

**A Communications Protocol in a Synchronous Chat Environment:
Student Satisfaction in a Web-Based Computer Science Course**

by
Paul J. Giguere

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A Communications Protocol in a Synchronous Chat
Environment: Student Satisfaction in a Web-Based
Computer Science Course

by
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Cluster 15

An Applied Dissertation Presented to the
EdD Program in Instructional Technology
and Distance Education
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for the Degree of Doctor of Education

Nova Southeastern University
2002

Approval Page

This applied dissertation was submitted by Paul J. Giguere under the direction of the persons listed below. It was submitted to the EdD Program in Instructional Technology and Distance Education and approved in partial fulfillment of the requirements for the degree of Doctor of Education at Nova Southeastern University.

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I dedicate this dissertation to the memory of my grandparents Gerard and Bernadette Vallerand whose love, support and guidance helped to bring me to this point in my life.

Abstract

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The effects of a communications protocol in a synchronous on-line chat environment on the satisfaction of students in a Web-based computer science course was studied. Two undergraduate faculty members who teach Web-based courses, and 42 students in four separate computer science courses participated in the study. Students completed a pretest that measured their prior experience, current attitudes, and expectations with regards to synchronous chats in a Web-based course. Two classes of students were introduced to a communications protocol by the instructors that was used throughout the course while in synchronous chat. The other two classes did not use a protocol. A posttest was administered to all students at the end of each course that measured student satisfaction with the synchronous chats held throughout the semester. A communications protocol, in the context of this investigation, is a set of rules or guidelines that are adhered to by all participants while engaged in a synchronous electronic discussion.

This study answered the question: What effect does a communications protocol in a synchronous on-line chat environment have on the satisfaction of students in a Web-based computer science course? The study showed that the use of a communications protocol in on-line synchronous chats had no effect on student satisfaction with Web-based courses.

Table of Contents

Chapter 1: Introduction.....	1
Background of the Study	1
Problem Context	2
Purpose of the Study and Focus Questions	3
Overview of Methodology.....	4
Limitations of the Study	5
Summary.....	5
Chapter 2: Review of the Literature	6
Research Orientation: The Theory of Transactional Distance	6
Types of Interaction.....	8
Interaction in Web-Based Distance Education.....	11
Computer-Mediated Communication.....	13
Studies in Synchronous Computer-Mediated Communication	16
Summary.....	18
Chapter 3: Method	19
Subjects	19
Resources	19
Methods and Procedures	20
Instruments Used in the Data Collection.....	21
Data Analysis	22
Reporting of Results	22
Timeline	23
Summary.....	23
Chapter 4: Results	25
Procedure	25
Analysis	26
Findings	30
Summary.....	31
Chapter 5: Discussion of Results	32
Conclusions	32
Implications	33
Recommendations.....	34
Summary.....	34
References	37
Appendixes	
A Pretest Instrument	42
B Posttest Instrument.....	47
C Synchronous Chat Protocol.....	52
D Pretest to Posttest Change for the Treatment Group	58

E	Pretest to Posttest Change for the Comparison Group	60
F	Definition of Terms	62

Tables

1	Timeline for Research Investigation.....	23
2	Crosstab Analysis by Condition for Posttest Item A.....	27
3	Crosstab Analysis by Condition for Posttest Item B.....	27
4	Analysis of Variance for Students With Prior Experience in a Web-based Course (N=28)	29
5	Analysis of Variance for All Students (N=42)	30

Chapter 1: Introduction

This investigation answered the research question: What effect does a communications protocol in a synchronous on-line chat environment have on the satisfaction of students in a Web-based computer science course? A communications protocol, in the context of this investigation, is a set of rules or guidelines that are adhered to by all participants while engaged in a synchronous electronic discussion.

The theory-base for this study is the theory of transactional distance (Moore, 1993) with an emphasis on computer-mediated communication and the types of interaction that occur between learners and instructors (Moore, 1989). In addition, this study built upon research that explores the use of communications conventions and protocols in synchronous electronic chat environments (Murphy & Collins, 1997).

Background of the Study

In Web-based training and instruction, synchronous conferencing tools have been employed as one of several methods for engaging learners in the instructional process. Computer conferencing is an important educational tool because it can have an effect on the learning process and outcomes, the rules that are utilized to communicate in a conferencing environment, and on how students can enhance their own knowledge of the content matter (Murphy, Drabier, & Epps, 1998). The types of tools commonly used can range from Internet Relay Chat (IRC or what is commonly referred to as a “chat-room”) to video/audio conferencing (sometimes in combination with Web-based applications called “eventware”). Among the benefits of synchronous tools in the delivery of instruction (Driscoll, 2001) are: (a) live group learning and immediacy of feedback, (b) just-in-time support, (c) complex topics are manageable. Limitations include: (a) passive instructional strategies do not work well, (b) logistics (different time zones for instance),

(c) high-end infrastructure technologies are needed.

Problem Context

Based on recent data collected by a four-year university that offers Web-based courses, 45 percent of respondents were very satisfied with synchronous chats in their Web-based course while 25 percent were very dissatisfied and 35 percent were neutral. Based on evaluations conducted by the University, synchronous chats were, in part, contributing to student dissatisfaction with both the communicative aspects of the course and the overall satisfaction with the course.

Interaction, both synchronous and asynchronous, has been cited as critical to student satisfaction and success with Web-based courses (King & Doerfert, 1996). Interaction is also a factor in maintaining the persistence of students at-a-distance. Regardless of the media used, it is the responsibility of the institution and the instructor to provide a learning environment in which the learner has an opportunity for appropriate interactions with the content, the instructor, and the other students (Moore, 1993). In focusing on the synchronous aspects of interaction in Web-based courses, this study ascertained the extent to which an intervention—a communications protocol in a chat room—affected student satisfaction by analyzing what Shotsberger (2000) has identified as two perceived roles for synchronous interaction: just-in-time-support and community building (that are the two primary uses for synchronous chat in Web-based courses at the University). The results of this study will help the University continue to work toward increasing student satisfaction with Web-based courses, that in turn will further the development of Web-based programs as a viable alternative to traditional methods of learning.

Purpose of the Study and Focus Questions

In 1997, the University established a division within its Continuing Studies (CS) Department to develop and deliver on-line courses. Ten faculty from the College of Computer Science were enthusiastic about exploring Web-based instruction and were willing to invest the time and energy not only to develop their courses in the on-line medium but also to become leaders in guiding the CS Department as the popularity of on-line courses grew. The new division came to be called the CyberEd Division.

Today, the University offers more than 85 on-line courses to 4,000 students annually, in many disciplines and subject areas. Both full-time and adjunct faculty are recruited to develop and teach these courses using a commercial course management system called IntraLearn.

IntraLearn supports both asynchronous (communication that occurs at different times, e.g. electronic bulletin boards) and synchronous (communication that occurs at the same time, e.g. chat rooms) methods for student-to-instructor and student-to-student interaction. At the University, synchronous chat rooms have been used almost exclusively for “virtual office hours” with little to no instruction taking place during the chats. The chats are primarily a means of allowing students to interact with the instructor in a real-time environment, as opposed to using a Web-based discussion board or e-mail (both of which are asynchronous).

The CyberEd Division requires that students are offered at least one chat per week (lasting approximately one hour) but no other use of the medium is required, nor are any standards imposed for conducting a chat. Using this approach, students have reported dissatisfaction with the on-line chats and the degree to which the chats contribute positively to the on-line learning experience.

The objective of this research study was to determine if the use of a communications protocol in a synchronous on-line chat environment has an effect on the satisfaction of students in a Web-based computer science course.

If the use of a protocol for synchronous chat improved students' satisfaction with Web-based learning in general (and synchronous chats in particular), participants in the study would eventually enjoy the benefits of such tools in the University's Web-based courses. The University constantly seeks to improve student satisfaction with its Web-based courses and to improve current on-line instructional practices with regard to the development and implementation of Web-based learning. This study contributed to that goal.

Overview of Methodology

This study utilized a pretest-posttest design with a comparison and a treatment group. The participants for this research consisted of 42 undergraduate students (across four courses) who were taking a Web-based computer science course offered by the CyberEd Division of the Continuing Studies Department. Students in treatment courses participated in synchronous chat using a communications protocol (see Appendix C). Students in the comparison courses did not use a communications protocol while participating in synchronous chats.

The communications protocol used in this study is designed to be applicable to any type of synchronous chat structures within the context of a learning situation. The protocols are guidelines that help provide a better means of generating substantive conversation when in a chat environment. The protocols help overcome some of the limitations of synchronous chats namely, lack of substantive discussion and lack of threading of discussions.

Limitations of the Study

There are several limitations to the generalizability of this study. This study was conducted with 42 students in a single university setting. Students who participated in the study were primarily students who were taking one or more computer science courses, thus their knowledge of and ability to apply technology may have been more sophisticated than that of other students who may not have a technical background. Also, of the 42 students participating in the study, only 28 students had any prior experience taking a Web-based course.

Summary

The results of this study contribute to improved interactions between students and instructors of Web-based courses offered at the University. By studying the effects of a communications protocol in synchronous chat environments and its effect on student satisfaction, this study helps to shape the University's use of synchronous chat and the training offered to instructors in the use of chat for Web-based course offerings and the manner in which they are taught.

Chapter 2: Review of the Literature

There exists a large body of literature on the nature of interaction in computer-mediated environments. This chapter will explain the theory-base for the study as well as provide a review of the literature that examines the nature of interaction in Web-based distance education as it relates to synchronous computer-mediated communication.

Research Orientation: The Theory of Transactional Distance

The theory of transactional distance is rooted in prior theories of distance education that examined distance education as a pedagogical concept and not simply a separation of the learners from the instructors (Moore, 1993). The transaction is an exchange that occurs between learners and instructors with the characteristic of being separated by distance. This distance is not determined by geography but by the amount of dialogue that occurs between the learner and the instructor, and the amount of structure that exists in the design of the course (McIsaac & Gunawardena, 1996). Transactional distance has the potential to lead to miscommunication and a general misunderstanding between the inputs and outputs of the instructor and those of the learner. As learner control and dialogue increase, transactional distance decreases (Saba & Shearer, 1994). Understanding and reducing transactional distance in the design of distance education programs can lead to increased effectiveness and the quality of programs can be increased (Moore, 1993). Moore's theory involves three clusters, each with their own set of variables, that are used to frame various teaching procedures and learner behaviors.

The first cluster, instructional dialogue in an educational capacity, involves purposeful and constructive interaction that is valued by both the instructor and the learner with the ultimate goal of improving the learner's understanding of content (Moore, 1993). In the context of distance education, communications media play a

greater role in ensuring the extent and quality of dialogue between instructors and students. The use of one-way media (such as a television, audiotape, etc.) does not allow for dialogue to occur between the learner and instructor and thus transactional distance is very high. By selecting media that increases dialogue (such as teleconferences, two-way video, and computer conferencing), transactional distance can be reduced.

The second cluster, program structure (design of the instruction), can also determine the level of transactional distance. Programs that contain little transactional distance usually involve a dialogue between the instructor and the learner, whereby learners receive instruction and guidance in an open structure that is designed to support individual interactions (Moore, 1993). Building this dialogue into the structure of the program involves integrating several processes into the program: (a) present content; (b) support learner's motivation; (c) stimulate analysis and criticism; (d) give advice and counsel; (e) arrange practice, application, testing, and evaluation; (f) arrange for student creation of knowledge.

The selection and integration of the various communications media with the processes listed above is necessary in reducing transactional distance. Selecting the appropriate media is not only a means of selecting media that simply lend themselves well to reducing transactional distance but that are also compatible with the teaching process being used and the individual characteristics of the learner and the content.

The third cluster involves taking into consideration the autonomy of the learner; the tendency of learners to use teaching materials and programs in a way that allows them to achieve their own goals in their own way with control residing with the learner (Moore, 1993). Students with advanced competence as autonomous learners prefer less structure, but more dependent learners prefer more dialogue, more structure, and greater

contact with the instructor. In designing programs, the autonomy level of the learners needs to be taken into consideration so that dialogue and interaction can be planned for in a way that best supports the learning process.

Moore's theory gives us a lexicon that we can use in describing a set of barriers that may be encountered in distance education that prohibit interaction and dialogue. This distinction provides us with a means for analyzing the relative significance of interaction in a distance education program (Kearsley, 1995). In identifying the problem (transactional distance), we are able to move forward with the creation of new media, approaches to instructional design, and new ways of thinking about the role of the learner in his/her learning process.

Types of Interaction

Because interactivity can be ubiquitous, we may not have reasonable definitions for the term (Yacci, 2000). The need for a definition of interaction is necessary if we are to integrate interaction into the instructional design process. Moore (1989) introduced the idea of a distinction between three types of interaction that can occur in distance education environments: learner-content interaction, learner-instructor interaction, and learner-learner interaction.

Learner-content interaction is a defining characteristic of education. This is literally the process of intellectually interacting with content in a way that influences a learner's understanding, perspective, or cognitive structures (Moore, 1989). The media for this type of interaction may include textbooks, websites, simulations, guidebooks, video, audio, television, etc. Although this form of interaction lends itself to self-directed approaches to learning, learner-content interaction is always coupled with other forms of interaction (such as learner-instructor).

Learner-instructor interaction is interaction between the learner and an expert in a content area (who may or may not have had direct responsibility for the creation of the program and/or teaching materials). This form of interaction is desirable by many learners because it can serve as a means of motivation and reinforcement of the program content (Moore, 1989). Instructors also have an opportunity to engage the learner in a process that builds upon prior material thus allowing the instructor to ascertain how well and how quickly the learner is making progress, thereby helping the instructor decide if alternative strategies are necessary throughout the learning process.

Learner-learner interaction is interaction between two or more learners in a learning environment. Learner-learner interaction may or may not involve the presence of an instructor. Although early applications of learner-learner interaction involved teaching interaction skills that were necessary because of the nature of the content being taught (a course on group dynamics for instance), there are other uses. Depending on the circumstances of the learner (age, experience, and level of autonomy), learner-learner interaction can provide certain levels of peer support and guidance, aid in some types of presentations, and be used for purposes of application and evaluation (Moore, 1989). Recently, new ideas regarding other types of interaction have begun to emerge.

Anderson and Garrison (1998) have suggested three additional types of interaction that are possible in a distance education environment. Teacher-teacher is a form of interaction that places an emphasis on professional development in order to enhance teaching competencies. Teacher-content interaction takes into account new and emerging technologies that allow for the organization and manipulation of content by instructors (learning management systems and instructional authoring environments, for instance). Content-content interaction may sound strange at first, but new technologies

have allowed for the creation of agent-software that can operate semi-independently, searching for information based on certain rules that have been established by the instructor and/or the learner (Anderson & Garrison, 1998).

Wagner, in attempting to create a functional definition of interaction, used instructional design concepts and various learning theories and communication models to demonstrate the importance of the function of interaction within the contexts of learning theory, instructional theory, and instructional design and delivery (Wagner, 1994). This early research has led to a redefinition of interaction (a mutual or reciprocally active means of two-way communication) as a central element to the social expectations inherent in education and as a primary goal of the larger educational process. This redefinition puts the emphasis on learning outcomes, rather than the agents of interaction, as it relates to instruction and the role of feedback, memory, motivation, instructional intervention, and the use of interactive instructional delivery systems (Wagner, 1997).

Other attempts to define interactivity have focused on paring down the categorization of interactivity into two basic types as they apply to instructional settings: social interactivity and instructional interactivity (Gilbert & Moore, 1998). This accounts for the social exchanges that frequently occur between and among students as well as students and instructors. This, in turn, may contribute to a positive learning environment (but has little to do with the achievement of instructional objectives) and those interactions that are necessary for learning to take place (instructional interaction).

Clearly, there are many levels of approach and application within each type of interaction, and many ways in which learner-content interaction can be accomplished. New technologies are constantly making their way into the classroom and the teaching environment and, frequently, hybrids of existing technologies are allowing for new and

novel ways of engaging students in the teaching material and in the interactive aspects of a program of instruction.

Learner-instructor and learner-learner interaction enables the use of synchronous technologies that allow us to move beyond the need to have to consider location and the propinquity of the learners to each other and the instructor. Other technologies allow for asynchronous interaction, that in turn allows both learners and instructors to transcend geographic and temporal limitations.

Interaction in Web-Based Distance Education

In a recent study examining the effects of student-faculty interaction in a higher education setting Kuh & Hu (2001) found that students place a high value on interaction with faculty. The study also found that student-faculty interaction was a determining factor in helping students devote more effort to other educationally purposeful activities during college. Students also find that learner-learner interaction within an educational context that encompasses both personal and professional interaction can aid significantly in pursuing educational goals (Muirhead, 1999).

Donaldson (1999) found that interpersonal communication that includes instructor-to-student and student-to-student interaction was regarded as “important” or “extremely important” by 83.2 percent (n=142) of first-year undergraduate students taking a Web-based course. Interaction has been repeatedly cited as an essential ingredient of the successful implementation of Web-based courses (Shotsberger, 2000). With synchronous communication, the opportunity to interact with instructors on a routine basis was deemed “very effective” or “effective” as an instructional tool by 19 mathematics teachers who participated in Web-based professional development (Shotsberger, 2000).

In a study by Soo (1998), eight distance education experts were asked to rank the different types of interaction and their importance in on-line learning. The study differentiated between asynchronous and synchronous interaction and the three types of interaction as identified by Moore (1989). On a scale of one (least important) to ten (most important), experts ranked asynchronous learner-learner interaction highest (9.3) followed by asynchronous teacher-learner interaction (8.3) and asynchronous learner-content interaction (7.3). The forms of interaction that are synchronous in nature were ranked lower (4.3 being the lowest score). Further examination of the results show that synchronous technologies are still highly favored (mostly because it may be more analogous to face-to-face instructional environments), but the technology does not adequately allow for quality interaction that are on par with face-to-face interactions (Soo & Bonk, 1998).

Interaction is a key factor in students' learning satisfaction, and it assists in maintaining the persistence of distance students (King & Doerfert, 1996). A factor that has been identified as influencing student satisfaction with synchronous interaction is structured dialogue and interaction, that has been designed into the course and includes both learner-to-learner interaction and instructor-to-learner interaction (Berge, 1995). The quantity, quality, and level of interaction on the part of the instructor is also seen as a key to student satisfaction (Mortera-Gutierrez & Murphy, 2000). The strategies that instructors may employ to ensure student satisfaction include (McIsaac, Blocher, Mahes, & Vrasidas, 1999): (a) provide immediate feedback to students, (b) participate in the discussion, (c) promote interaction and social presence, and (d) use collaborative learning strategies.

Prior experience with computer-mediated communication influences student

satisfaction with interaction in general in a Web-based course (Vrasidas & Stock-McIsaac, 1999). However, students who have weak computer communication skills will not necessarily be at a disadvantage when participating in a Web-based course that uses computer-mediated communication (Ross, 1996). Issues such as prior knowledge of course content seem to play a greater role with regards to participation in computer-mediated communication events.

In general, students have reported that they use both synchronous and asynchronous forms of computer-mediated communication (CMC) for different reasons (Davidson-Shivers, Tanner, & Muilenburg, 2000). Synchronous forms of CMC (such as chat room environments) are used as a means of direct interaction in which interaction can be related to a specific topic that may change as the discussion progresses. Asynchronous CMC (such as electronic mailing lists and bulletin boards) give learners the opportunity to give reflective, thoughtful responses to posed questions and to give insightful reaction to others' postings (Davidson-Shivers et al., 2000).

The role of an instructor or facilitator in Web-based interaction is to keep interactions focused and productive in order to avoid learner discourse with CMC (Lee, 2000). This was reinforced by research conducted at an open university in which students indicated that the presence of the instructor in CMC was deemed desirable by students when the focus was of an academic nature (Morris, Mitchell, & Bell, 1999).

Computer-Mediated Communication

Computer-mediated communication (CMC) is the name given to a large set of functions in which computers play a role in supporting human communication (Santoro, 1995). There are three general categories of CMC. The first category involves the use of direct human-human interaction with a computer(s) acting as a conduit for the

interaction. In this case, the computer is the mechanism for handling the transaction (and sometimes the storage and retrieval functions) between two or more humans. Common examples of this type of CMC includes e-mail, electronic mailing lists, and electronic bulletin boards.

The second category of CMC includes information that has been organized and maintained by humans through the use of a computer, and where other humans are able to retrieve, manipulate, or contribute to the information (Santoro, 1995). This is commonly called “informatics” and may include on-line library catalogs, searchable database systems, Web search-engines, and data archives.

The third form of CMC is one in which the computer, acting on programmed instructions and rules, structures and manages the presentation of information to humans (Santoro, 1995). The computer program may allow for variations in the delivery of the instruction based on choices made by the user as the program executes. Examples of this form of CMC include computer-based training (self-paced CD-ROM training guides and manuals for example) and computer-assisted instruction.

Research has also focused on the interpersonal characteristics of CMC and the impact they may have on the learning process (Romiszowski & Mason, 1996). Recognizing that communication that lacks personal, social, or emotional features is sometimes advantageous, strategies for advancing interpersonal communication in the learning process may have implications for Group Decision Support Systems (Walther, 1992) where consensus and group action need to proceed quickly and efficiently. This type of CMC could have an impact on approaches to instruction that may be more learner-centered or constructivist in nature (Berge, 1999). The media utilized in CMC may even contribute to a level of affection and emotion that surpasses the face-to-face

parallel. This phenomenon is known as hyperpersonal communication and comprises CMC that may be more socially desirable than the face-to-face equivalent (Walther, 1996). Studies comparing face-to-face interaction and CMC-based interaction have shown that long-term versus short-term partnerships have a larger impact on anticipated future interaction when CMC is utilized versus face-to-face interaction (Walther, 1994). This form of social presence has led to increased learner satisfaction with CMC environments and increases in perceived learning on the part of students participating in Web-based courses in general (Jiang, 2000).

Gunawardena (1997) studied how well social presence predicts overall learner satisfaction in a text-based CMC medium. The study examined social presence (the degree to that a person participating in a CMC environment is perceived to be a real person with unique characteristics to their personality), opportunity to participate in CMC, and technical skills with CMC. Social presence contributed to about 60% of the variance, suggesting that it is a very strong predictor of satisfaction (Gunawardena & Zittle, 1997). In part, social presence was enhanced by the use of various communication protocols (guidelines governing interaction in the text-based CMC environment) that included the use of emoticons (text-based symbols) to express missing nonverbal cues. Social presence also plays a factor in computer-mediated cooperative learning when communication between learners is not only essential for completing various tasks but must be maintained over longer periods of time so that long-term educational goals can be attained (Higgins, 1991). Other benefits of CMC can include greater interaction, opportunities for skill development, and relevance to the learner through active-learning (McKeage, 2001).

Studies in Synchronous Computer-Mediated Communication

The chat room (an electronic meeting place where participants can communicate with each other at the same time but in different places) is currently the most likely candidate to replace the interactivity of the traditional classroom when used in a virtual classroom environment (Williams, 1999). Within the synchronous chat environment, it is possible that new methods of creating shared systems of significance may have implications for the academic discourse (Reid, 1991). Synchronous environments can sometimes increase the opportunity for learners to improve critical thinking, problem solving, and communication skills (Marjanovic, 1999). Synchronous chat environments potentially are motivational and can function as an effective tool for interactive learning (Sorg, 2000). Paulsen (1995) identified several techniques that can be used in a synchronous chat environment that include: a) debates, b) simulations or games, c) role play, d) case studies, e) transcript-based assignments, f) brainstorming, g) Delphi-like techniques, h) forums, and i) group projects. Advantages of chat rooms include ease of logistics, convenience, anonymity, and record keeping. Disadvantages include conversation lag time, lack of person-to-person interface, deindividuation (or the tendency to not perceive participants in chats as individuals, limited modes of communication, artificiality, and lack of flexibility in accommodating different learning styles (Coleman, Paternite, & Sherman, 1999). These disadvantages can lead to a questioning of the quality of synchronous computer-mediated communication and can be a deterrent to participation (Perdue & Valentine, 2000).

The use of chat environments can result in greater collaboration, social interaction, and positive engagement and can assist in providing an effective forum for immediate feedback and brainstorming tasks. Chat environments, however, may not

encourage reflective thought (Pena-Shaff, Martin, & Gay, 2001). Knowledge construction, through interaction and collaboration with peers and experts, is possible in synchronous chat environments (Chou, 2001). A chat room may not be the only method for synchronous interaction in virtual classroom environments, but it can serve as an alternative to or can augment other traditional forms of interaction. Through the use of engaging and structured activities, interaction can be enhanced (Koszalka, 2002). Further, certain subject matter may lend itself well to synchronous chat environments (Williams, 1999). The disadvantage of not being able to organize a conversation in a synchronous chat environment is one issue that can be addressed by either improving upon software that is used for such purposes or by improving on the communication conventions that are used while in the chat environment (MacDonald & Caverly, 2000).

Learners need support to engage in discussion (ask questions, make comments, lead discussion, etc.), keep track of their discussion, and to organize their interface when participating in synchronous electronic discussion (Veerman, Andriessen, & Kanselaar, 2000). There are different approaches to interaction management in synchronous chat environments. Some approaches include using techniques similar to face-to-face interactions such as introductions, framing, outcome explanation, and group goal setting for a chat session (Rintel & Pittam, 1997). Dialogue structuring is another approach where implicit structuring can induce group discussion by working through key questions. The results can be a sense of greater orientation on the subject matter and less of a chance for discussion to drift off-topic (Hron, Hesse, Cress, & Giovis, 2000). Other approaches, such as 3-D virtual chat environments using chat software that differs from traditional text-based interfaces, can be effective in overcoming transactional distance (Altun, 1998), although pitfalls to such approaches include group sizes that are too large,