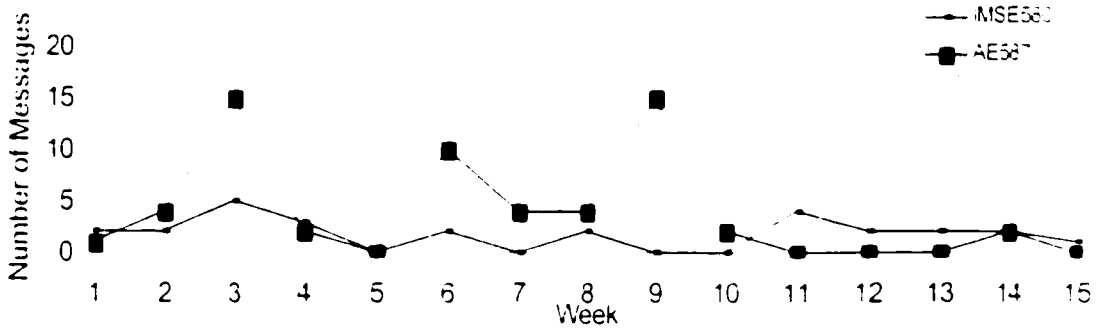

Figure 3. Comparison of Weekly Online Participation for both classes.

IMSE 580 averaged just under, 1 (.93) message per week.

AE 587 averaged 2.1 messages per week.

The time of day that messages were posted averaged late afternoon from 2:00-4:00p.m. for IMSE 580. For AE 587, the time varied throughout the day (see Figure 4 and 5).

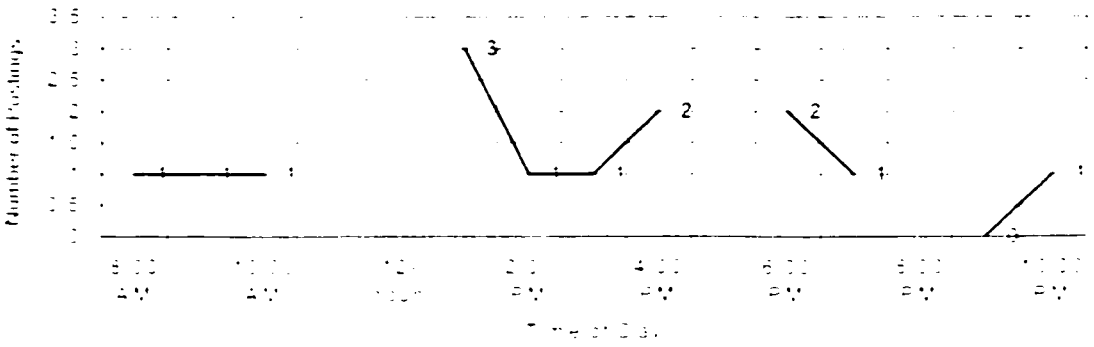

Figure 4 IMSE 580 Time of Question Board Postings

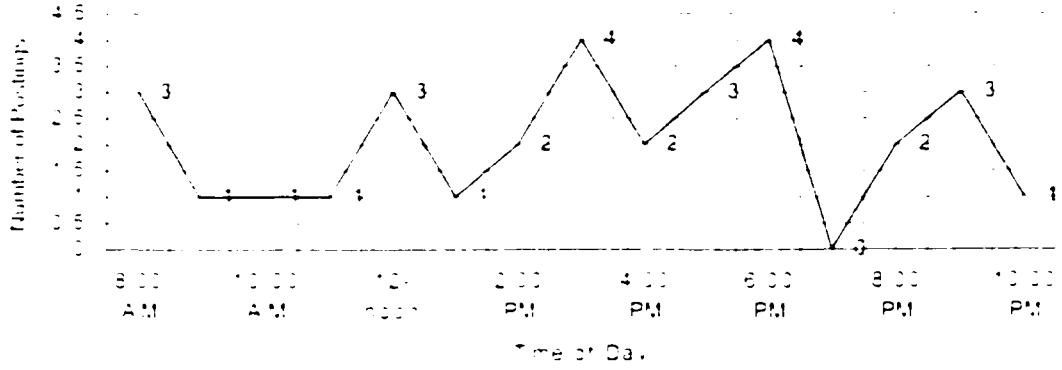

Figure 5. AE587 time of Question Board Postings

The Question Board and in-class coding data results were entered into a statistical analysis package to identify a possible relationship. Chi square was computed for a 2x2 table for both professors. Variables examined include the percentage results of both in-class lectures and their corresponding question board postings for those specific weeks. The observed frequencies were not significantly different than the expected frequencies for each professor. This may be partly a consequence of the small sample size (n=16). A larger sample would likely have produced significant results. (see Table 2 for the data used in this test

One explanation for high postings to the AE 587 Question Board could be that students prefer asking questions online because they were too shy or lacking in self-confidence to make a presentation in front of face-to-face group or are simply unprepared at that time to speak off the cuff (Mason, 1988, p. 38). Perhaps this was the case for some students. However, shyness or social anxiety was not measured in this study. The survey results did indicate that the students are experienced with computers. The students rated themselves as experienced computer users with 62% being "very experienced" and 38% as "somewhat experienced" (see figure 6).

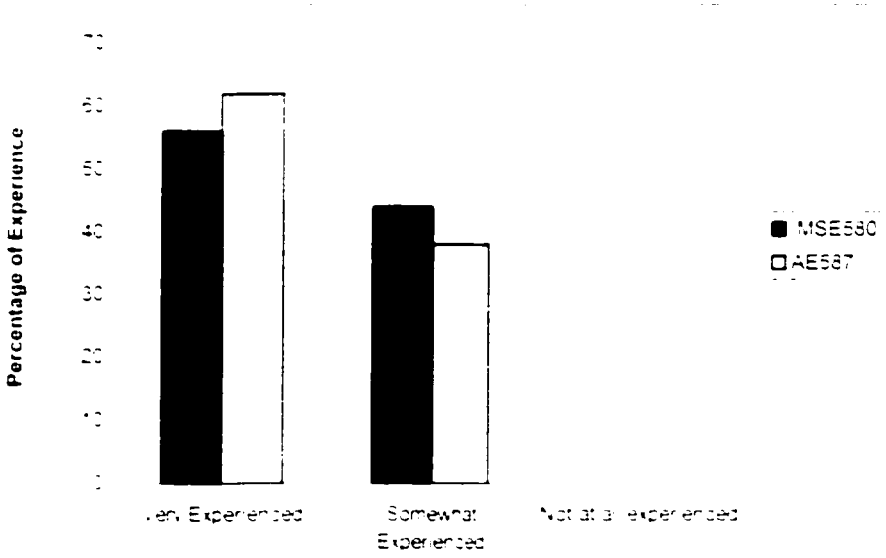

Figure 6. How experienced students viewed themselves with computers.

Interviews with both instructors and the review of the syllabus of each class revealed that the use of the class web sites was not a requirement. Ironically, however, instructor Z (IMSE 580) heavily promoted the class web site. He consistently encouraged the students to visit the web site to check grades, ask questions, review the notes, and more. During the instructor interview, instructor Z explained that CMC in the classroom is a trend for the future and it was under his direction that the VLT (Virtual Learning Tool) web site was created for use among all faculty on this campus. Instructor K (AE 587) also believed in the benefits of the class web site and also encouraged the use of the site in his class however he did not do so as often as Instructor Z. Field notes indicate that Instructor Z promotion of the class web site averaged once every other week and sometimes every week. Whereas, Instructor K encouraged the use of the web site only a couple of times throughout the semester (February 28, March 14).

Although the rate for online discourse was easy to measure (it is generally harder in face-to-face settings) it says nothing about the quality of the interaction (Henri, 1991). This is why the second part of question #2 focused on content. The content of the student participation in course-related online discussion was examined to determine if the in-class discourse continued onto the Question Board the quality of the discourse, and the extent of their exchanges. These results help to explain the relationship between in-class and online discourse.

Content of Online Messages

Although the rate of online participation between the two classes was considerably different, the content was largely the same. The Question Board was almost exclusively focused on the homework. IMSE 580 had a total of ten questions regarding the homework assignments on the Question Board (see Appendix B for Content Categories). The remaining 4 messages posted were single topics covering questions in regard to the research paper, assignment, group paper, and last, when the grades will be posted from the final exam. Instructor Z responded 13 times (See Table 2 for number of content categories).

Table 2

Number of Messages posted on the class Question Board categorized by Content for IMSE 580

	1 Research Paper	2 "EMGT 520" Assignments	3 Homework	4 Paper	5 Final Exam/Grades	Teacher Responses	TOTAL
Number of Messages	1	1	10	1	1	13	27

The homework questions, as well as the other questions were brief and to the point. The following examples illustrate how the instructor was succinct in his replies to on-line questions:

HW#5 Question 4
IMSE #5 – Monday, 13 November 2000 at 1:21 p.m.

Professor, in problem 4, is it acceptable to recommend eliminating some of the launches based on Moore's Algorithm?

Re: HW#5 Question 4
Instructor Z – Monday 13 November 2000, at 1:43 p.m.

Yes.

Homework 6
IMSE #7 – Sunday, 26 November 2000 at 4:05 a.m.

When will the final homework assignment be posted on the web?

Re: Homework 6
Instructor Z – Monday, 27 November 2000 at 1:40 p.m.

Wed., Nov 29. HW#6 will be due Thursday, December 7.

HW 2 problem #3
Student (IMSEQB 5) – Monday, 25 September 2000, at 8:14 a.m.

Which Linear Programming formula should be used for 3c and 3d? In order to use the simple LP method our notes have a unit profit value given (r). This value is not given in problem 3. The only other method I found would be to use the Workforce Linear Programming model. Is this correct?

RE: HW 2 problem #3
Instructor Z – Monday, 25 September 2000, at 1:31 p.m.

Yes. For Problem 3 (parts c, d, e) use Workforce Planning Linear Programming model to solve the problem (lecture notes, pp.28-30).

These questions and corresponding replies demonstrate the simplicity of the on-line discourse. The in-class comments were just as brief and to the point as the Question Board results indicate. The topics did not vary from the topic of homework. The Question Board did not contain other topics such as career, industry, or personal related questions.

In one example the student appears to ask a well thought out question and coincidentally, the instructor did not reply:

Sample Problems for Future Homework

IMSE #1 – Wednesday, 27 September 2000, at 7:11 p.m.

Dr. Instructor Z,
For future homework, is it possible for you to provide sample problems (beyond those worked out in class). The samples in the notes are very good, but since some of them are excel tables and such, they often lack integral, "in between" steps that would allow us to follow through prior to working the homework problems assigned. Having a reference following the lecture (after it becomes less fresh in our minds) for when we work the problems would be a great resource. Even if the spreadsheets in the lecture notes were "live" imports from excel or such, such that we can reason out the formulae, this would help very much. Thank you in advance.

The example post above is clearly thought out and written well. The student even posts the question as a letter to the instructor, making it appear more formal. More importantly, note how the student is asking for more

interaction from the teacher. The student sites 'in between' steps that can truly only be supplied by the instructor in class. He also asked for 'live' imports on the notes in which he downloaded off the class web site. This demonstrates the general lack of interaction that occurred in this class. Coincidentally, the instructor did not reply to the student at least with the Question Board, perhaps due to lack of time.

The topics of AE 587 was more of the same of IMSE580 online results. Questions regarding homework or specific homework problems made up the majority of the questions. All but one question appeared to be directed to Instructor K with the hope or expectation of a response. For example:

Homework #3
Student (AEQB1)– Monday, 19 February 2001, at 8:56 a.m.

> I'm having difficulty with problem 10C-15. Specifically, I'm trying to solve for the final volume to in turn solve for the original blank diameter. Not having any information on the radius, I'm assuming the final volume is equal to the volume of the walls (with a height of 160; OD of 200; ID of 196) + the volume of the bottom (thickness = 5; D of 200) but the OD (compared to the answer in the back of the book) is much too high. Any thoughts?

Re: HW#3
Instructor K – Monday, 19 February 2001, at 10:32 a.m.

> You can assume E(steel) to be 193 Gpa as the book suggests, but 205 to 210 Gpa is the typical range.
>
> As for problem 10C15, the starting sheet thickness has to be equal to the thickness of the largest section of the cup since you can not thicken the material during drawing.
>
> Assume the radius of the punch to be zero (which is not really feasible, but will make the problem easier).

Only one question was directed to everyone ("someone") on the Question Board and is a general plea for help:

#10C-17
Student – Tuesday, 20 February 2001, at 6:22 p.m.

1.Can someone let me know what the initials stand for in Ex. 10-15 (pg. 431)? Also, is the 100 mm cup diameter inner or outer for the first part of 10C-17? 3. Why does the author ask questions about material properties that aren't in the book?

Re: #10C-17
Instructor K – Tuesday, 20 February 2001, at 6:44 p.m.

1. Answer is in the book. 2. Cup diameter usually refers to inner diameter. 3. If the material properties are not in the book, you should look them up in other sources.

The remaining questions for this class were somewhat just as brief as in the other class:

16-C23
AE #9 – Tuesday, 13 March 2001, at 5:20 p.m.

To calculate the number of passes we need the total depth to be removed. It is not specified, so what value should we use? Also, the surface speed (wheel speed) is not given. How can we calculate it?

RE: 16-C23
Instructor K – Tuesday, 13 March 2001, at 5:25 p.m.

This is the number of cross passes. You do not need the wheel speed for your calculations what you need is the table speed (which is given in the problem).

Part 3, 16C-15
AE #3 – Tuesday, 13 March 2001, at 3:16p.m.

To find the power requirement we need t (depth of cut). Do we use the value given for slab milling (table 16-5)-which is 4mm, OR, given the information for the problem, should we use 3mm (...a depth of 3mm)...)?

Re. Part 3, 16C-15
Instructor K – Tuesday, 13 March 2001, at 3:20 p.m.

The values given in the table are the maximum values. If the problem gives specific values, then you should use what is specified in the problem.

The second highest category were questions regarding lecture notes, followed by single questions on charts and one on their presentation (see Table 3 for categories).

Table 3

Content of AE 587 Question Board Messages: Number of Messages by Content Category

	1 Charts	2 Lecture Notes	3 Homework	4 Problems	5 Presentation	6 Teacher Responses	7 TOTAL
Number of Messages	1	4	11	15	1	27	59

The data addresses research question #2 by suggesting that the majority of students for both classes were only interested in asking questions regarding their homework. There was not a continuation of the in-class discourse, nor were there questions in regard to interest outside of the classroom such as work or even social commentary as found extensively in one class examined by Yagelski and Grabill (1998).

Further, the interactions were very brief and concise. This suggests that students were only interested in communicating about their homework topic and nothing else. Some educators might look at this as a shallow search for the 'one right answer' versus using their critical thinking skills and attempting to communicate broadly about the course content (Henri 1991).

For both classes, the focus of the online communication was purely course related. Topics regarding automotive, personal or career related discussions that might reflect the in-class discourse simply did not happen. Discussions from in-class discourse did in this case continue on the Question Board. The discussions were not in-depth conversations or even casual conversations or comments. The on-line content was strictly to-the-point and primarily focused on the homework and/or specific textbook problems. Many of the questions concerned the textbook presenting the material correctly or understandably. For example, some of the homework questions confused the students and therefore, the students used the question board for clarification from the instructor and in once case the entire class.

Results from the quantitative data indicate a reflective positive pattern between in-class discourse and online discourse. The total of Instructor K in-class student communication (39%) had a higher rate of communication than the total of Instructor Z class (14%) and had twice as many postings on the question board (59) than Instructor Z class (27). Even though the content of the postings. were the same content categories. 39% of Instructor Z class participated and 34% of Instructor K class participated on the Question Board.

Survey Results

The survey results indicate the level of student experience and attitudes towards computers and their understanding of the uses of the technology. The results profile the students as educated, experienced computer users. The students from IMSE 580 compared to AE 587 had higher ratings regarding technologies they used and how they used them. This in itself complicates the interpretation of the results. The assumption is that the instructor presentation of the Question Board and his discussion of the Board may have influenced the online ratings. The survey results, instructor and student interviews, and the field notes show which factors might have influenced their online participation.

Statistical analysis was conducted using Pearson r to determine the relationship between in-class discussion and posting to the class Question Board. Only data from the week instructor K and Z lectured was used in the analysis (See Table 2). The test results indicate no significant correlation r=(.062). This was however a positive correlation and a larger sample would likely have yielded a significant relationship between in-class discussion and postings.

Question Board data collected during the weeks of holidays, such as Thanksgiving or during weeks that in-class lectures without coding were not used for this statistical analysis because there were no classes held at that time. This is important because had all the data collected from the Question Board been used the results would have been skewed. Only the in-class coding data

matched against the respective weeks were taken into consideration. Any data taken outside of the time frame was purposely not used for the analysis.

In both cases, the survey was distributed during class prior to the exam night. In IMSE 580, 18 out of 23 students (78%) filled out the survey, whereas in AE 587, 24 out of 38 (63%) responded to the survey. The results varied slightly between the two classes. Overall, all of the students report being very experienced with computers despite the fact that none of the students had taken a course in high school that had utilized a web site as a formal part of the class that could of prepared them for this experience. Further, only slightly half (47%) of both classes combined had taken a university course that utilized a web site as a formal part of the class (61% of IMSE and 37% of AE 587 students). The remaining 22 students (52%) had not. In conclusion, IMSE 580 showed greater experience with web sites used in the classroom but as discussed earlier, ironically, had low discourse for in-class and on-line interaction.

In response to how the students used the computer in the classroom, 90% indicated they used it for email (IMSE 580 student responded to this question at 88% and AE 587 students responded 91% use it for email; (see Figure 7). This is not surprising. A recent study conducted at a larger university found the percentage of their students who use it for e-mail regularly has grown from 17% to 97% in just seven years (University of Michigan President Information Revolution Commission Report [CR], 2001, p. 1-7). In other areas, 76% of both classes used it for question boards. Ironically, IMSE 580 (77%) had

a slight lead over AE 587 (75%). As discussed earlier, the IMSE class used the Question Board less than AE 587.

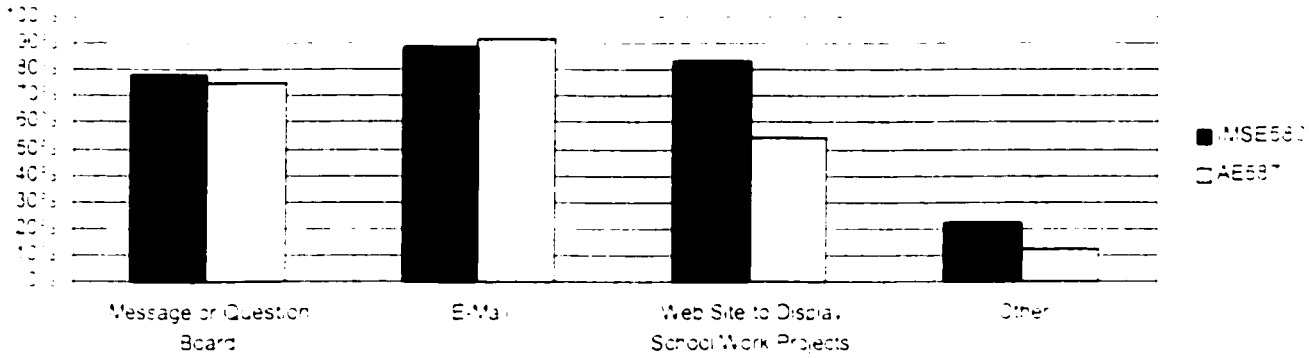

Figure 7. Survey results how students have used computer technology in the classroom.

Further, 66% of the students from both classes used web sites to display school work/projects where, again - ironically, the students in IMSE 580 had a higher percentage (83% versus 54%) of use indicating more experience with CMC. Others (7 students) indicated they used computers in the classroom for laptop presentations, to view grades or test scores, for submitting homework, class notes, and to transfer files.

The majority owned their own computers (88%). This is typical of students at the University of Michigan where "eighty-five percent of U of M students come here owning a computer" (CR, 2001, p. 1-18). Only 5 out of the total 42 students represented from both classes did not own a computer (only 1 was in IMSE 580). Further, "over 50% of Americans now have access to the Internet and use it regularly, a much higher percent of those with college degrees use the Internet regularly" (CR, 2001, p. 3-8).

The survey data results regarding the student current feelings about using computer technology varied slightly between the two classes yet were all positive attitudinal responses. Therefore, this data was combined. Computers were reported to be more stimulating (80%) than dull (10%) for both classes. Students even indicated that computers were fun (79%), easy (79%), helpful (80%), unthreatening (85%), efficient (90%) and desirable (86%). However, in regard to computers being demanding or obliging, 42% were neutral. The remaining students were split between indicating computers to be more demanding (31%) and more obliging (24%). These results compared to the student interviews indicate no negative attitudes towards using the computer.

Student interviews indicated their perception of using computers was positive. However, working students often do not have time to check the web site for answers to questions, let alone post a question.

Students rated themselves on the survey as either very experienced (59%) or somewhat experienced (40%) (see Figure 7). All indicated that they have used email (100%). This is typical, for in the same study mentioned above, 97% report using email regularly (CR, 2001, p.1-18) Survey results also showed that the students frequently used commercial online services such as AOL, CompuServe, etc. (85%), chat rooms (61%) and 59% have used newsgroups and 14% have used Listserv (see Figure 8). One student indicated video conferencing use. The percentages were very close for all categories between the two classes.

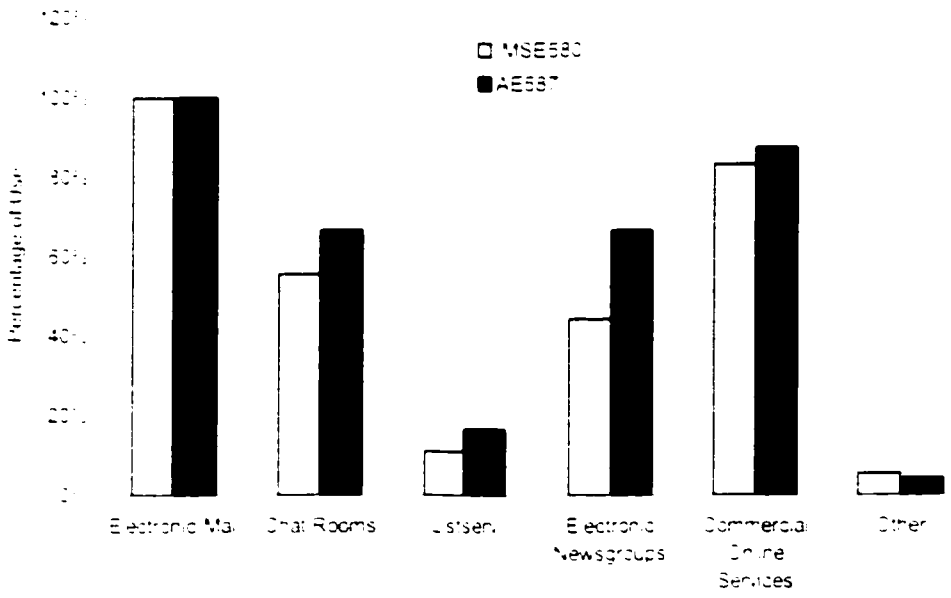

Figure 8 Survey results indicating what technologies have ever been used by the students.

These results indicate that the majority of students experience with computers comes from work and school use, followed by entertainment, personal and research use. For example, 95% use computers for work. Results indicate they are very skilled in using information and communication technology for such applications as email, reports, spreadsheet applications, word processing, excel, PowerPoint, simulations, CAD and SAP programs and other technical engineering applications.

In regard to school applications, 95% indicated they use it for school applications such as emailing or downloading special software for homework, research, reports, projects, grades, retrieving assignments and/or posting questions to question boards. In regard to research, 59% indicated positive use. One student indicated they use it "as an important part of research". Others use computers to research airline fares, school information, school projects, comparative studies, engineering subjects, SAE (Society of Automotive Engineers) papers, trips, products, and financial information.

For entertainment, 78% indicated they use computers (IMSE 580, 100% and AE 587, 62%) and for other purposes such as chat rooms, games, surfing, time and location of events, movies, books, games, music-sharing web site Napster, travel planning, Ebay and/or sports information.

Last, in regard to personal use of computers, 64% claimed they use it for other purposes. Purposes listed included travel flights, road maps, online purchases, email friends and or family, taxes, develop resume, shopping (such

as searching for cars, jewelry and/or music) and staying connected (IMSE 580 responded 72% and AE 587, 58%).

The majority of students report that they are very comfortable with computers. Out of the total 42 responses, 78% indicate they are very comfortable, whereas only 14% said they were "somewhat comfortable".

In regard to the study at hand, the results indicate student feelings towards computers varied slightly between the two classes yet were all positive attitude responses and were therefore combined. Computers were found to be more stimulating (80%) than dull (10%) for both classes. Students even indicated that computers were fun (79%), easy (79%), helpful (80%), unthreatening (85%), efficient (90%) and desirable (86%). However, in regard to computers being demanding or obliging, 42% were neutral. The remaining students were split between indicating computers to be more demanding (31%) and more obliging (24%). This conclusion appears to make sense because of the series of tedious steps required for something as simple as reading your e-mail, such as turn on the computer, log-on to your mail, pull up the in-box, open the mail and then proceed to read it. Under the category of whether computers were personal or not, 31% were neutral on their feelings and 40% indicated computers were impersonal and the remaining 25 indicated the opposite, personal.

One student from IMSE 587 challenged the attitudinal portion of the survey with the following written comment:

> This part is very ambiguous. Reading some breaking news can be stimulating (liking you finger and sticking it in the power supply can also

> be stimulating), yet writing a paper for a class can be dull. Software can be intuitive and easy or can be in German and be difficult. My conclusion is that it depends on the software being used. The majority of computer issues are due to the software being used. The majority of computer issues are due to the software, and without it, the hardware would just be an expensive anchor. For each of the first 8 pairs of words, depending on the situation I could circle every number, but I can be definitive in my belief that computers are at the least desirable, what you do with it after you have one determines the result.

As a whole, generalized attitudes towards computers are hard to determine. Much of it depends on the task, workload, pressures on the job or school. In addition educational level regarding computers and personal experiences can change student attitudes. If a respondent is unsophisticated regarding the use of spreadsheets on the job and needs to input data, the task changes to a demanding and unpleasant experience. This can be complicated by the fact that little or no help is being offered by your internal IT department. In conclusion, as these results indicate that although the IMSE 580 class had less in-class communication yet, was more experienced with computers, why then were they not utilizing the Question Board more often? Perhaps it is not the quantity that needs to be measured, but the quality of the instructor discourse. For example, had Instructor Z lectured less, the Question Board may have the same results as this study. In other words, it is the impression or the way the instructor talks to the students that can affect their responses, not the quantity. Perhaps the "impression" of the instructor should have been measured. The student and instructor interviews, and field notes results are discussed next.

Student Perceptions of CMC and Their Roles Online (Interviews)

Student interviews were conducted throughout the semester to generate

an understanding of how students used and perceived the class web site. In AE 587, one student (AE # 3) responded that she is on the computer all day long at work. She indicated that this was her 3rd time in a class using a web site. She loves the web site and uses it to download class lecture notes, ask question, and/or check grades, etc. AE #3 survey results indicate her feelings towards computer technology to "completely" stimulating, fun, helpful and unthreatening. She had "neutral" feelings as to whether computer technology was easy or difficult. She found it to be "more" demanding, efficient, and desirable and personal than the opposite.

> In the same class, AE # 14 responded in agreement with student AE #3: I love it for the PowerPoint notes. I don't want to come in and take notes when I've been working all day. I work in the Ford Wind Tunnel and it is too hard to write notes. I learn better without taking notes. I can comprehend what the teacher is saying. When I have to take notes, I'm too busy trying to write down what the teacher is lecturing that it becomes a game to keep up – and I am not learning. I work sometimes at night (during class) and can become very tired.

This is an important student interview. Had the student not downloaded the Powerpoint notes, he may have not had time to interact with the instructor because he would be too busy taking notes.

On the survey, AE #14 responded that computer technology is "completely" efficient and helpful, was "neutral" as to whether it was stimulating versus dull, impersonal versus personal. He found it to be "more" fun, easy, desirable, unthreatening and obliging than the opposite.

In the AE587 class, AE # 1 indicated he does not like the PowerPoint notes. He prefers to write notes in his book. He feels he does not learn when

the material is handed to him. He learns when the teacher is talking and he is actively taking notes at the same time. However, he did indicate he likes the web site, but for a different purpose. He noted that students need a "place to go" outside of the classroom. He explained that because this university is a "commuter" campus with students living off campus, students miss the camaraderie they might gain from living on campus or from hanging around the mall or in the student union halls. He enjoys the cultural experience that the university can provide. Prior to this class, he has not had computers in his classes where he attended a University in South India. In regard to the student survey, he found computer technology to be "completely" stimulating, fun, efficient, desirable, and unthreatening. He felt it is more easy than difficult, more personal and helpful than not.

The IMSE 580 students had an entirely different attitude towards downloading the course notes versus the AE 587 class. One student responded that downloading the class notes made the class very boring, "You don't have to take notes. It becomes boring and makes you lazy".

Overall, the students of IMSE 580 took a more proactive role towards their note taking. They were more interested in wanting to write down the notes during class time versus downloading the notes from the web site. Perhaps as the AE 587 student pointed out, taking notes during class prohibits time to ask questions and interact during class. The field notes taken for this study helped me to further understand the nature of the classes.

In an IMSE 580 separate student interview, when asked if he utilized the class' Question Board, the student replied, "no, I try to ask in class". When asked why, the student replied "I can get my answer in class and don't have time to check the web site. If I don't understand it in class I ask then". This pattern also helps explain the lower level web site use.

Field Notes and Instructor Interviews

IMSE 580

The Question Board was not a requirement of the IMSE 580 class. However, instructor Z viewed it as an excellent education tool for the students. When I interviewed Instructor Z early in the semester, he indicated that he was enthusiastic about the web site and about the role computers are now taking place in academia. Although he felt there is a lot of work involved with the technology, he also believed it is not only beneficial for the students but the teachers as well.

Field notes taken during class time show the instructor's hopeful comments for web site usage followed by the date the field note was taken.

- Instructor Z encourages the students to use the web site once a week for updates and to download class notes (9/7/00).
- Instructor Z discusses the postings to the Question Board in class (9/28/00).
- Instructor Z informs the students that the homework "solutions will be on the web" (9/7/00, 10/3/00, 10/13/00, 10/26/00, 10/30/00).
- Instructor Z tells the students that the "questions on the web will let me know how the homework is going" (10/13/00).
- Instructor Z lets the students know that grades are posted on the web site (10/26/00).
- Directions for the class project can also be downloaded from the site (11/9/00).

Instructor Z was proactive in instructing the students to visit the web site. The first day of class Instructor Z encouraged the students to use the web site once a week for updates.

The students in IMSE 580 had one of three projects to complete for their final grade. One of the projects asked that the students be responsible for the development of software for some of the topics discussed in class (algorithms or heuristic approaches). The requirement asked that the code be written in a modern language, preferably JAVA, with a user-friendly interface. Other programming environments, such as C, C++ Visual Basic, or Excel can be used. Therefore, the student prior computer technology knowledge coming into IMSE580 was already high.

AE 587

Instructor K was positive about the class web site as well and indicated he wished students would use the site more often. The Question Board was not a requirement of this class either. He did not think students used it as much as they could and were missing an educational benefit. He had hoped students incorporate work-related examples and/or past research into their Question Board discussions, which would lead to further discussions online. However, throughout the semester, Instructor K very rarely referred to the site during class time and the nature of the research was not as he had hoped, but was brief and primarily focused on the homework.

In regard to AE 587, although the class web site was on the syllabus, it was not promoted during the class. Only two examples taken from class field

notes were found to encourage the use of the class web site:

- Instructor K asked the class "how many assignments did I put on the web?" (2/28/01)
- Instructor K asked the class to "check out the web site for questions and comments" (3/14/01)

This data is also contrary to what was originally expected to be a high involvement rate. Based on the rate of online discourse for this specific course, the field notes have indicated otherwise.

Summary

In summary, the results of the analysis alone are somewhat puzzling. The IMSE 580 students had more experience with the use of computers in the classroom and the technology as a whole, and the instructor was constantly promoting the class web site, however, the AE 587 students had greater online communication than IMSE 580. If Instructor Z promoted the Question Board more than Instructor K, why then did the students of IMSE 580 not respond?

An ironic twist to education technology is that, despite its latest and greatest digital tools, educators and students have continued to approach the technology and its tools with their own set of tools (a) what they are familiar with and (b) comfortable with. To become adept to CMC one must converse and emerse themselves within it. Could it be that the students were more familiar and comfortable with there past academic communication styles that lacked CMC? Although Instructor Z created the format of which the Question Board is based, he was not overly communicative with his students on the Question Board. If they are not comfortable and adept to CMC it shows in their work and teaching styles.

Instructor Z did not communicate frequently with his students. Faculty use discussion in their teaching to reach one of their primary goals, which is to encourage students to undertake an intellectually challenging and perhaps at times unwarranted personal exploration in a non-threatening setting such as the classroom. By interacting openly with fellow students, either face-to-face or via CMC, students can hone in on the new tools they are simultaneously attaining.

Supportive feedback can be more immediate as they tentatively articulate their changing ideas and opinions, as can rousing arguments as opposing perspectives clash. Students are thereby exposed to different points of view, lifestyles and belief systems and receive various forms of encouragement as their own world-views are revised. In IMSE 580, however, the instructor asked few questions. He was quick to respond to his own questions directed to the students. Therefore, his responses limited the flow of communication in-class and perhaps the on-line discussion as well.

Perhaps this starch impression of Instructor Z happened early on, that in turn affected the results of the Question Board. In other words, no matter how much Instructor Z lectured, the results would be the same. Early on at one point during the semester students were discussing that Instructor Z was easier than another professor offering the same course. Perhaps this encouraged a complacent attitude. The convenience of downloading lecture notes from the class web site may also contributed to students who made little effort to post a question on the Question Board. They became content knowing they would pass the class no matter what.

One overlooked point in preparing to teach with CMC is to be over prepared. Instructor Z had all the class notes on Powerpoint slides that student could download. Notes, project descriptions, grades and related course information were all at the student fingertips. This abundance of information left the students with nothing to do. The lack of note taking in class perhaps gave the students of feeling that the class was not important. Perhaps this

assumption carried into the student efforts to log onto the class web site. This is one potentially troubling consequence of course web sites. These questions along with the four research questions and their implications are examined more fully in Chapter 4.

CHAPTER 4: IMPLICATIONS

Research Questions

The study was designed to compare student CMC to their face-to-face discourse within the classroom to gain a fuller understanding of the factors associated with or affecting the student CMC participation. Computer mediated communication continues to have dramatic impacts on the students and teachers not only during class but also outside the class content. Little is known however about this new challenging technology effects on classroom discourse. Is a relationship developing between CMC and traditional teaching formats? Does the class setting influence CMC? This study focused on electronic discourse and face-to-face discourse by analyzing how CMC was used. This study was designed to address the following research questions: 1) What was the rate and content of student participation in course-related online discussions in a graduate engineering course in which CMC was employed? 2) What factors associated with the context of this course, in which CMC was used to supplement face-to-face discussion, might have affected the rates and nature of student participation in course-related online discourse? How might students perceptions of CMC have affected their online participation? 3) How did the online discourse relate to face-to-face discourse?

Discussion and Purpose

This study sought to identify the relationship CMC has to traditional face-to-face classroom discourse and identify factors that affected CMC within two specific university Graduate Engineering classes.

Results indicate that there were three main factors influencing the rate and nature of online communication within the two classes under study. Student interviews revealed these factors were first, the instructor teaching style. This included, for example, whether he was approachable or not. Secondly, factors included time. For example, working adult students have busy schedules characterized by high levels of outside demands. Finally, the course design was structured in a way that stifled communication and participation, which did not succeed in meeting the student desire for personal contact.

In regard to the last factor, some student responded that through the process of downloading the Power Point lecture notes the transfer of information was more effective than in traditional forms of classroom communication. This was revealed during student interviews where one particular student argued that "by downloading the class notes from the web site, they would not learn, and therefore, there would not be a knowledge transfer of the material under study". Students however, wanted the personal contact provided by the instructor. These three factors were found to influence the rate as well as the nature of online communication for these particular students.

The student interviews and surveys revealed that outside factors heavily influenced the student rate of online communication. Statistical analysis

confirmed that the rate of online communication was not significantly related to the in-class communication. Therefore, outside factors contributed to the rate. The following factors were initially assumed to affect the online use but did not. According to the results:

- the individual ways the instructors introduced the class web site,
- promoted its use during in-class time, or
- posted lecture or grades on the site.

None of these factors, however appeared to affect the rate of online communication. In other studies, factors such as, student attitudes towards computers, prior knowledge of computers or personal experiences were found to have a significant impact on student online participation. However, the results of this study do not suggest that these factors relate to the *nature* of student online participation.

The results of this study did not suggest that student decisions about how often to engage in online discussions (rate) were mediated by their own knowledge about and attitudes toward CMC. Rather, those decisions may have had more to do with busy schedules, working full time, home life, and other school responsibilities. The students under study were non-traditional graduate students, working full time and taking classes after work. Their days started early at work and ended late into the evening in their classrooms. Some students stated in the interviews that they started work at 7:00 a.m. Classes started at 6:00 p.m. and ended around 9:00 p.m. This made for very long days and exhausted the student in the classroom. Therefore, students participated in

the online Question Board not as an extension from in-class discourse, but rather because they needed answers to specific questions. They used the question board for their education purposes only and kept their communication brief, and to-the-point. The majority of postings occurred in the late afternoon primarily between 2:00 pm and 6:00 pm.

In short, the purpose of this study was to assess the relationship between CMC and face-to-face discourse in traditional teaching formats within two engineering classes. Such a relationship will help foster future classes and more specifically, the set up of online classes or traditional classes incorporating online methods into the classroom. The three research questions posed in this study are discussed in detail below. Each question is restated and explains how the data answers question and why the question was asked is discussed.

Research Questions

The first research question guiding this investigation was:

What was the rate and content of student participation in course-related online discussions in a graduate-engineering course in which CMC was employed?

Rate of Student Participation

The IMSE 580 class was not as communicative (in-class or online) as the AE 587 class. The IMSE 580 class discourse was primarily teacher-centered and one-way, whereas the AE 587 class discourse contained considerably more interactions between the teacher and the students and flowed back and forth. The results of the in-class and Question Board coding paralleled each other. For example, the AE 587 class was more communicative in-class and just as much on the class Question Board. The same applied for IMSE 580 but the results were generally opposite. The students had little in-class discourse and relatively few postings to the Question Board.

The AE587 in-class rates were higher than the rates of IMSE 580. Instructor K asked many questions in class and the students responded frequently. Once the initial question was asked by instructor K the dialogue would begin. This class was very productive in their conversations. The IMSE 580 class participation rates were extremely low. The instructor asked hardly any questions. The few questions he did ask were generally followed by his own response. The rate for the class online discussion was just as low. Few questions asked by the students, the instructor was so brief that at one

interaction, the instructor replied with one single word – "yes".

In explaining the similar patterns between in-class and on-line, some researchers might argue that the high communication online followed by the Question Board might be continuing discussions on-line past the traditional class. This was not the case for AE 587 (or IMSE 580). The Question Board coding data indicates the students primarily discussed homework problems and not what was talked about in class. Only four posting were coded as "lecture notes" and even these postings were not a true continuation of the class room discourse. In other words, if the Question Board contained discourse related to their in-class discourse the students would be using the Question Board as a tool to continue their discussions. The Question Board was not used that way in their classes.

Another explanation for high postings to the AE 587 Question Board could be that students prefer asking questions online that perhaps they were too shy or lacking in self-confidence to present in front of a face-to-face group or there simply unprepared at the time to speak off the cuff (Mason, 1988, p. 38). This explanation could not be assessed in this study but reviews an area for potential inquiring in future studies.

This raises several questions. If the rate of the in-class communication is reflected in the rate of online communication, should we not assume the students experiences with computers were the same in each class? In other words, were students from one class at a different level of computer knowledge than the other class? The survey results indicate that this was not the case. The

students were all at very similar if not the same level of expertise with computer experience and use. Many used computers daily at work, home and of course for school. Further the students in both classes understood the purpose(s) of the Question Board and their roles as participant because they used the web site. Had they not used the web site, then there might be a question if they understood the use of the board. The class syllabus and field notes indicate that both instructors promoted their sites. It is not clear how their understandings of the purpose of the web site might influence the nature of their online discourse. Three factors seem to be related to this lack of direct communication.

First, the instructor classroom style appears to have highly influenced the student rate of communication in-class. For example, the IMSE 588 instructor answered many, if not all of his questions in class. Second, little eye contact appeared to be made with the students. He appeared to lecture to the back wall. This suggests a lack of direct communication between the instructor and the students. Third, his lecture style never varied from his prepared notes. In other words, he never got off track from his notes. These factors were evident in field notes. This will be elaborated more fully in the discussion of the next research question.

The written word is sometimes taken at times much more serious than the spoken word. Face-to-face communication can be modified quickly should the speaker see that the listeners response indicate a sense of confusion. Further, a writer must make ideas, questions, direction of thought, bases for claims and so forth, completely explicit. Writing, then, forces students to think ideas through in

order to be understood clearly, thus further sharpening ones critical thinking skills (McComb, 1993). The graduate students in this study have reached that level already. However, there were outside contributing factors, such as time restraints and instructors teaching style. These factors were identified during student interviews. In summary, the first portion of the research question regarding rate provides a picture of the amount of communication for both in-class and online discourse. The next research question examines factors affecting the rate and nature of CMC.

The second research question guiding this study asked:

What factors associated with the context of this course, in which CMC was used to supplement face-to-face discussion, might have affected the rate and nature of student participation in course-related online discourse? How might students perceptions of CMC affected their online participation?

The first part of this research question - factors associated with the context of this course, was asked to understand if there is something that contributes to the students amount of time spent using CMC. Factors might include the instructors in-class promotion of the Question Board or promotion on the syllabus itself. Other factors might include if it was a course requirement to post questions to the Question Board; was the class so highly interactive that a student could not get a question answered; or, was the instructors communication style in-class and online discouraging communication from the students? The research question asks what within the structure of the course affected their participation? These 'course-related contextual' factors might

explain why the rate of online use was low for IMSE 580 or high for AE 587 and why the nature of the discourse was so specifically related to the homework for both classes.

Instructors Teaching Style

In regard to the IMSE 580 class, it was initially assumed that the low participation rate was partly due to the instructor not promoting the Question Board. This was not the case. The field notes indicate that Instructor Z promoted the use of the web site often in class - almost daily (although a minor factor, the class web site was not listed on the course syllabus).

Although the weekly remarks of encouragement might motivate students to go to the site, specific data regarding the number of times each specific student visited the class web site was not collected and, therefore, could not be analyzed. These individual figures might show that the instructor encouragement to go to the site was working or at least associated in time with the promotion. However, as a whole, the instructor encouragement appeared to have no bearing on the rate of online communication.

The second part of this research question asks how might students perceptions of CMC have affected their online participation? The results of the survey data regarding the student current attitudes about using computer technology varied slightly between the two classes yet were all positive. The student interviews showed that time played the most critical role in whether or not students used the question board.

Time Factors

Prior to computers, students spent their time meeting with professors, scheduling appointments with their professors, or calling them directly on the telephone. However, the working students of today have the advantage in regards to their use of computers. Computers once thought of as a vehicle to ease the workload, or to position workers ahead of their workloads, has in fact increased the workloads. The workload, in many cases in has doubled.

In this study, available time is an invisible factor influencing use of the Question Board. The Question Board was not related to the in-class discussion, but was rather an independent tool used in the process of learning. It provided the students with a vehicle to communicate by being able to post a question for the teacher during off-hours. It was largely used independently from in-class discussions. It appears, however, that students did not have time to use CMC. The few students who did have time were posting questions during working hours and downloading the Power Point slides so they would not have to take notes in class probably because they were tired. The survey revealed students were generally well along in their masters degrees and working full time. It also showed that they frequently used computers for most activities when applicable such as work, school, research and even entertainment. Students were very comfortable with the medium. Had the Question Board been part of the grading process perhaps rate use would have increased. However, students were tired at the end of the day. The fact that the online discussion rates were low is not because of the student perceptions, but most likely due to the lack of student time and energy. In conclusion then, students used the Question Board

independently from in-class communication and only when they had time. Their perceptions of CMC therefore, did not appear to affect their online participation.

The third research question asked:

How did the online discourse relate to face-to-face discourse?

This question was asked to explain the relationship between in-class and on-line discourse. This question assumes a relationship and that the study could clarify that relationship. At first review of the data, there appeared to be a correlation between the teacher lecturing and the number of questions posted to the Question Board. The more the in-class discourse the more questions were posted to the class Question Board. However, the statistical analysis of the data, found these factors were independent with no significant correlation. It should be noted, however, that with a large number of subjects a significant correlation might be found. It appears, therefore, that the outside factors affected the nature and rate of online communication:

(1) Instructor teaching style,

(2) time factors (working students), and

(3) desire for personal contact (human interaction in the learning process is desired).

These outside factors appeared to affect the rate of communication on the class question board resulting in a low participation effect. Student work schedules limited their time for other things such as using the computer for school purposes. Attending graduate classes in the evening also places pressure on students to leverage their time in a productive way.

Implications of the Study

This exploratory study examined in-class discourse to assess the relationship to computer mediated communication. Although the sample is small, the results suggest to researchers that more needs to be done to understand the relationship CMC has within the traditional classroom. First, a study with a larger student base could provide more definitive results. This was a smaller study and more can be gained from additional investigations. The student population of nontraditional students is different than other populations of students examined and should be taken into consideration in future inquiry. For example, many nontraditional students hold full time jobs, are accessible to computers and are more advanced with the technology than traditional students. Last, the factors found in this study such as instructor teaching style, time factors, and desire for personal contact should be reviewed more closely in future studies and perhaps independently.

The overall effect CMC is having on the students and teachers not only during class time but also outside the classroom needs further examination. The findings of this study show that there is no direct relationship between in-class discourse and online discourse but that there are other factors outside the classroom that do affect the rate of CMC. These results need to be interpreted cautiously however given the small size of the sample. The variables that were measured such as, instructor encouragement, promotion of the web site in class or through out the course materials, students CMC experience, perceptions and/or knowledge in the present study, had no bearing on the student rate or

nature of participation. However, the study also demonstrated that these variables were difficult to measure. In fact there are several variables that were outside the scope of this study. These are discussed in detail under limitations and suggestions for future research.

Future Research

Several implications emerge regarding future studies of CMC within the classroom. Specifically, the research in this study focuses specifically on working students or other the non-traditional students. Most other investigations, such as Yagelski and Grabill (1988) and Althaus (1997) have focused on traditional, full time undergraduate students.

Non-traditional students of today are experienced with CMC and understand how to use CMC within the classroom. Instructors are also well versed in the technology. Moreover, with the increasing prominence of the IT field, it is not surprising to see new students emerging as trail blazers and cases of reverse mentoring where students guide and instruct faculty in this field. Moreover, working students are more likely to use CMC as a principal method of instruction.

In understanding the CMC relationship, we also need to know more about the make up of the needs and skills of students. For example, the information environment that the working student lives in can be valuable component to the classroom environment if managed and evaluated properly. These outside experiences can be shared with the class to create a broader educational experience for all students.

We cannot examine CMC without understanding how methods of teaching and learning are also changing. The nature of the student external relationships encompasses new models that cut across traditional lines of academic work. There is a new environment – a "knowledge economy" that is

fiercely competing with academia. We must also keep in mind that there is no technological substitute for time with an instructor. CMC can reduce the need for face time but cannot eliminate face time without jeopardizing or reducing the total learning experience. Further inquiry into the relationship of "face time" to CMC learning time is needed. This investigation concluded that the tone set by the instructor during "face time" influenced CMC use. Further inquiry is needed to confirm this finding.

Limitations of the Study

Several limitations to this study should be noted. The study did not measure outside variables that affected the rate and nature of CMC use. The research questions were structured around classroom variables. The study did not take into account that outside variables could affect the use of the Question Board. These include the instructor teaching style, time factors (working students), and desire for personal contact (human interaction in the learning process is desired).

Content analysis is generally an unobtrusive research technique. However, other methods through their acts of measurement may interfere with the behavior of the phenomena being assessed and can contaminate observations. For example, measurement error can occur when there is awareness of being observed or tested. In this study, the students were aware of my coding and this may have affected their personal responses to the teacher or to other classmates thereby, affecting the coding results. Further errors can occur when the experimenter-interview interaction effects the subject. For example, in this study students may have been affected by interview style.

Another weakness of content analysis and observation occurs during the execution of the study. The most well designed content analysis is bound to have unanticipated problems emerge, even in the most well thought through research plan. When the solution to such problems cannot be specified in advance, short of discontinuing the content analysis altogether, one has to go back and modify the design, keeping the over-all research objective in mind.

Throughout the study, the data reflected coding that was audible in the class setting. There are instances when it was simply impossible to decipher what was said or observe non-verbal response. Unfortunately, in this particular situation, the design of the coding could not be modified to account for these factors.

The students participating in the study had multicultural backgrounds and education. Thus, no generalizations can be (nor are) extrapolated to any greater population. It is not certain whether English proficiency was the same for all the participants as there were no measurements of this variable. Although students pass the Toefel exam prior to the degree sought within these programs, it is not clear that the language is proficiently understood through CMC as well. The communication pattern of this multicultural class maybe different from a class where students have the same culture background. Specific students were not measured for comparative data results.

CONCLUSIONS

This study adds to the body of knowledge regarding CMC in the classroom. Although the sample size might have been larger for stronger statistical results, the conclusions do add to our overall understanding of CMC. The literature review indicates a number of positive outcomes when using CMC even though several factors may influence the rate of the student online participation. However, the CMC relationship to participation in class is not fully described by the results of this study. Factors such as course assignments, teacher online style, teacher input during course discourse, the student perceptions of CMC and fellow students discourse may all play a part in the rate and nature of CMC.

Regarding the second research question, factors such as the structure of the course, or the teacher in-class communication with students may appear to affect outcomes. Also, the way the instructor controls the class discussion to stay on the topic yet can control the student conversations in such a manner that the students do not interact with each other is another factor of the course. The difficulty of the course itself may affect the use and rate of the Question Board and or the web site. The ways in which CMC is incorporated into the classroom by the instructor and accepted by the students and the student perception of what role they play as a participant can also affect outcomes.

It is clear that CMC will become an increasingly prominent technology of instruction. Economic demands and demands for new education is forcing its widespread adoption. As CMC becomes more common, it will be increasingly

important to understand factors related to CMC effectiveness. In particular, the effectiveness of CMC with non-traditional students is important to understand.

Appendix A

Coding Scheme for Type of Face-To-Face Classroom Discourse

Code	Description	Definition
TL	Teacher Lecturing	Teacher is talking, explaining, and providing information with no overt attempt to involve students.
TQ1	Teacher Question, 1	Teacher asks a direct question to the students as a group, expecting some sort of answer from a volunteer(s).
TQ2	Teacher Question, 2	Teacher asks a direct question to a particular student, perhaps in a follow-up to a student comment.
TR1	Teacher Response, 1	Teacher responds to a student's answer to his/her direct question. This response may be answer.
TR2	Teacher Response, 2	Teacher responds to a student's direct question to him/her.
TC	Teacher Command	Teacher gives students directions for an in-class assignment or exercise.
MSQ	Male Student Question	A male student asks a direct questions of the teacher.
FSQ	Female Student Question	A female student asks a direct question of the teacher.
MSR	Male Student Response	A male student responds to a question posed by the teacher.
FSR	Female Student Response	A female student responds to a question posed by the teacher.

MSC	Male Student Comment	A male student makes a comment, not in response to the teacher's direct question, but unsolicited, perhaps as part of a classroom discussion.
FSC	Female Student Comment	A female student makes a comment, not in response to the teacher's direct question, but unsolicited, perhaps a part of a classroom discussion.
SMG	Small-Group Discussion	Students engaged in face-to-face discussion in small groups as part of a class assignment or exercise.
ST	Student Presentation	A one-on-one discussion between the teacher and one student or a small group of students that does not involve the entire class; such a discussion may be the result of a specific question about an assignment or course work posed to the teacher by the student.
SP	Student-Teacher Discussion	A formal presentation to the class by a single student or group of student.
NVR	Student Non-Verbal Response	Student responds to teacher question with a non-verbal gesture, such as a raised hand.

APPENDIX B: CODING SCHEMES FOR CONTENT OF ONLINE MESSAGES

Content categories for posts to the IMSE 580 course question board:

1. Research Paper. Includes all questions relating to the research paper.
2. EMGT 520 (another course/same instructor) Assignments. Posts focused on a particular assignment.
3. Homework. Posts focusing on primarily course assignments, including comments and questions about assignments.
4. Paper. Posts focused primarily on course paper, including concerns, questions, and comments about in-class presentations and when final draft is due.
5. Final Exam/Grades. Posts related to all final exam questions and the final grade for the class.

Content Categories for posts to the AE 587 course question board:

1. Charts.
2. Lecture Notes. Posts related to the student's lecture notes in need of clarification.
3. Homework. Posts in regard to student's questions of the homework.
4. Problems. Posts from students asking specific questions of a particular problem in the homework.
5. Presentation. Posts regarding questions of the student's presentations.
6. Teacher's Responses. Posts from the teacher, answering the students' questions.

APPENDIX C

Student Survey for a Study of Computer-Mediated Communication

Instructions: Please complete the following questions as accurately as you can.

1. Have you ever taken a university course that utilized a web site as a formal part of the class before this semester (circle one) Yes/No

2. Have you ever taken a high school course that utilized a web site as a formal part of the class (circle one) Yes/No

3. How have you used computer technology in the classroom?

_____Message or Question Boards

_____E-Mail

_____Web site to display school work projects

_____Other (please specify)_____

4. Have you ever used any of the following technologies?

(please check all that apply)

_____ electronic mail

_____ electronic newsgroups (bulletin boards)

_____ listserv mailing lists

_____ commercial online services (such as America Online, Compuserve, etc.)

_____ chatrooms

_____other (please specify)_____

5. How experienced would you consider yourself with computers? (circle one)

very experienced somewhat experienced not at all experienced

6. How often do you use a computer (your own or someone else's) for your schoolwork? (circle one)

Always Most of the Time Some of the Time Rarely Never

7. Do you own your own computer? (circle one) Yes/No

8. How comfortable do you feel about using computers? (circle one)

very comfortable somewhat comfortable

somewhat uncomfortable very uncomfortable

9. For what purpose do you use computers? (Circle all that apply and please describe)

Work_____

School_____

Entertainment_____

Research _____

Personal _____

Other (Please specify)_____

10. Are you a full-time student? (circle one) Yes/No

11. What is your major?_____

12 Please indicate how many semesters you have attended at this university (or another university or college) as a full-time or part-time student_____

For each of the following pairs of words, please circle the response that is closest to your current feelings about using computers. For instance, if you feel computer systems in general are completely "stimulating" to use and not at all "dull", circle the number 1 for the first item below: the number 4 means that you are undecided or neutral or that you think that computer systems are equally likely to be stimulating or dull; the number 3 means that you feel that computer systems are slightly more stimulating than dull; and so on.

Stimulating	1	2	3	4	5	6	7	Dull
Dreary	1	2	3	4	5	6	7	Fun
Easy	1	2	3	4	5	6	7	Difficult
Personal	1	2	3	4	5	6	7	Impersonal
Helpful	1	2	3	4	5	6	7	Hindering
Unthreatening	1	2	3	4	5	6	7	Threatening
Efficient	1	2	3	4	5	6	7	Inefficient
Obliging	1	2	3	4	5	6	7	Demanding
Desirable	1	2	3	4	5	6	7	Undesirable

Thank you very much for your help with this study

APPENDIX D

Student Interviews

The questions were purposely less formal and more conversational:

Student experience with CMC in the classroom.

Student perception of CMC in the classroom.

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NOTICE OF EXPEDITED APPROVAL

TO: **Theresa Ceccarelli**
(Communication)
15653 Promenade Street
Allen Park, MI 48101

FROM: Peter A. Lichtenberg, Ph.D. Peter A. Lichtenberg
Chairman, Behavioral Institutional Review Board (B03)

DATE: September 22, 2000

RE: Protocol # 09-32-00(B03)-ER "Computer-Mediated Communication in Graduate Engineering Classroom. A study of the Relationship of Online Discourse and Classroom Discourses in an Engineering Class." No funding requested

The above-referenced Protocol and Consent Forms were **APPROVED** following Expedited Review (Category 7*) by the Chairman for the Wayne State University Institutional Review Board (B03) for the period of **September 22, 2000 through September 21, 2001.**

EXPIRATION DATE: September 21, 2001

This approval does not replace any departmental or other approvals that may be required.

Federal regulations require that all research be reviewed at least annually. **It is the Principal Investigator's responsibility to obtain review and continued approval before the expiration date.** You may **not** continue any research activity beyond the expiration date without HIC approval.

- If you wish to have your protocol approved for continuation after the above approval period, please submit a completed Continuation Form at least six weeks before the expiration date. It may take up to six weeks from the time of submission to the time of approval to process your continuation request.
  Failure to receive approval for continuation before the expiration date will result in the automatic suspension of the approval of this protocol on the expiration date. Information collected following suspension is unapproved research and can never be reported or published as research data.
- If you do not wish continued approval, please submit a completed Closure Form when the study is terminated.

All changes or amendments to your protocol or consent form require review and approval by the Human Investigation Committee (HIC) **BEFORE** implementation.

You are also required to submit a written description of any adverse reactions or unexpected events on the appropriate form (Adverse Reaction and Unexpected Event Form) within the specified time frame (see HIC policy)

- **Based on the Expedited Review List, revised November, 1998**
- C. M. Seeger, Assoc. Prof., 585 Manoogian

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ABSTRACT

COMPUTER-MEDIATED COMMUNICATION IN GRADUATE ENGINEERING CLASSROOM: A STUDY OF THE RELATIONSHIP OF ONLINE DISCOURSE AND CLASSROOM DISCOURSES IN TWO ENGINEERING CLASSES

by

THERESA CECCARELLI

December 2002

Advisor: Dr. Matthew Seeger

Major: Communication

Degree: Doctor of Philosophy

This exploratory, qualitative and quantitative study examines in-class discourse to assess their relationship to computer mediated communication (CMC). Two 16-week graduate-engineering courses were observed using a coding scheme to understand the rate and nature of in-class discourse. Student messages and questions were posted to the class' online question boards and analyzed for rate and content of online messages using a coding scheme.

In addition to these quantitative measures, field notes and interview data was analyzed to identify key factors influencing the quantitative results and to examine potential factors within the classroom that might of influenced the online discourse. A survey was administered at the end of the semester to collect

information regarding students' perceptions of and experience with CMC. Three primary conclusions are drawn from the student interviews, observations and the survey responses.

First, the instructor's teaching style during class later affected the students use of the question board. One instructor was open, communicative and clearly had a good relationship with the students. The class question board reflected this pattern and had more questions posted. The other class had fewer postings to the class question board. In this particular class the instructor's communication was short and curt with the students. This communication pattern was reflected online as well.

Second, time factors affected the rate of the online messages. Students were working full time and taking classes during the evening. In some cases student's days started at 7am at work and ended at 9pm in the evening for the classes. Students were busy and didn't have time to go online and post questions. Many saved their questions for class time and the instructor then. Finally, the student interviews revealed that the desire for human interaction or personal communication with the instructor was valued over posting a question to the instructor on the class question board.

In class and online discourse is highlighted throughout the dissertation. Additionally, suggestions for online teachers and students as well as suggestions for future research are offered.