ABSTRACT

Title of Dissertation: COMMUNICATION STRUCTURES IN COMPUTER-SUPPORTED COOPERATIVE LEARNING (CSCL) ENVIRONMENTS FOR ADULT LEARNERS IN DISTANCE EDUCATION

Martha Patricia Verdines-Arredondo
Doctor of Philosophy

Dissertation directed by: Professor M. Delia Neuman
College of Information Studies

This qualitative study addresses the research question: *What is the nature of the instructional communication process sustained by computer-supported cooperative learning (CSCL) environments for adult learners in constructivist distance education?* The target audience was adult learners; the constructivist learning paradigm guided the analysis of the teaching/learning interactions and communication events. A course was selected as the unit of analysis by following a theoretical construct sampling strategy.

Relevant information selected purposively from the course archive was analyzed using conversation analysis to explore the nature of the instructional communication process (the "macro" level") and content analysis to identify the types of teaching/learning interactions, the types of knowledge and the cognitive processes that occurred in the chosen environment (the "micro" level). The study develops a model that characterizes online conversations as instructional communication events, and establishes a framework for the systematic analysis of online conversations in CSCL environments.

At the “macro” level of analysis, the participants’ discourse in the synchronous conversations moderated by the instructional team was well-structured and composed of a set of phases – opening, instructional delivery, and closing – as in face-to-face classroom discourse research. In contrast, the unmonitored asynchronous conversations were characterized as ill-structured; only the opening phase or the instructional delivery phases were represented in the discourse. At the “micro” level, extensive and diverse types of interactions occurred in the asynchronous conversations, but fewer types were evident in the synchronous conversations, which were structured by the instructional team to limit active participation to only a few students. These findings suggest that online instructional conversations can be characterized as student-centered, teacher-centered, or a combination of both, according to the type and variety of interactions that occur among participants.

The analysis also identified the types of knowledge constructed and shared by students as well as the cognitive activity represented in their discourse, which were characterized as instances of specific learning processes – such as collaborative problem solving and collaborative argumentation – and diverse learning outcomes consistent with the learning goals in the course selected in the study.

COMMUNICATION STRUCTURES IN COMPUTER-SUPPORTED COOPERATIVE LEARNING (CSCL) ENVIRONMENTS FOR ADULT LEARNERS IN DISTANCE EDUCATION

By

Martha Patricia Verdines-Arredondo

Dissertation submitted to the Faculty of the Graduate School of the
University of Maryland, College Park, in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
2006

Advisory Committee:

Professor M. Delia Neuman, Chair
Professor Vedat G. Diker
Professor Jennifer J. Preece
Professor Marilyn D. White
Professor Donna L. Wiseman

© Copyright by
Martha Patricia Verdines-Arredondo
2006

Dedication

To my beloved family and friends, for being the greatest joy in my life.

Acknowledgements

I am deeply grateful to the course participants – students, faculty, teaching assistants, and guest speakers – for granting permission to access their conversations within the course archives and for their assistance in validating the research results.

Dr. M. Delia Neuman, my dissertation adviser, not only inspired and supervised this research project since the very beginning but also provided a fine example of dedication to high-quality research, teaching, and professional service. I gratefully acknowledge her commitment, her support, and her patience during every stage of this research project.

Dr. Vedat G. Diker, Dr. Jennifer J. Preece, Dr. Marilyn D. White, and Dr. Donna L. Wiseman, members of a truly interdisciplinary dissertation committee, provided valuable insights and feedback. I gratefully acknowledge their participation and their contributions throughout this research.

Faculty at the College of Information Studies provided an exciting and supportive research environment since my very first day as a graduate student. In particular, I gratefully acknowledge the advice, support, and encouragement received from Dr. Eileen Abels.

Fellow Ph.D. students revised early drafts and provided valuable insights and feedback. In particular, I gratefully acknowledge Kara Reuter and Fei Wu for their assistance in testing and validating the coding scheme used in this research project.

The Paul Wasserman Library served as an extremely useful research environment in which I had access to diverse information services, learning resources, and networking opportunities within the community at the College of

Information Studies. I gratefully acknowledge the assistance, support, and encouragement graciously provided over the years by Karen Patterson, Tim Hackman, and the students serving as library research assistants.

This research was fully sponsored by a scholarship from the US Department of State Fulbright Program, a research grant from ITESM Campus Monterrey, a travel grant from the University of Maryland Graduate School, a tuition fellowship from the University of Maryland College Park, and a graduate assistantship from the College of Information Studies. I will always be grateful for this support.

Table of Contents

List of Tables

List of Tables (continued)

List of Figures

Chapter 1: Introduction

1.1 Purpose of the study

The design of effective instruction involves the design of effective information delivery and communication environments for specific audiences. In traditional instructional settings, the delivery of instruction is carried out by an instructor within a classroom as the primary communication space. With the integration of new information technologies and new communication media into existing instructional venues, new instructional technologies and computer-mediated learning environments have emerged. One such environment is online distance education. While a good deal of research has looked at various aspects of this environment, we still have much to learn about its nature, processes, and effects. This study draws on research in a number of disciplines –learning theory, distance education theory, and communication theory – to investigate how particular aspects of a communication system in a distance education environment contribute to the effectiveness of that environment.

Research on *computer-mediated communication (CMC)* for instructional purposes has focused on understanding the *communicative affordances* of specific computer-based learning tools (Holt, Kleiber, Swenson, Rees & Milton, 1998; Kirschner, Strijbos, Krejins & Beers, 2004; Marra, Moore & Kilmczak, 2004; Ronteltap & Eurelings, 2002); the *frequency of interactions* among learners (Hara, 2002; Hara, Bonk & Angeli, 2000; Mowrer, 1996; Rada & Hu, 2002); and the *interaction style* of instructors and learners in distance education environments (Anderson, 2003; Blignaut & Trollip, 2003; Flottemesch, 2000; Howell-Richardson

& Mellar, 1996; Jeong, 2003; Martinez, Dimitris, Rubia, Gomez & De la Fuente, 2003). Most of this research analyzes the intended, first-order learning outcomes resulting from the design and development of computer-mediated instruction (Herring, 2002); very few research efforts have explored the nature of the instructional communication process, specific communication behaviors, and specific instructional interactions emerging from the convergence of several communication structures and media within a computer-mediated instructional setting.

Several studies in the fields of *cognitive science* and *educational technology* have provided additional dimensions to the study of CMC environments by focusing on specific aspects of the teaching-learning experience: particular subject domains (Dunlap & Grabinger, 1996; Hannafin, Oliver, Hill & Glazer, 2003; Lajoie, 1993) or a particular learning paradigm (Duffy, 1996; Honebein, 1996; Jonassen, 1999; Land & Greene, 2000, Mayer, 1999; Wilson & Lowry, 2000). This research suggests a starting place for the design and evaluation of CMC tools for particular instructional strategies and specific domains. Further research with a focus on gaining a deep understanding of the instructional communication process within the framework of specific learning theories is strongly suggested, since each particular learning theory suggests and supports particular ways of communicating – organizing, presenting, enhancing, and evaluating learning experiences – and addressing the cognitive processes sustaining those experiences.

Several studies of *collaborative problem-solving* (Arts, Gijselaers & Segers, 2002; Uribe, Klein & Sullivan, 2003) and *collaborative argumentation* (Cho & Jonassen, 2002; Veerman, Andriessen & Kanselaar, 2002) among groups of students

in computer-supported cooperative learning (CSCL) environments can also be identified in the literature. Most of these focused on the usability and effects of specific computer-based instructional tools for specific collaborative tasks within specific domains rather than on the communication processes involved in performing collaborative tasks under the constraints of real instructional settings (Krauss & Fussell, 1991; Mazur, 2004). Further research in terms of the communicative interactions, events, and processes involved in performing collaborative tasks in CSCL environments is strongly suggested.

The significant research efforts across these disciplines have emerged from different knowledge bases and research traditions. Therefore, it is not surprising that there is a lack of agreement among researchers and practitioners regarding a generic framework in which to situate studies of the interactions and communicative events taking place within CSCL environments. Further research is strongly suggested to develop and validate a generic design framework grounded in currently available communication models and learning theories to represent the instructional interactions within a particular venue for learning and for specific audiences in CSCL environments.

As a first attempt at generating this framework, a qualitative study was conducted to analyze the nature of online conversations in a CSCL environment in distance education. For this study, the target audience was adult learners; the learning paradigm within which the interactions among participants were analyzed was *constructivism.* The research questions focused on specific aspects of the communication process within the chosen environment.

1.2 Research question

The research question addressed in the study is: *What is the nature of the instructional communication process sustained by computer-supported cooperative learning (CSCL) environments for adult learners in constructivist distance education?*

1.3 Foreshadowing questions

The foreshadowing questions addressed in the study are:

- Q#1: What types of interactions are supported and enhanced by CSCL systems for adult learners in constructivist distance education environments? What types are discouraged or impeded?
- Q#2: What types of instructional interventions and activities are supported and enhanced by CSCL systems for adult learners in constructivist distance education environments? What types are discouraged or impeded?
- Q#3: How and to what extent can the available research body on classroom discourse be applied to the analysis of online conversations in CSCL environments?
- Q#4: How and to what extent do online conversations serve as evidence of learning processes and learning outcomes?
- Q#5: What type of model best represents the computer-mediated communication process among adult learners and their instructors in constructivist distance education environments?

To assess the implications of this research for distance education theory, the following questions were also addressed:

- Q#6: How and to what extent could the systematic analysis of online conversations inform the instructional design process for adult learners in computer-mediated distance education environments?
- Q#7: How and to what extent could the systematic analysis of online conversations inform the design and evaluation of computer-mediated instructional systems in distance education environments?

1.4 Scope of the study

This study of the nature of the instructional communication process supported by CSCL environments for adult learners in distance education focused only on the communication process itself. It did not include the analysis of the infrastructure and information technologies sustaining this process. Moreover, it did not address the political, cultural, and institutional factors that might influence the distance education environment in which the instructional communication process is embedded. These factors are beyond the scope of this study.

1.5 Limitations of the study

The data collected and analyzed served as evidence to address the foreshadowing questions guiding the study. However, the researcher is fully aware of several limitations.

Scope of the analysis: Detailed information about the students' backgrounds was not available for the study, nor was the researcher able to contact the students for in-depth interviews. Therefore, the richness of individual differences, cultural differences, and offline interactions among the students was not addressed in the study.

Participants' performance: The concepts and constructs guiding the procedures for data analysis allowed the researcher to identify certain learning outcomes in the discourse representing the participants' communication behavior. The students' discourse provided evidence of their ability to construct and share factual, conceptual, procedural, and metacognitive knowledge together with their ability to understand, analyze, apply, and evaluate particular concepts and procedures relevant to the course content. Although the evidence obtained from the systematic analysis of online conversations suggests that students accomplished a variety of learning tasks, a psychometric assessment of the participants' actual understanding and knowledge in the domain of interest is beyond the scope of this study.

Representativeness: Information within the course was selected according to a purposive sampling strategy to obtain a wide range of types of data on which to test the proposed analytic approaches and procedures. Therefore, the results that emerged from the data represent an analysis of only a sample of the interactions among the participants rather than an exhaustive investigation of all relevant data.

Transferability: Because only one course was selected as the unit of analysis, this study does not represent all instances of the phenomenon of interest. Factors inherent in this individual course – such as the course content, the instructional team

members' and students' previous experiences with computer-mediated instructional systems and the CSCL environment, and instructional strategies selected by the instructional team – make it unique. However, the instructional communication model as well as the framework for analysis that emerged from the study could be adapted to the analysis of online conversations in courses with similar settings.

1.6 Definitions

This section provides definitions of the main constructs and concepts guiding the research questions addressed in the study.

Adult learners: Non-traditional students who are highly motivated, self-directed, self-reflective, independent, willing to collaborate with others, and willing to participate in group decision-making processes (Eastmond, 1998; Morrison, Ross & Kemp, 2001).

Classroom discourse: Conversations and interactions sustained in a classroom; between teacher and students or among students with or without a teacher; and involving an array of symbolic tools, such as written texts, narratives, books, images, and equipment (Pontecorvo, 1997).

Closing phase: A set of conversational actions in which a participant in the teaching/learning process provides other participants with specific directions or general information by the end of the conversation (Mehan, 1985). The conversational actions generally included in the closing phase of online conversations involve a moderator or a student acknowledging all participants' contributions *(A)*, a moderator or a student sharing information or facts of interest for future sessions *(S)*, and a moderator formally ending the session *(C)*.

Collaborative learning: An instructional situation involving a group of self-directed students working together within ill-structured processes to share ideas and reach conclusions (McWhaw, Schnackenberg, Sclater & Abrami, 2003).

Communication behavior: The interaction patterns and trends identified for a source or a receiver participating in a communication environment. In instructional situations, the communication behavior of teachers and students is defined in terms of the social structures in which they participate – individuals, pairs, small groups, large groups, or collaborative networks – and the type of interactions – student-teacher, student-student, student-content, etc. – within the instructional communication process.

Communication event: An activity beginning with the same general purpose and the same topic, involving the same participants, generally using the same language variety, and maintaining the same tone and the same rules for interaction in the same setting (Saville-Troike, 1989). Lessons, seminars, and debates are considered basic instructional communication events in traditional instructional settings; in contrast, real-time chat sessions, discussions on electronic bulletin boards, and video conferencing sessions are considered instructional communication events in CSCL environments.

Communication structure: The social structure in which students participate and collaborate – as individuals, pairs, small groups, or large groups – within a particular environment.

Computer-supported cooperative learning (CSCL) environments: Instructional situations coordinated by an instructor to enhance team performance by

providing shared workspaces for communication, information sharing, problem-solving, and decision-making (Dede, 1996).

Constructivism: A view of the teaching-learning process that emphasizes the learners' own meaning making and intentionally seeks to relate new ideas to the learners' prior knowledge and experiences (Jonassen, 1999). In a constructivist learning environment, learners may work together and support each other as they use a variety of tools and information resources in their guided pursuit of learning goals and problem-solving activities (Wilson, 1996).

Conversational actions: Observable behaviors resulting from the interactions among participants in a conversation. The basic conversational actions identified for conversations in instructional situations are: *(O)* opening/starting a lesson or topic, *(I)* initiating/eliciting participation, *(R)* responding to a request for participation, *(E)* evaluating the quality of a response, *(F)* providing feedback to other participants, *(A)* acknowledging other participants' responses, and *(C)* closing/terminating a lesson or topic (Adger, 2001; Cazden, 2001; Mehan, 1985).

Discourse sequence: A set of turns within a conversation in which diverse conversational actions are carried out, followed up, or responded to by the participants. In CSCL environments, a discourse sequence can be identified as the set of turns taken by a faculty member, a guest speaker, and a student to pose a question, to respond to a question, and to provide feedback within an online conversation.

Distance education: An instructional situation in which the instructor and learners are separated in time and location. In such situations (1) the instructional process takes place in a different location from the learning process, (2) the learning

process can take place at a different time than the teaching, and (3) the instructor and learners communicate via media (Morrison & Guenther, 2000).

Instructional communication: A human communication process that occurs in instructional settings for learning purposes; in CSCL environments, communication media support the teaching/learning process and the interactions among teacher and students (Staton, 1989).

Instructional interaction: A two-way communication process involving an instructor, one or more students, and the course content. The main types of instructional interactions in CSCL environments are instructor – content interactions, instructor –student interactions, student – content interactions, and student – student interactions (Anderson, 2003).

Instructional phase: A set of conversational actions represented by the discourse of the participants in the teaching/learning process. The main instructional phases identified in classroom discourse research are an opening phase, an instructional delivery phase, and a closing phase (Mehan, 1985).

Instructional delivery phase: A set of conversational actions in which a participant in the teaching/learning process elicits participation and reacts to the contributions of others in relation to the course content (Mehan, 1985). The conversational actions generally included in the instructional delivery phase of online conversations involve a moderator or a participant initiating a discourse sequence by sharing her insights, asking for information, or posing a question *(I);* one or more participants responding to other participants' postings *(R);* a moderator or a participant evaluating the quality of a participant's response *(E);* a moderator or a

participant providing feedback to participants *(F);* a moderator or a participant probing for clarification or to confirm responses *(P);* and a moderator or participant acknowledging the responses from other participants *(A).*

Opening phase: A set of conversational actions in which a participant in the teaching/learning process provides other participants with directions and information at the beginning of the conversation (Mehan, 1985). The conversational actions generally included in the opening phase of online conversations involve a moderator or a student formally starting the session *(O),* a moderator or a student greeting all participants *(G),* and a moderator or a student sharing isolated facts of interest for the session *(S).*

Virtual classroom: An instructional space in which (1) an instructor and a group of learners interact through a computer-mediated learning environment, (2) several mechanisms to support communication and collaboration are provided by computer-mediated tools, and (3) both instructor and learners have opportunities to interact with each other and with the course content and instructional resources within the computer-mediated environment (Motiwalla & Tello, 2000). A virtual classroom is also referred to as an *online classroom* or an *electronic classroom.*

Chapter 2: Conceptual Framework

This chapter describes the connections among several disciplines – learning theory, distance education theory, and communication theory – that provided the conceptual framework for this research. It also describes the way in which the research questions guiding the study were grounded in the constructs and concepts emerging from the connections among these disciplines.

2.1 Instruction as communication

Instruction has been defined in the literature as the systematic organization and delivery of information to produce learning (Heinich, Molenda & Russell, 1999). When trying to identify the connections between instruction and communication, Staton (1989) found that both concepts are “integrally related in that instruction is actually a communicative process” (p. 364) and defined *instructional communication* as the study of the human communication process as it occurs in instructional settings for learning purposes. Therefore, it is extremely important to conceptualize an instructional situation as a venue in which a particular type of communication occurs and in which several communication structures, communication media, and communication behaviors converge to provide instructional experiences. When all these communication elements support an effective instructional communication process, these experiences lead to learning. As Heinich, Molenda, and Russell (1999) have stated, "effective instruction will not take place unless effective communication has taken place" (p. 12).

The design of effective instruction involves the design of effective information delivery and communication spaces for specific audiences. In traditional instructional settings, the delivery of instruction is carried out by an instructor within a classroom as the primary communication space. However, with the integration of new information technologies and new communication media into existing instructional venues, new learning environments have emerged. Among these environments are both face-to-face and virtual settings. Although such settings have many differences, they share a need to encompass strategies and techniques that take full advantage of the interactivity and individualization afforded by new technologies.

To design a computer-mediated instructional system as an effective learning environment in any setting, it is extremely important to identify the particular view of learning upon which the system features, navigation model, and interaction style are based. In addition, the instructional designer should carefully identify the communication features that provide learners with an instructional communication space consistent with a specific learning paradigm. For instance, the system features to support the roles assumed by instructors and students within a behaviorist learning environment emphasizing individual work (Kozma, 1987) would be different from those features supporting a situative/socio-cultural learning environment with a focus on collaborative problem-solving and argumentation among students (Jonassen & Carr, 2000).

Very little research exists on the study of instructional situations in relation to instructional communication models. However, Heinich, Molenda and Russell (1996) applied several communication models (Schramm, 1971; Shannon & Weaver, 1964)

as a framework to understand and analyze the critical elements and stages within the instructional communication process of generic instructional situations. Their characterization of this process evolved into a transactional model that represents students' active participation in the teaching/learning process within student-oriented instructional settings (Heinich, Molenda & Russell, 1999). To extend these insights, the instructional communication process should be further analyzed within the framework of learning theory, since a particular *learning paradigm* suggests and supports particular ways of organizing, presenting, enhancing, and evaluating learning experiences.

Guba and Lincoln (1998) defined a *paradigm* as "a set of basic beliefs with principles representing a view that defines the nature of the world, the individual's place in it, and the range of possible relationships to that world and its parts" (p. 200). With this definition in mind, the following sections describe the assumptions of four *learning paradigms* identified in the literature as the most significant (Greeno, Collins & Resnick, 1997; National Research Council, 2001) and suggest a *communication model* that could represent the communication structures, communication elements, and types of interactions among learners and instructors for each learning paradigm. A preliminary discussion of potential implications for the design of computer-mediated instructional systems within each of these learning paradigms is also provided.

2.1.1 The behaviorist paradigm

A *behaviorist view of learning* assumes that meaning exists separately from personal experience and that learning is based on knowing the entities, attributes, and

relationships existing in an objective reality (Greeno, Collins & Resnick, 1997). Learning objectives are framed in terms of specific, observable behaviors, while assessment tools usually focus on evaluating the learners' acquisition of factual and conceptual knowledge (National Research Council, 2001). Instructors plan and deliver instruction and lead learners to a desired level of performance, while learners can appear to be passive, primarily reacting to the information and stimuli provided by the instructors rather than generating new information on their own (Heinich, Molenda & Russell, 1996).

The instructional communication process within a behaviorist paradigm seems to be consistent with the communication model introduced by Shannon and Weaver (1964), in which *a linear model of communication* conceptualizes the audience as not making overt responses during the learning process but reacting to the messages they receive and interpret through individual communication events. The main communication goal of this model is *persuasion*, assuming that effective communication affects and influences the behavior of the audience. A linear view of instructional communication implies the design of straightforward instructional activities in which the content is delivered within a linear, unidirectional structure (See Appendix A).

A system designed as a learning environment under a behaviorist perspective should serve as an effective mechanism for *information dissemination,* in which instructional units and activities are presented in linear form, with restricted navigation choices. The use of pre-defined tools to enhance the learner's performance, such as tutorials or drill-and-practice exercises, is consistent with this view of

learning, particularly in those situations dealing with factual information and basic concept learning (See Appendix B).

2.1.2 The information-processing/cognitivist paradigm

An *information processing/cognitivist view of learning* assumes that knowledge is stored in mental structures and that learning occurs when those knowledge structures are modified by the perception, acquisition, and processing of information from the environment. Learning objectives are framed around the development of higher-order cognitive skills (such as problem solving, decision-making, critical thinking, and metacognition) while assessment tools tend to evaluate the learners' performance and cognitive processes when accomplishing well-structured tasks within well-structured domains (Greeno, Collins & Resnick, 1997). The role of instructors is to provide course content, to link information from content to the learners' existing knowledge, and to encourage the learners' development of cognitive strategies. Learners develop higher-order thinking skills by actively selecting, acquiring, and processing information from the instructional environment and by reflecting on their own learning strategies and progress (National Research Council, 2001).

The *relational communication model* introduced by Schramm (1971) conceptualizes communication as a dynamic process in which both sender and receiver share a common frame of reference so that communication transactions can be carried out efficiently. Its central concern is with the communication, reception, and interpretation of meaningful symbols – processes that are at the heart of instruction (Heinich, Molenda & Russell, 1999). Such a communication process can

be affected by cognitive, cultural, and environmental factors in relation to both sender and receiver. The role of the audience is reactive, since they select the type of messages to be received and interpreted rather than originating them (See Appendix A).

The instructional communication process within an information-processing paradigm seems to be consistent with Schramm's communication model: in a teacher-centered instructional situation, the teacher plays the role of sender – selecting and creating relevant messages as the course content – while learners play the role of receivers – actively deciding which messages to receive, process, and integrate in terms of the common frame of reference shared with the course teacher. The "frame of reference" for this instructional situation could be seen as the combination of learning goals, deadlines, sequence of content, and evaluation tasks and criteria described by the teacher at the beginning of the instructional transaction. This conceptualization of instructional communication assumes a generally reactive role for learners but also includes several opportunities for them to reflect on their progress, set their own learning goals, and define their own learning strategies during instructional transactions.

A system designed under an information processing/cognitivist view of learning should serve as an *information space* to support active, goal-directed learners in their information acquisition, information processing, knowledge representation, and knowledge integration. The system should provide features to enhance the development of the learners' metacognitive strategies as well as features to scaffold their problem-solving strategies in well-structured domains (See Appendix B).

2.1.3 The constructivist paradigm

A *constructivist view of learning* is an extension of the cognitivist view which assumes that learning is the result of the learners' active engagement in meaningful learning experiences: the learners' prior knowledge and life experiences serve as the basis upon which to acquire and construct new knowledge (Greeno, Collins & Resnick, 1997). Learning objectives are framed around fostering a deep understanding of concepts and principles, while authentic assessments strive to evaluate the learners' acquisition and development of knowledge in relation to meaningful contexts. By modeling and guiding a generic knowledge-construction process, instructors provide opportunities for learners to assemble knowledge. At all times, instructors also encourage the learners' development of self-regulation strategies. Learners create their own interpretations of the course content and reflect on those interpretations in collaboration with other learners (National Research Council, 2001).

The *convergence communication model* introduced by Rogers (1980) could serve as a basic frame in which to represent the communication elements and teaching/learning interactions within the instructional communication process under a constructivist paradigm. In Rogers' view, the main goal of communication is to share information and to build mutual understanding in collaborative environments as a requisite for *convergence of meaning.* Both senders and receivers are active in creating, perceiving, interpreting, understanding, and evaluating messages and in reacting to the content of those messages. *Communication networks* rather than instructor-student dyads are the unit of analysis in Rogers' model, since a single

person could be a member of several teams, groups, or learning communities at the same time and could be sharing information and building mutual understanding via several communication channels within a communication space (See Appendix A).

A learning system designed according to the constructivist paradigm should serve as an *interactive information space* to provide learners with opportunities for information discovery, information exploration, knowledge construction, knowledge integration, collaboration among learners, and self-regulation. Learners should be perceived as an active, self-directed audience. Dynamic visualization spaces with features allowing a structural representation of knowledge, self-assessment, and self-regulation should also be provided (See Appendix B).

2.1.4 The situative/socio-cultural paradigm

A *situative/socio/cultural view of learning* assumes that learning is the result of social interactions among learners. This view promotes social practices supporting the development of shared cognition and also assumes that learning depends on the context in which learning experiences are provided (National Research Council, 2001). Learning objectives are framed around social practices of knowledge construction and inquiry, and the assessment of learners' performance is based on their roles during *collaborative processes* and on their participation in *social inquiry* and *social practices.* Instructors provide opportunities for learners to collaborate and exchange ideas while facilitating and guiding collaborative processes such as idea generation, argumentation, and knowledge sharing. At all times, instructors encourage the learners' development of self-regulation strategies, while learners actively participate by selecting and interpreting information in the context of their

own social and cultural backgrounds. In this view, learners also participate in the assessment of their own progress and learning performance (Greeno, Collins & Resnick, 1997).

The communication model introduced by Vickery & Vickery (2004) could be used as a framework to conceptualize the instructional communication process as a set of social transactions taking place within a social context, in which the main communication goal is not only to inform and to instruct but also to construct *shared knowledge* as the result of social interactions. Communicators could play the role of sender or receiver and could be individuals, teams, groups, organizations, or institutions. The social and cultural context of senders, receivers, and communication media should be carefully considered when designing or analyzing communication transactions within this model (See Appendix A).

CSCL environments designed under a situative/socio-cultural perspective should serve as *task-centered, effective collaboration spaces* enhancing collaborative processes such as information sharing, problem-solving, decision-making, argumentation, knowledge construction, and knowledge integration. Because the audience should be perceived as active and collaborative, features supporting shared workspaces, shared knowledge bases, and shared communication spaces should be provided by the system. Features designed to scaffold the learners' self-assessment and self-regulation practices are also important (See Appendix B).

2.1.5 Convergence of learning paradigms

The learning paradigms described in the previous sections all have long traditions within the research communities of cognitive science and educational

psychology (Greeno, Collins & Resnick, 1997; National Research Council, 2001). Despite a tendency of both researchers and practitioners to compare and contrast the differences among those learning paradigms, in fact they converge and complement each other. All have provided important insights into the teaching-learning process, and none offers a complete explanation of that process or of its underlying communicative aspects. While the overall design of an instructional system is generally based upon a specific view of learning and specific learning goals, a given instructional unit or a specific instructional activity usually incorporates components and features from several learning paradigms.

2.2 Learning environments in distance education

This section reviews the literature on distance education research with a focus on those guidelines, principles, frameworks, and models supporting the design and evaluation of learning environments for adult learners in distance education. While the environments described are termed "constructivist," they in fact incorporate elements from other learning paradigms, as noted above.

2.2.1 Adult learners in distance education

Sound instructional design practices include a comprehensive analysis of the general characteristics, competencies, and learning strategies of the intended audience for each instructional situation. Since this research involved a qualitative study in which the target audience was adult learners, this section reviews the literature on teaching-learning practices related to adult learning.

Adult learners have been described as non-traditional students who are highly motivated, self-directed, self-reflective, independent, willing to collaborate with

others, and willing to participate in group decision-making processes (Eastmond, 1998; Morrison, Ross & Kemp, 2001). Such learners tend to have a *task-centered, problem-solving approach to learning* and to bring a wealth of real-life experience as a powerful learning resource (Driscoll, 1998; Long, 1990). Specific types of adult learners have also been identified: (a) *goal-oriented learners*, who desire to attain a certain goal and seek clear-cut results to any learning experience; (b) *activity-oriented learners*, who seek learning to meet social needs; and (c) *learning-oriented learners*, who participate in learning experiences for the joy of knowledge acquisition and intellectual stimulation (Nealand, 1992; Nussbaum, Baringer & Kundrat, 2002).

According to Knowles (1970), *adult learning* should involve a process of guided interaction in which learners engage in learning activities and tasks as part of *self-directed inquiry.* Therefore, a truly artful adult educator perceives the locus of responsibility for learning to be in the learners themselves. Kasworm (2003) conceptualizes the *knowledge-construction process* for adult learners as a "constructivist, self-regulatory, socially and culturally mediated process" (p. 82) in which adult learners individually construct new representations and models of reality and then later negotiate and validate those representations and meanings through cooperative social practices, such as discourse or debate.

Garrison and Archer (2000) have introduced *a transactional approach to adult learning*, according to which educational transactions grounded in the general characteristics of adult learners allow those learners to create meaning in the context of their work and life experiences. In this view, collaborative learning environments allow adult learners not only to confirm their ideas and interpretations but also to develop their critical thinking and self-regulation abilities in relation to specific

educational goals. Personal meaning-making and reciprocal confirmation are iterative phases of an interdependent teaching-learning transaction.

While many adults take formal courses and participate in organized learning experiences, few are involved in formal instruction when they learn how to use new technologies. Rather, they tend to rely on self-directed learning and informal knowledge sharing with their colleagues (Cahoon, 1998). Whether adults attempt to master either "content" or "technology," a comfortable, supportive environment is key to successful learning (Nealand, 1992).

An increasing level of *diversity* in terms of professional and cultural backgrounds of adult learners in distance education environments has been also identified in the literature. The following kinds of differences have been identified as affecting adult learners' needs: *individual* (Freudenthal, 2001; Kasworm, 2003; Morrison, Ross & Kemp, 2001; Sorg, 2000; Teo & Lim, 2000); *cultural* (Chen, Mashhadi, Ang & Harkrider, 1999; Collis, 1999; Gunawardena, Wilson & Nolla, 2003; Lagier, 2003); and *cognitive* (Galotti, 1994; Hartson, 2003; Justice & Dornan, 2001). Adaptive instructional environments providing flexible and complementary instructional methods together with several approaches to the assessment of academic performance will most likely fit the characteristics of audiences of culturally diverse adult learners (Flowers, 2000; Rudestam & Schoenholtz-Read, 2002).

CSCL environments have the potential to accommodate the needs of adult learners when the design of those learning environments is grounded in sound instructional-design principles and practices. However, the increasing demand for adult learning opportunities, together with the emergence of new instructional models

and theories, is challenging the ways in which adults' needs are being defined, communicated, and eventually met (Belanger & Tuijnman, 1997).

Despite conflicting views in the field, several authors have written about designing effective online learning environments for adult learners (Driscoll, 1998; Kasworm, 2003; Rudestam & Schoenholtz-Read, 2002). A basic set of guidelines and principles encompasses the following recommendations: (a) incorporate problem-centered learning; (b) involve learners in planning and evaluating; (c) include several instructional methods and media; (d) include several assessment tools and strategies; (e) include a variety of roles for both learners and instructors; (f) encourage exploration, action, and reflection; (g) provide regular and constructive feedback; (h) provide features for social interactions; and (i) nurture self-regulation strategies.

2.2.2 Constructivist learning in distance education

The *instructional design process* has been defined by Morrison, Ross, and Kemp (2001) as "a systematic planning method that results in successful learning and performance" (p. 2). Several instructional design models have successfully integrated guidelines, principles, and theories from a variety of disciplines: learning theory, general systems theory, communication theory, and instructional design theory (Douglas, 2001; Heinich, Molenda & Russell, 1999; Jonassen, 1997; Reiser & Dick, 1996; Smith & Ragan, 1999). Despite the fact that each learning theory suggests and supports a different view of the teaching-learning process, sound instructional design practices tend to focus on a single overarching pattern: analyzing the learners' profile, defining learning goals, designing or selecting instructional materials, and assessing the learners' performance in terms of a particular learning paradigm.

As shown in Appendix B, the roles of instructors, learners, and instructional media within specific instructional situations are defined by the learning paradigm upon which the instructional design process is based. The extent to which the inherent characteristics of the methods and media used to deliver instruction influence and shape the learning experiences is still an issue under investigation; however, as Kozma (1991) noted, “good instructional design successfully integrates both content and media” (p. 205).

Debates and proposals for learning theories and instructional design models in both traditional and computer-mediated distance education environments can be identified in the literature. For instance, Picciano (2001) stated that distance education is not a distinct form of education and that the teaching-learning process sustained in distance learning environments is the same as in any other instructional setting. Dillon and Zhu (1997) asserted that "there is nothing magical about the Web as a new technology that requires us to reinvent instructional design" (p. 223), while Bostock (1997) claimed that “simply publishing a Web site does not constitute instruction, since the tedium of listening to the lecture is replaced by the tedium of reading from the computer screen" (p. 225).

Research-based instructional design models and theories for traditional or computer-enhanced classroom settings with a constructivist view of learning can also be identified in the literature (Dunlap & Grabinger, 1996; Honebein, 1996; Jonassen, 1999; Mayer, 1999; Wilson, 1996). Several instructional design models have focused on the design and evaluation of constructivist learning environments in distance education for adult learners (Huang, 2002; Jonassen, 1995; Rovai, 2004; Wilson &

Lowry, 2000). Together, all these guidelines, principles, and frameworks for the design and evaluation of constructivist learning environments make it clear that current instructional design practices are grounded in a diversity of research approaches and theoretical backgrounds. Additional research is strongly suggested to provide a deeper understanding of the nature of constructivist learning in distance education environments for adult learners.

2.2.3 Interaction analysis in distance education

The concept of *interaction* and the relationship of *instructional interactions and learning* has been an area of much debate among researchers in distance education (Gunawardena & McIsaac, 2004). Despite the lack of agreement regarding a standard definition for the concept of interaction, the importance of interactions among teacher, students, and course content is a "given" (Hillman, Willis & Gunawardena, 1994).

This section explores the concept of interaction and the basic types of instructional interactions in the context of distance education environments. Then, it describes several theoretical and research approaches identified in the literature for the analysis of instructional interactions in computer-mediated learning environments.

2.2.3.1 Interaction types

Researchers and practitioners in distance education tend to use the terms "interaction" and "interactivity" to describe the same constructs; however, there are substantial distinctions between them. *Interaction* is defined as a two-way communication process within an instructional setting in which two or more participants exchange information for accomplishing a common goal (Flottemesch

(2000). *Interactivity* is defined as the extent to which participants in a communication process have control over their roles and their interactions (Severin & Tankard, 2001). In all education environments, *instructional interactions* exist across an instructor, a learner or a group of learners, and the course content.

Moore (1989) conceptualized instructional interactions as "a defining characteristic of education" (p. 2) and introduced three basic types of learners' interactions in distance education environments: (1) *learner-content interactions,* (2*) learner-instructor interactions,* and (3) *learner-learner interactions*. Later, Hillman, Willis, and Gunawardena (1994) suggested a fourth type of learner interaction: *learner-interface interactions*, in which learners interact with media to access content, to interact with instructors, or to interact with other learners. These four interaction types have served as the basis upon which others have elaborated and defined the types of interactions sustained in computer-mediated distance education environments.

Anderson (2003) defines *teacher-content interactions (T-C)* as the selection, organization, representation, adaptation, and presentation of course content by a teacher for the purpose of instruction. In CSCL environments, teacher-content interactions are mediated by authoring and delivery systems or Web-based communication tools. *Teacher-student interactions (T-S)* involve the communications between a teacher and a student with instructional, motivational, or social purposes. In CSCL environments, teacher-student interactions are mediated by computer-based tools such as electronic bulletin boards, e-mailing systems, and discussion groups.

Anderson's (2003) *student-content interactions (S-C),* also called *student-media interactions (S-M),* take most of a student's time in CSCL environments: the student must select, analyze, and transform the information received as a means to construct meaning and develop new knowledge. *Student-student interactions (S-S)* involve communications among students; in CSCL environments, a computer-mediated instructional system provides the resources for students not only to interact with the course content but also to collaborate, reflect, and learn with other students.

Most distance education designs begin with teacher-group *(T-G)* interactions. Student-student *(S-S)* interaction is an element of computer-mediated distance education environments that depends completely on the technology used. Kumpulainen and Wray (2002) found that student-student interactions *(S-S)* tend to differ from teacher-student interactions *(T-S)* in their degree of reciprocity, since turn-taking and selection of content are more distributed in student-student interactions *(S-S)* than in teacher-student interactions *(T-S).* Teacher and student interactions with content *(T-C, S-C)* are also critical in distance education environments. Clearly, effective communication processes and accommodations for diverse interaction styles are vital to effective learning, distance or otherwise (Picciano, 2001).

Effective interactions among instructor, learners, and content are a key factor in meaningful learning experiences in all educational environments; however, in CSCL environments it is not unusual for designers to overemphasize the technology sustaining instructional interactions rather than structuring content to meet the needs of learners. Information technology has the potential to enhance the presentation of information, the delivery of that information, and the interactions between instructor

and learners; however, both instructor and students determine how various technological approaches work for them (Flottemesch, 2000). Therefore, when designing or selecting media formats to support interactions in CSCL environments, the designer or instructor must carefully analyze the strengths and inherent characteristics of each format (Parker, 1999).

2.2.3.2 Interaction research

Dewey (1938) defined "growth" as the ability to secure meaning from experience and to act in ways instrumental to the achievement of worthwhile ends. Later, Vygotsky (1978) introduced the socio-constructivist view of learning, which suggests that the fundamental role of education is to facilitate individuals' personal growth. These perspectives underlie a constructivist view of learning, which assumes that learners do much more than simply process information delivered to them: they build their own understandings and interpretations through interacting with the information and the environment in which that information is presented (Wilson & Lowry, 2000).

Studies of traditional classroom interactions have found a connection between the quality of those interactions and the students' performances and attitudes, and distance educators confirm that effective interactions lead to positive educational outcomes (Flottemesch, 2000). Therefore, the educational value of the interactions among instructors and learners makes *interaction research* a prime concern in the field of education. While early research on instructional interactions had a teacher-centered view of the teaching/learning process, advances in learning theory have suggested new paradigms with diverse views of learning, leading to a shift from a

model of information transmission from teacher to students to focus on student-centered instructional interventions (Kumpulainen & Wray, 2002).

Interaction studies based on a cognitive view of learning tend to focus on the analysis of the learners' individual activities in instructional settings, together with the effects of those interactions on individual students' performance. In contrast, studies based on a socio-cultural perspective have concentrated on describing the activities of the group of students as a social entity, characterizing the features and forms of the interactions within the group of students. Both perspectives have strengths and make contributions to a holistic understanding of learning: interaction studies with a cognitive view of learning focus on the forms and functions of instructional interactions and classroom discourse as these are experienced by individuals, while studies with a socio-cultural perspective tend to investigate the construction of meaning as an interactive group process within an instructional setting. Therefore, it is increasingly common to find interaction studies that integrate both perspectives and views of the teaching/learning process (Dodson, 1999; Naylor & Cowie, 2000; Schrire, 2004; Stahl, 2005).

There is a need for a theoretical approach to conceptualize interaction research in a way that integrates these perspectives. Kumpulainen and Wray (2002) call for research to find "interpretative constructions of interactional phenomena whose aim is to describe, interpret, and predict the social activities and learning processes constructed by the participants" (p. 29) in a goal-oriented instructional communication process. To gain a deeper understanding of the nature of instructional interactions in distance education environments, Wagner (1997) suggests further

research to explore the *interaction outcomes* instead of the agents involved in or affected by those interactions. He claims that a taxonomy of instructional interactions could support both researchers and practitioners by helping them better understand the purpose, intent, and/or intended outcome of those interactions.

Several such frameworks and taxonomies of instructional interactions can be identified in the literature for *traditional classroom settings* (Bales, 1950; Kliebard, 1963; Perry, VandeKamp, Mercer & Nordby, 2002); *computer-enhanced classroom settings* (Gunawardena, Lowe & Anderson, 1997; Hara, Bonk & Angeli, 2000; Hara, 2002; Henri, 1992; Howell-Richardson & Mellar, 1996; Kumpulainen & Wray, 2002; Marra, Moore & Kilmczak, 2004; Zemel, Xhafa & Stahl, 2005); and *virtual classrooms* (Anderson, 2003; Flottemesch, 2000; Hillman, Willis & Gunawardena, 1994; Jeong, 2003; Moore, 1989; Ronteltap & Eurelings, 2002; Treleaven, 2004). The variety of settings, together with the diverse theoretical and research approaches on which these taxonomies of instructional interactions are based, illustrates the lack of convergence among theorists and researchers in terms of a preferred learning paradigm and a single set of types of interactions that sustain effective learning processes.

2.3 Classroom Discourse

This section provides a review of the research literature on classroom discourse. First, it describes several theoretical approaches for the analysis of discourse in traditional classroom environments involving face-to-face interactions between a teacher and a group of students. Then, it discusses several frameworks for the analysis of discourse in computer-mediated communication environments in

several domains. Finally, it addresses the need to conduct much more research to understand the nature of computer-mediated discourse in learning environments.

2.3.1 Research on traditional classroom discourse

Discourse in daily life and discourse in schools have many common features: both are routinized forms of behavior delineated by well-defined boundaries and well-defined sets of behavior within those boundaries. Classroom lessons are interactional in the sense that they fully depend upon the participation of many parties for the assembly of their structure (Mehan, 1985). To understand the instructional communication process, classroom-discourse researchers address the study of the communication systems and the social systems by which teachers and students interact and participate in the teaching/learning process in particular learning environments (Cazden, 2001).

Classroom discourse is defined by Pontecorvo (1997) as "any type of discourse which goes on in the classroom: between teacher and students, or among students with or without a teacher, involving an array of symbolic tools – such as written texts, narratives, books, images and equipment – all conveying sociocultural features and being part of a semiotic mediation" (p. 169). Recent research on classroom discourse has moved from a focus on discrete chunks of language to concerns with understanding the instructional communication process as a whole and with understanding the role of language and culture within instructional discourse (Adger, 2001).

A *sociolinguistic approach* to research on classroom discourse attempts to identify patterns of discourse as expressions of underlying rules and structures; an

ethnography of communication approach to the study of classroom discourse has focused on an analysis of the linguistic knowledge, interaction skills, and cultural backgrounds of all participants in any given instructional setting (Cazden, 2001; Saville-Troike, 1989). A *sociocultural approach* to research on classroom discourse conceptualizes schools as the social context in which to study cultural differences in discourse and interaction patterns, and it is more clearly oriented toward the question of how discourse can promote the construction of shared knowledge and learning (Cazden & Beck, 2003; Pontecorvo, 1997).

Within the sociolinguistic approach, several *structures of classroom discourse* can be identified in the literature as means of explaining how the organization of instruction shapes and gives form to classroom discourse and interaction patterns. Kliebard (1963) described the language of teaching by characterizing classroom-discourse units as *teaching cycles* in which four basic pedagogical moves represent the basic teaching discourse in a traditional classroom: structuring *(STR),* soliciting *(SOL),* responding *(RES),* and reacting *(REA).* The combinations of these four moves into *individual moves* (STR, SOL, RES, REA); *pairs of moves* (STR-SOL, STR-REA, SOL-RES, SOL-REA, etc.); and *combinations of multiple moves* (STR-REA-REA, STR-SOL-RES, STR-SOL-RES-RES, etc.) results in a set of 21 cycles or sequences. The cycles that were actually used by teachers being observed in several sessions within the context of traditional classroom settings were *SOL-RES* and *SOL-RES-REA.* Kliebard (1963) found that the students initiated only 15% of the teaching cycles, which implies a teacher-centered discourse model in which the students were playing the role of question-answerers much more than that of question-askers.

Within a similar research approach, the *Initiation – Response – Evaluation (I – R – E) sequence* has been identified as a basic framework for the analysis of traditional classroom discourse (Adger, 2001; Cazden, 2001; Mehan, 1985). The (I – R – E) sequence assumes that an interaction is initiated by a teacher posing a question to a group of students, continued when the teacher allocates turns to speak and answer the question to students by identifying them by name, and finishes when the teacher provides feedback on the quality and accuracy of answers. Such a model of instructional interaction clearly assumes a teacher-centered approach; however, the instructional communication process in student-centered learning environments frequently proceeds in ways that do not necessarily follow the interaction model on which the (I – R – E) sequence is based (Adger, 2001; Cazden & Beck, 2003; Pontecorvo, 1997). For instance, research in distance education for adult learners suggests that adult learners appreciate flexibility, cooperation, and reflection in their learning experiences, which can result in a learning environment with a variety of interaction modes that reflect collaboration among participants, diverse participants' roles, and diverse assessment strategies (Driscoll, 1998; Kasworm, 2003; Rudestam & Schoenholtz-Read, 2002).

2.3.2 Research on electronic discourse

The role of computers in the teaching-learning process has been the focus of much research, which could be classified into the following dimensions (Cazden & Beck, 2003): (a) research on *students talking to computers*, in which students interact with stand-alone computer-aided instruction (CAI) environments or cognitive/intelligent tutors (Aleven & Koedinger, 2002; Anderson, Corbett,

Koedinger & Pelletier, 1995; Azevedo, 2002; Lajoie, 1993; Shute & Psotka, 1996); (b) research on *students talking at computers*, in which pairs or groups of students interact with computer-supported instructional systems and also discuss their insights and points of view (Azevedo, Verona & Cromley, 2001; Cobb, 2001; Kumpulainen & Mutanen, 2000); and (c) research on *students talking through computers*, in which all interactions among students are sustained by a CSCL environment.

Computer-mediated discourse is defined by Herring (2001) as "the communication produced when human beings interact with one another by transmitting messages via networked computers" (p. 612). *Text-based* computer-mediated discourse takes a variety of forms, depending on the communication tools sustaining the interactions among participants and the social and cultural factors embedded in particular instances of computer-mediated communication (CMC) environments. Researchers from several disciplines and diverse theoretical backgrounds have attempted to study the nature of discourse within CMC environments, focusing on different aspects and different levels of communication behavior.

Early research on CMC analyzed the types of interactions and the frequency of their appearance as measures of communication behavior in CMC environments (Romiszowski & Mason, 2004). The content of transcripts representing written discourse in particular domains was analyzed and coded to describe participation trends by type, by topic, by gender, or by group. Similarly, research on computer-mediated learning environments has focused on understanding the *communicative affordances* of specific computer-based learning tools (Holt, Kleiber, Swenson, Rees & Milton,

1998; Kirschner, Strijbos, Krejins & Beers, 2004; Marra, Moore & Kilmczak, 2004; Ronteltap & Eurelings, 2002); the *frequency of interactions* among learners (Hara, 2002; Hara, Bonk & Angeli, 2000; Mowrer, 1996; Rada & Hu, 2002); and the *interaction style* of instructors and learners in distance education environments (Anderson, 2003; Chong, 1998; Davidson-Shivers, Muilenburg & Tanner, 2001; Howell-Richardson & Mellar, 1996; Jeong, 2003; Martinez, Dimitris, Rubia, Gomez & De la Fuente, 2003).

A few of these research efforts have explored the nature of the instructional communication process, communication behaviors, and instructional interactions as expressed through computer-mediated discourse in CSCL environments. Drawing from language-focused research paradigms such as pragmatics, sociolinguistics, text analysis, and critical discourse analysis, Herring (2004b) introduced *computer-mediated discourse analysis (CMDA)* as a research approach within the field of CMC research to study language form, function, and use in online interactive behavior.

The focus of CMDA research is on analyzing the linguistic structure, turn-taking features, and social practices involved in computer-mediated discourse for specific domains. The CMDA approach has been used to study micro-level linguistic phenomena such as online word-formation processes, lexical choice, sentence structure, and language switching among bilingual speakers. At a macro-level, several studies on identity, gender, and community as expressed through discourse used a CMDA approach. Herring (2004b) identified several limitations on the type of research questions that can appropriately be addressed with CMDA as an empirical, text-based approach to discourse analysis: while computer-mediated discourse

behavior can be directly analyzed, larger social or cognitive formations of interest can only be inferred.

In her review of the literature on conversation analysis for educational technologists, Mazur (2004) identified the need to explore ways to apply the research body on classroom discourse to the analysis of online conversations in CSCL environments. She introduced *conversation analysis* as a research paradigm that could serve as the methodological framework to address the issue. Conversation analysts assume that interaction patterns, trends, and behaviors of interest can be discovered and described by conducting an iterative and systematic process of analysis by listening, transcribing, and interpreting numerous instances of similar interactions in their natural setting (Ten Have, 1999).

Although conversation analysis provides a means to understand and describe interactional phenomena, current research has not defined a framework for understanding and describing the discourse mechanisms sustaining or inhibiting computer-mediated instructional conversations (Mazur, 2004, Winiecki, 2003; Zemel, Xhafa & Stahl, 2005). Further research in the context of computer-mediated instructional systems would help in understanding how conversations and interactions continue to shape and influence the instructional communication process within computer-mediated distance education environments.

2.4 Framing the study

The basic interaction types introduced by Moore (1989) and Anderson (2003) provide generic representations of the teaching/learning interactions among participants in distance education settings. These generic representations were

selected as key constructs to guide the research questions in the study because they complement each other. Taken together – and augmented by the researcher to meet the needs of this study – these types reflect the full range of interactions that should occur among instructors, learners, and content in constructivist learning environments.

These key constructs were augmented with ideas drawn from five other areas – communication theory, computer-mediated communication research, learning theory, distance education theory, and classroom-discourse research – to provide a comprehensive framework for the data collection and analysis. When the teaching/learning process is conceptualized as a communication process, the interactions among instructors and learners can be analyzed in terms of diverse *communication models and theories*. For instance, Appendix A illustrates the researcher's attempt to compare diverse communication models in terms of those constructs – information as content, communication goals, and role of audiences – that can guide the analysis of the behaviors and interactions among participants in the teaching/learning process.

Computer-mediated communication (CMC) research can also inform the analysis of the interactions among instructors and learners in computer-supported cooperative learning (CSCL) environments. Several taxonomies and models representing the interactions among instructors, learners, and content for particular settings and particular instructional strategies can be identified in the literature.

The communication process in instructional settings should also be analyzed within the framework of *learning theory*, since a particular view of learning involves

and supports particular learning goals and particular roles for instructors, learners, and media. Appendix B illustrates the researcher's attempt to analyze instruction as communication in terms of diverse learning paradigms. It also describes the nature of the learning goals, the learning activities, and the roles of participants and media as these reflect specific views of the teaching/learning process. These connections among diverse communication models and several views of learning served as an important component of the conceptual framework for this study.

To characterize online conversations as learning processes, the study draws from classroom-discourse theory and research. The basic classroom-discourse structures and instructional phases for face-to-face instructional settings (Adger, 2001; Cazden, 2001; Mehan, 1985) were selected to guide the systematic analysis of online conversations in a CSCL environment. In addition, the study draws from the taxonomy for learning, teaching, and assessing introduced by Anderson and Krathwohl (2001) to identify specific learning processes and outcomes within online conversations.

The constructs and procedures introduced by Ten Have (1999) for the systematic analysis of face-to-face conversations informed the procedures for sampling, data collection, data display, and data analysis in this study. The way in which the researcher adapted these constructs and procedures for the systematic analysis of online conversations in a CSCL environment is fully described in Chapter 3.

Chapter 3: Research Methods

This chapter describes the research paradigm upon which the design of the study is based and the research design and research methods identified as the most suitable to address the research questions. Then, it outlines the foreshadowing questions that focus the study and explains the procedures for data collection, data analysis, and data display. Finally, it describes the procedures invoked to address the issues of credibility, dependability, confirmability, and transferability.

3.1 Design rationale

Each discipline adheres to its own traditions, theoretical approaches, and research paradigms. As a first step, then, selecting the research design and methods for a particular disciplined inquiry involves identifying the theoretical and methodological connections among the disciplines in which the proposed study is grounded (Shulman, 1988). The discipline in which this study is conceptually framed is information science, which is defined by Reitz (2004) as "the systematic study and analysis of the sources, development, collection, organization, dissemination, evaluation, use, and management of information in all its forms, including the channels and technology used in its communication" (p. 358).

As a result of the inherent interdisciplinary nature of the field, information scientists rely on diverse theoretical and methodological traditions embracing both quantitative and qualitative research paradigms (Blake, 2003). Currently, there is a tendency to use qualitative research designs to address issues related to information seeking,

information use, and communication behavior by information users in natural settings (Powell, 1999; Wang, 1999).

The qualitative research paradigm assumes that reality is constructed by individuals according to the experiences and meanings that they bring to any given activities, processes, or phenomena. The focus is on the participants' perspectives, which reflect multiple realities as described and reconstructed by the researcher (Creswell, 1994). Research design evolves in a way that allows participants' understanding of a phenomenon to emerge as fully and deeply as possible.

The strengths of the qualitative paradigm derive from its inductive approach, its focus on specific situations, and its focus on narratives rather than on parameters or measures. Therefore, the main research questions for which a qualitative research paradigm are well-suited tend to address the nature of events, processes, and actions involved in a phenomenon of interest in a particular context in which the participants act and make sense of their own perspectives and experiences (Maxwell, 1996).

Qualitative research is interactive, inductive, and highly reflective. It requires the researcher to build constructs, interpretations, and theories from interaction with the data gathered from the natural setting in which the study takes place. Creswell (1998) defines qualitative research as "a process of understanding based on distinct methodological traditions of inquiry that explore a social or human problem in a natural setting" (p. 15). In general terms, the research questions to be addressed in a qualitative study come from a researcher's deep interest in understanding the nature of real-world events or processes within an everyday context. Procedures for data collection and data analysis, theory development and refinement, reflection and

reformulation of research questions, and identification and elimination of threats to validity are conducted in parallel, each activity influencing all the others (Maxwell, 1996).

This study is based upon a qualitative research paradigm because it focuses on understanding the nature of the instructional communication process as it is situated in an authentic context. In this context – a particular distance education environment – the perspectives and individual experiences of the course participants converge in instructional interactions and communicative events directed toward learning. Understanding these elements and their convergence requires the deep and extensive probing that is characteristic of qualitative research.

The constructs and research questions guiding the study are grounded in learning theory, distance education theory, and the theories represented by various communication models; however, since the research process was sensitive to the interpretations and themes emerging from the interaction of the researcher with the data gathered from the environment, the research questions evolved as the study proceeded.

3.2 Research design

Stake (1995) defines a *case* as "a specific, complex, functioning, bounded system" (p. 2). An attempt to study a particular case in its context involves seeking a detailed understanding of the interactions among multiple elements. It requires several procedures for data collection, several levels of analysis, and specific procedures for verification of the research results. Therefore, *case study research* has

been characterized as one of the most challenging of all social science endeavors (Yin, 2003).

Case study research is a fairly new tradition in the field of information science. Powell (1999) defines it as “in-depth, detailed study of one subject, that subject being one person, one specific group composed of many people, or one organization composed of many subgroups” (p. 96). Information science researchers typically conduct qualitative case studies with a focus on observing and analyzing the behavior of information users as it occurs naturally, in real-life situations (Wang, 1999). Since case study research assumes that each case is unique in its situation and context, it supports the field’s shift toward a user-centered approach to studying the individual, situational, environmental, and historical conditions inherent in information-related behavior (Fidel, 1993).

Several definitions of case study research can be found in the education literature as well: Bogdan and Biklen (1998) define it as “the detailed examination of one setting, a single subject, or a particular event” (p. 54), while Creswell (1998) defines it as "an exploration of a bounded system over time through detailed, in-depth data collection from multiple sources of information rich in context" (p. 61).

This research is based upon a *single case study design* because the purpose of this study is to understand the nature of the instructional communication process as it is supported by computer-mediated instructional systems for adult learners in a particular distance education environment. In this case, the individual perspectives and experiences of both instructors and learners converged to sustain instructional interactions and communicative events for learning.

The study's focus is on the interactions and the communicative events carried out as online conversations in a specific course. Several factors inherent in the course selected as the unit of analysis, such as the course content and the instructor's and the students' previous experiences with computer-mediated instructional systems, make it a particular instance of a distance education environment that does not represent all instances of the distance education paradigm. Thus, the study's results can not be generalized to other distance education courses. However, to increase the transferability of the results to similar settings, a full description of the study setting and a detailed description of the research process itself are provided.

3.3 Case selection

The following sections describe the criteria used by the researcher to select a particular course as an instance of the phenomenon of interest. The procedures conducted to obtain the participants' permission to access the course data for research purposes are also discussed.

3.3.1 Unit of analysis

The unit of analysis was the archive of transcripts from a course on electronic reference services for adult learners in a distance education environment. Computer-supported communication tools mediated all the interactions among the course participants, and the resulting transcripts were analyzed in the context of the instructional unit in which they took place within the course. Thus, while the interactions of course participants were not directly observed – as they are in most qualitative studies – the archive served as a surrogate for those interactions that

allowed the researcher to investigate processes and actions aimed specifically at meaning making (Maxwell, 1996).

3.3.2 Selection criteria

A course was selected following a theoretical construct sampling strategy (Lindlof, 1995) in which the nature of the phenomenon of interest is defined well before the researcher goes to the field. For this study, the course selected as the unit of analysis had to match each of the following pre-defined criteria:

- Adult learners as the target audience. *Adult learners* are defined as non-traditional students who are highly motivated, self-directed, self-reflective, independent, willing to collaborate with others, and willing to participate in group decision-making processes (Eastmond, 1998).
- A constructivist view of learning as the basis for the design and delivery of instruction. *Constructivism* is defined as a view of the teaching-learning process that emphasizes the learners' own meaning making and intentionally seeks to relate new ideas to the learners' prior knowledge and experiences (Jonassen, 1999). In a constructivist learning environment, learners often work together and support each other as they use a variety of tools and information resources in their guided pursuit of learning goals and problem-solving activities (Wilson, 1996).
- A virtual classroom within a distance education environment with no face-to-face communication among participants. A *virtual classroom* involves an instructional situation in which (1) an instructor and a group of learners interact through a computer-mediated learning environment; (2) computer-

mediated tools provide several mechanisms to support communication and collaboration; and (3) both instructor and learners have opportunities to interact with each other and with the course content and instructional resources within the computer-mediated environment (Motiwalla & Tello, 2000). A virtual classroom can also be called an *online classroom* or an *electronic classroom.*

- A computer-supported cooperative learning (CSCL) environment supporting the instructional interactions among participants as the delivery system. Features of both synchronous and asynchronous communication are included in this environment.

3.3.3 Access

The researcher contacted a faculty member who has been designing and conducting distance education courses for adult learners for several years. Once the faculty member understood the nature of the study, she granted the researcher access to archival data from a distance education course taught during a summer session. The CSCL environment supporting the course was WebCT, which afforded participants with diverse computer-based communication features. The researcher will keep a copy of WebCT archives with online conversations among participants in the course for up to five years.

3.3.4 Informed consent

As part of the course, the students were asked to complete an online form granting or withholding permission to access the information related to their participation within the course for research purposes (Appendix D); all students who

participated in the course granted this permission. The participants' names and affiliations have been edited in all the transcripts in an attempt to protect their privacy. To protect the instructors' privacy, their names and affiliations were also edited in the transcripts.

Appendix D includes copies of forms received from the Human Subjects Review Board at the University of Maryland College Park confirming that the researcher was granted permission to access the archival data within WebCT.

To allow the researcher efficient access to the data, a course roster was created for the study in which participants were identified by alphanumeric codes that were used consistently throughout the work. F1 was the lead instructor, while F2 participated in particular modules of the course. Guest speakers (E1, E2, E3, E4 and E5) were assigned their IDs according to the sequence in which they appeared in the course conversations. Students were assigned their IDs (S1 to S29) according to the alphabetical order of their last names.

3.3.5 Pilot study

Before the full study began, a pilot study was conducted to test the proposed research design and procedures. A set of six conversations from a section of the course that would not be used for the final study was selected for analysis. Three asynchronous conversations from the electronic bulletin board and three synchronous conversations from the chat room sessions composed the data set for the pilot study.

The procedures introduced by Ten Have (1999) for the analysis of face-to-face conversations were easily adapted and applied to the analysis. Previous research on classroom discourse for face-to-face instructional settings was adapted and used to

guide the exploration and elaboration phases of the analysis at the macro level. The conversational features (Malmkjaer, 2000; Ten Have, 1999) and the basic structures of classroom discourse (Adger, 2001; Cazden 2001; Mehan, 1985) selected from the literature proved to be appropriate without revision.

A preliminary coding scheme created to represent the concepts and constructs guiding the content analysis was revised in light of the themes that emerged from the data during the analysis at the micro level. Four types of knowledge – factual, conceptual, procedural, and metacognitive – derived from the taxonomy introduced by Anderson and Krathwohl (2001) as well as four new interaction types that emerged from the data were included in a revised coding scheme.

The proposed analytic procedures and the revised coding scheme proved to be appropriate for use in the full study. Specific changes that informed the data analysis are described in the appropriate sections that follow.

3.4 Case description

The following sections describe the course selected for the study in terms of (1) the university offering the course, (2) the course content, (3) the instructional team, (4) the students, and (5) the CSCL system that mediated the interactions among the course participants.

3.4.1 The host institution

The course selected for the study was offered during a summer session as a graduate course at a public, research-oriented state university in the United States. The university campus hosting the course is the largest one in its university system, with 25,000 undergraduate students, 10,000 graduate students, and 3,661 faculty

members. The college that offered the course has 17 full-time faculty members, 44 adjunct faculty members, 7 emeritus faculty members, and 9 staff members. It serves an average of 350 graduate students by offering two Master's degree programs and a Ph.D. program.

3.4.2 The course

The course is an elective, normally taken by adult students who have already completed all core courses in a Master's or who are enrolled in a Ph.D. program. The course includes several sections, addressing not only the course content but also links to (a) additional information relevant to the course content and (b) comprehensive information about the technical specifications and features of the CSCL environment. The course content was delivered in the following six sections:

(1) *WebCT tips,* which provides a WebCT student manual with a comprehensive description of the features and technical requirements of WebCT as the CSCL environment hosting the course. The section also includes guidelines for students' interactions online with each other during the course.

(2) *Course orientation,* which provides the course syllabus, the course goals, the course calendar of activities, a full description of the instructional activities designed for the course, and the evaluation criteria to be used by the instructional team. The section also provides access to a pre-assessment survey instrument and to the consent form described above. Finally, this section introduces the instructional team members and

instructs each student to create his/her own Web site within the WebCT environment.

(3) *Course content*, which provides all the concepts and procedures related to the subject matter of the course, grouped in several modules by topic. The section includes a detailed description of the learning objectives for each topic and a description of the instructional activities designed by the instructional team to support students in achieving those objectives.

(4) *Course resources,* which provides access to the following resources:

- An electronic calendar to keep track of individual and team projects scheduled as part of the course.
- A glossary, created by the instructional team, with definitions of concepts and procedures relevant to the course content.
- Links to additional readings, bibliographies, bibliographic databases, and Web sites relevant to the course content.
- Links to the archival data with the conversations among the instructional team and the students in the chat rooms assigned to "dialogue with an expert" and "office hours."
- A space for the instructors to retrieve transcripts of conversations among participants in chat rooms.

(5) *Communication tools,* which provides access to several computer-based communication spaces for the instructional team, guest speakers, and students to pursue discussions in a synchronous or asynchronous format. The communication spaces provided are:

- An electronic discussion board for asynchronous conversations between the instructional team and small groups of students, grouped by topic.
- A chat room for students to interact with the instructional team during "office hours."
- Two chat rooms to serve as private workspaces where students can discuss their team assignments.
- A chat room for a faculty member and a small group of students to pursue a "dialogue with an expert."
- An e-mail system for the instructional team and students to pursue conversations in an asynchronous format.
- A space for the students' individual Web sites with their contact information and individual assignments.

It is notable that none of these tools allows synchronous communication with the class as a whole, only with segments of the class. This lack of opportunity for synchronous communication with entire classes is one key distinction between current CSCL environments and "traditional" classrooms.

(6) *Course wrap-up*, which includes a post-assessment survey instrument to keep track of the students' expectations and perceived levels of satisfaction after the course. The section also provides instructions for students to evaluate the relevance of the course content, the role of the instructional team, and the quality of the instructional activities included in the course.

3.4.3 The instructors

A faculty member, a teaching assistant, and five guest speakers participated as the instructional team in the course. The team had previously collaborated in the design and delivery of workshops and lectures for professional development; however, the course itself represented only the second time the team had designed and delivered a computer-mediated distance education course with no face-to-face interactions among participants as part of an academic curriculum. The diversity in the backgrounds and professional expertise of the instructional team ensured an interdisciplinary view of the topics included in the course content and a variety of instructional activities to support students in achieving their learning goals.

3.4.4 The students

A total of 29 students participated in the six-week course during a summer session. All the students were pursuing a graduate degree in a college in which the average age of students is 32 years and in which most of the students work full time, generally taking no more than two courses a semester and one or two courses each summer. The space for the students' individual Web sites did not provide the researcher access to either demographic or cultural information about the students participating in the course; therefore, an understanding of how individual and cultural differences could have influenced the interactions among students was beyond the scope of the study.

3.4.5 The CSCL environment

WebCT is a Web-based virtual course environment that supports faculty as they prepare, deliver, and manage computer-based courses (WebCT Web site, 2005).

The course selected for the study was designed and delivered online by using WebCT, which afforded participants with several computer-based instructional communication tools.

a) Communication features used by *students:*
    - Read messages and materials posted by instructors
    - Create Web sites as individual information spaces
    - Use chat rooms as shared workspaces for team assignments
    - Answer online survey instruments
    - Submit assignments in a Drop Box
b) Communication features used by *the instructional team:*
    - Post course materials, presentations, transcripts, and announcements
    - Read messages and materials posted by students
    - Retrieve transcripts from chat rooms
    - Design and deliver online survey instruments
c) Communication features used by *all participants:*
    - Create, send, and store e-mail messages
    - Read messages and materials posted by students
    - Use chat rooms as shared communication spaces
    - Read transcripts from chat rooms posted by instructors
    - Look at Web sites with information relevant to the course content

WebCT also provided access to the course archival data from the online discussions and conversations between instructors and students with both synchronous and asynchronous communication tools. In the archival raw data, the messages posted by each participant within conversations in the chat room were identified by the participant's name. The messages posted by each participant within conversations in the electronic bulletin board or the e-mailing system were identified by the participant's name, the date in which the message was posted, and the subject or topic of each message.

3.5 Data collection

Merriam (1998) defines a *document* as "a wide range of written, visual, and physical material relevant to the study at hand" (p. 112). Yin (2003) describes *documentary information* as a relevant data source in qualitative inquiry that "tends to be stable, unobtrusive, with a broad coverage, including a long span of time, many events, and many settings" (p. 86).

Documents and *artifacts* provide qualitative researchers with a means to reconstruct and interpret past or ongoing events, processes, and phenomena that are not available for direct observation (Lindlof, 1995). Types of documents may serve any of the following purposes as research materials in a qualitative study: (a) texts, including particular features of those texts which are themselves the object of study; (b) texts representing utterances and events from specific groups whose behavior is the focus of the study; and (c) texts representing communication components that could serve as indicators to analyze communication processes or situations of interest for a researcher (Titscher, Meyer, Wodak & Vetter, 2000). Because texts can serve so

many purposes, it is extremely important to define the particular function of documents as data sources in a study before selecting the procedures for data collection and data analysis.

For this study, the various kinds of online messages created by the instructors, guest speakers, and students were conceptualized as *documents* representing instructional interactions and communication events. A conversation analysis procedure introduced by Ten Have (1999) was used as the main theoretical and procedural structure for gathering and transcribing data for the study.

3.5.1 Sampling

All relevant information within the WebCT environment was copied and integrated into a case study database as *raw data.* Thus, information on the syllabus, the instructional goals, the instructional activities, the instructional team, the students, and all interactions among instructors and students was included in the case study database (Table 3.1). Because it encompassed too much data to be analyzed for the study, relevant information within each of the course sections was selected according to a *purposive sampling strategy* to obtain a wide range of types of data to analyze.

Conversations were selected by the researcher to include a variety of types of interactions: (a) conversations sustained in several types of interaction formats, (b) conversations supported by several communication channels, (c) conversations representing the discourse of diverse course participants, (d) conversations representing diverse instructional activities, and (e) conversations representing several stages of the instructional communication process.

The resulting data set included four synchronous conversations selected from the chat room sessions and four asynchronous conversations selected from the electronic bulletin board (Table 3.2). The conversations included in the data set represent diverse stages in the course, diverse instructional activities, and diverse participation patterns. The students were required to participate in several asynchronous conversations – A1, A2, and A4 – as part of their individual assignments, while their participation was optional in all synchronous conversations – S1, S2, S3, and S4 – and one of the asynchronous conversations – A3 – in the data set (Table 3.3).

Section	Information units relevant to the analysis	Unit of Analysis	Participants
Course orientation	Course syllabus Instructional goals Evaluation criteria Assessment tools Research consent form Instructional team profile	Instructors' notes	Instructional Team
Course content	Instructions for individual and team assignments	Instructors' notes	Instructional Team
Course resources	Dialogue with experts	Synchronous conversations	Faculty Member, Guest Speakers and Students
	Virtual office hours	Synchronous conversations	Faculty Member and Students
Communication tools	Bulletin board discussions	Asynchronous conversations	Instructional Team and Students
Course wrap-up	Instructions for individual course evaluation	Instructors' notes	Instructional Team

Table 3.1: Information from each course section included in the data set

Conversation type	ID	Description	Participants	Date
Synchronous	1	*"Dialogue with E1,"* a conversation in which F1 moderates the interactions of a small group of students with an expert in the field.	S1, S3, S6, S8, S14, S17, S21, S23, S25, S27, F1 and E1	June 9 (1 hour)
	2	*"Dialogue with E2,"* a conversation in which F1 moderates the interactions of a small group of students with an expert in the field.	S1, S3, S12, S14, S17, S20, S22, S25, S27, F1 and E2	June 16 (1 hour)
	3	*"Dialogue with E3 and E4,"* a conversation in which F1 moderates the interactions of a small group of students with two experts in the field.	S1, S5, S6, S9, S13, S14, S16, S18, S21, S26, S27, F1, E3 and E4	June 22 (1 hour)
	4	*"Dialogue with E5,"* a conversation in which F1 moderates the interactions of a small group of students with an expert in the field.	S6, S8, S11, S13, S17, S21, S25, F1 and E5	July 1 (1 hour)
Asynchronous	1	*"Two points of view,"* a conversation in which students share their insights about two points of view discussed in diverse articles included in the course **(Required)**	F1, F2, and all students but S20 and S24	From May 31 to July 7
	2	"Listserv," a conversation on topics emerging from virtual discussion groups and related to the course content **(Required)**	S1, S3, S5, S6, S7, S8, S9, S10, S11, S12, S13, S14, S16, S18, S19, S21, S22, S23, S25, S26, S27, S28, S29, F1 and F2	From June 2 to July 9
	3	*"Software tools,"* a conversation on topics and questions related to exercises involving the use of diverse software tools	S1, S3, S6, S9, S11, S13, S15, S28, F1 and F2	From June 5 to July 2
	4	*"Course evaluation,"* a conversation in which students share their insights anonymously about the course and the instructional team **(Required)**	Anonymous students, F1 and F2	From July 6 to July 9

Table 3.2: Conversations included in the data set
F: faculty member. *E:* guest speaker. *S*: student.

Participant	Synchronous Conversations				Asynchronous Conversations			
	1	2	3	4	1	2	3	4
F1	X	X	X	X	X	X	X	X
F2					X	X	X	X
E1	X							
E2		X						
E3			X					
E4			X					
E5				X				
S1	X	X	X		X	X	X	X
S2					X			X
S3	X	X			X	X	X	X
S4					X			X
S5			X		X	X		X
S6	X		X	X	X	X	X	X
S7					X	X		X
S8	X			X	X	X		X
S9			X		X	X	X	X
S10					X	X		X
S11				X	X	X	X	X
S12		X			X	X		X
S13			X	X	X	X	X	X
S14	X	X	X		X	X		X
S15					X		X	X
S16			X		X	X		X
S17	X	X		X	X			X
S18			X		X	X		X
S19					X	X		X
S20		X						X
S21	X		X	X	X	X		X
S22		X			X	X		X
S23	X				X	X		X
S24								X
S25	X	X		X	X	X		X
S26			X		X	X		X
S27	X	X	X		X	X		X
S28					X	X	X	X
S29					X	X		X

Table 3.3: Participants in each type of conversation in the data set

3.5.2 Transcribing

It is often said that transcripts are not "data" but rather a convenient way to capture and present interactional phenomena of interest in written form. Despite the lack of standard procedures for transcribing and formatting verbal interactions, most researchers have agreed on the need for symbolic notations and formats to preserve some of the key features of talk-in-interaction. Furthermore, the transcription process is itself an opportunity for the researcher to gain a better understanding of the features of interactions and to discover interactional patterns, trends, or events (Psathas, 1994; Ten Have, 1999).

Table 3.4 shows the transcription elements suggested by Ten Have (1999) for the analysis of verbal interactions, compared with the elements adapted for the analysis of online conversations as the focus of this study.

Transcription elements suggested by Ten Have (1999) for the analysis of verbal interactions	**Transcription elements adapted from Ten Have (1999) for the analysis of online interactions**
• Time, date and place of the original recordings • Identification of the participants • Words as spoken • Sounds as uttered • Inaudible or incomprehensible sounds or words • Spaces / Silences • Overlapped speech and sounds • Pace, stretches, stresses, volume, etc.	• Transcript ID • Page numbers • Line numbers • Time, date and context of each conversation • Participants in each conversation • Words as written in each conversation • Delays within each conversation • Overlapped messages within each conversation

Table 3.4: Transcription elements adapted for the study

As illustrated in Table 3.4, the transcripts created from the course archival data contained the following elements, adapted from the procedures suggested by Ten Have (1999) for face-to-face conversations: (a) a means to identify each transcript; (b) page numbers; (c) line numbers; (d) the time, date, and context of each conversation; (e) a means to identify each participant in a conversation; (f) words as written in each conversation; (g) delays within conversations among participants; and (h) overlapped messages within conversations among participants. The researcher accessed the course archives in WebCT, obtained an electronic copy of the text within each conversation, and then created an MS Word file for it. To protect the identity of the course participants, their names and affiliations were edited within all transcripts.

Appendix E shows a sample transcript representing a synchronous conversation among a faculty member (F1), a small group of students (S3, S6, S8, S23, S1, S21, S27, S25, S14, and S17), and a guest speaker (E1) as part of an instructional activity called “Dialogue with Experts.” The transcript shows the conversation with the turns taken by each participant, the original messages obtained as raw data from the course archives, and the transcript elements added by the researcher (page numbers, line numbers, conversation source, and conversation ID); all elements added by the researcher are shown in italics.

Appendix F shows a sample transcript representing an asynchronous conversation between two members of the instructional team (F1 and F2) and almost all the students in the class participating in a course exercise involving the exchange of topics discussed in several mailing list servers. The transcript shows the original messages obtained as raw data from the course archives as well as the transcript

elements added by the researcher (page numbers, line numbers, conversation source, and conversation ID); all elements added by the researcher are shown in italics.

3.6 Data analysis

Computer-mediated instructional systems provide researchers with access to written conversations and trails of behavior that are the object of analysis for several educational technologists (Savenye & Robinson, 2004). Previous studies on interaction research in computer-mediated instructional settings have categorized not only interaction styles but also interaction patterns or modes, which have been used to identify the number, frequency, and types of interactions by individual participants or by groups of participants. However, very few of these studies have described the interactional phenomena and communication processes sustaining and enhancing those interaction styles, patterns, and modes in instructional settings.

This study builds on previous research by analyzing the interactions among instructors and students in a CSCL environment from two perspectives: a *macro level of analysis*, in which each conversation was analyzed in the context of the instructional unit in which it took place within the course, and a *micro level of analysis*, in which each message within a conversation was considered a unit of analysis. Within each of these two general perspectives, a variety of specific analytic foci were included. The result of this multifaceted approach is a comprehensive and integrated picture of instructional communication in a CSCL environment.

Data analysis included (a) *conversation analysis* to explore the nature of the instructional communication process in a CSCL environment and (b) *content analysis* to identify the types of interactions, cognitive processes, and types of knowledge that

converged in the course. The procedures for conversation analysis attempted to answer research questions at the "macro" level, while the procedures for content analysis addressed questions at the "micro" level. The QSR NVivo software version 2.0 (QSR Web site, 2005) was used to support the procedures for data collection, data display, and data analysis in the study.

3.6.1 Conversation analysis

Conversation analysts assume that interaction patterns, trends, and behaviors of interest can be discovered and described by conducting an iterative and systematic process of analysis by listening, transcribing, and interpreting numerous instances of similar interactions in a natural setting (Malmkjaer, 2002; Psathas, 1994; Ten Have, 1999). Therefore, conversation analysis has been characterized as an inductive search for patterns of interaction, resulting in the formulation of an interpretative structure of the actions being accomplished by the participants in a conversation, that is grounded in the participants' reality (Ten Have, 1999).

Table 3.5 shows the research questions guiding the conversation analysis. The following sections describe the procedures used for sampling, data display, exploration, elaboration, and validation in the analysis of online conversations among the instructional team, guest speakers, and students.

Unit of analysis: The conversation analysis procedures introduced by Ten Have (1999) suggest two phases: (a) a phase of *analytic exploration*, in which the researcher conducts a systematic analysis of individual instances of an interactional phenomenon of interest, and (b) a phase of *elaboration*, in which the researcher extends the analysis to a larger corpus of individual conversations for comparative

purposes. During the analytic exploration phase of this study, each *individual conversation* was considered a unit of analysis. During the elaboration phase, *all conversations* were analyzed in the context of the course selected for the study.

Method	**Level of analysis**	**Unit of analysis**	**Research questions being addressed**
Conversation analysis	Macro	Conversations	Q#2: What types of instructional interventions and activities are supported and enhanced by CSCL systems for adult learners in constructivist distance education environments? What types are discouraged or impeded? Q#3: How and to what extent can the available research body on classroom discourse be applied to the analysis of online conversations in CSCL environments? Q#4: How and to what extent do online conversations serve as evidence of teaching/learning processes and learning outcomes? Q#5: What type of model best represents the computer-mediated communication process among adult learners and their instructors in constructivist distance education environments? Q#6: How and to what extent could the systematic analysis of online conversations inform the instructional design process for adult learners in computer-mediated distance education environments? Q#7: How and to what extent could the systematic analysis of online conversations inform the design and evaluation of computer-mediated instructional systems in distance education environments?

Table 3.5: Research questions guiding the conversation analysis

Conversational features: A systematic analysis of conversations should be grounded in constructs and concepts representing the features and structures that produce interaction patterns, such as turn-taking, topic-management, topic-shift, preferences, conversational sequences, and conversational repairs (Malmkjaer, 2002; Ten Have, 1999). Classroom discourse, like the discourse for many other individual domains, has a particular organization (Mehan, 1985). Therefore, the conversational features selected for the systematic analysis of the participants' discourse in online conversations reflect that organization: (1) *turn-taking,* the construction of turns, pauses, delays, or overlaps in the flow of a conversation; (2) *discourse sequences,* the sets of conversational actions represented in the discourse produced by each participant; (3) the *roles of course participants* in terms of the ways in which they interact with each other and with the course content; and (4) the *role of media* supporting the instructional interactions among the course participants within a CSCL environment.

Data display: Miles and Huberman (1994) suggest that qualitative researchers create and use data displays during the process of data analysis to provide visual representations of the context, core concepts, relationships, or salient properties of the phenomenon of interest. For this study, *conversation charts* were created to represent the discourse sequences, interaction types, cognitive processes, and knowledge types identified for each conversation. A single chart was done for each conversation in the data exploration phase. Then, the charts were contrasted and compared within and across each type of conversation – synchronous or asynchronous – as part of the data elaboration phase.

Appendix G shows a chart representing the synchronous conversation in Appendix E, while Appendix H shows the chart representing the asynchronous conversation in Appendix F. The symbols incorporated in the appendices are explained in the following sections, which provide details of how the data-display charts were used to support the data analysis.

Data analysis: The phase of analytic exploration was conducted by reviewing each transcript. The first step was the selection of *a conversation*. Then, *a discourse sequence* within the conversation was selected by locating the turn in which one of the participants initiated an action and/or a topic that was taken up or responded to by other participants. In synchronous conversations, a discourse sequence was identified as the set of turns taken by a faculty member, a guest speaker, and/or a student to pose a question, to respond to a question, or to provide feedback in relation to the responses of other participants. In asynchronous conversations, a discourse sequence was identified as the set of turns taken by participants to create and post individual messages to start discussions and/or to respond to messages posted by other participants. Once the discourse sequences had been identified, the actions within each sequence and their relationships with other actions in the sequence were analyzed in a turn-by-turn basis.

Several conversational actions derived from the literature in traditional classroom discourse analysis (Adger, 2001; Cazden, 2001; Mehan, 1985) were included in the pilot study as a preliminary framework for analysis of online conversations: *(O)* opening/starting a conversation, *(C)* closing/terminating a conversation, *(I)* initiating a sequence/eliciting participation, *(R)* responding to a

request for participation/elicitation, *(E)* evaluating the quality of a response, *(F)* providing feedback to other participants, and *(A)* acknowledging other participants' responses. Then, the new actions that emerged from data in the pilot study were also included in a revised framework for the analysis: *(G)* greeting/introducing participants, *(P)* probing participants for clarification or to confirm their responses, and *(S)* stating facts relevant to a topic (Table 3.6).

Unit of analysis	**Code**	**Definition**
Actions	O	Opening/starting a conversation/session
	C	Closing/terminating a conversation/session
	I	Initiating a sequence/eliciting participation
	R	Responding to a request for participation/elicitation
	E	Evaluating the quality of a response
	F	Providing feedback to other participants
	A	Acknowledging other participants' responses
	G	Greeting/introducing participants
	P	Probing participants for clarification or to confirm their responses
	S	Stating facts relevant to a topic

Table 3.6: Revised framework for the "macro" analysis of online conversations (adapted from Cazden, 2001, and Mehan, 1985)

The research on the analysis of face-to-face classroom discourse reports that lessons in teacher-centered environments are generally represented with a teacher initiating a conversation by eliciting participation from students *(I)*; then, the teacher

allocates the turn to respond to a student *(I – R);* finally, the teacher evaluates the quality of the student's response, resulting in a discourse sequence of type *(I – R – E),* with a single turn by participant and a single action per turn. In the sample of online conversations selected for this study, however, a single conversation generally had more than one discourse sequence, a discourse sequence usually included more than one turn by each participant, and a single turn often represented one or more actions by each participant.

For instance, Table 3.7 shows an excerpt from a synchronous conversation among a faculty member (F1), a guest speaker (E2), and a small group of students. F1 opens the session *(O)* by welcoming the audience: one small group of students participating as active members with the right to pose questions, another small group of students participating as observers with no intention to ask any questions, and a guest speaker (E2) participating as an expert in a domain. F1 acknowledges E2's participation in the session *(A).* Then, F1 requests S3 to pose a question for E2, initiating *(I)* a discussion related to a specific topic from the course. S3 responds by posing a question *(I – R).*

Before responding, E2 provides feedback to S3 on the quality of her question, resulting in the sequence *(I – R – F).* When E2 proceeds to answer the question by posting several short messages, the sequence evolves to *(I – R – F – R).* Then, F1 addresses S3 to determine whether the answer has been consistent with her expectations *(I – R – F – R – P).* S3 replies *(I – R – F – R – P – R)* and politely acknowledges E2's response to her question *(I – R – F – R – P – R – A).*

Expert Chat with E2	
Participants' discourse	**Discourse sequences**
F1>>We are ready to get started.	*O:* A faculty member opens a synchronous conversation in a chat room session
F1>>Thanks for joining us today, E2.	*A:* The faculty member acknowledges E2's participation in the session
F1>>S3, do you have a question?	*I:* The faculty member initiates a discourse sequence by inviting one of the students to pose a question
S3>>You indicate in [your article] that librarians should consider switching a conversation with a patron into another medium (e.g., from chat to phone) if they feel the conversation would work better there? I can see that chat works best when the question involves co-browsing; could you make any generalizations about which sort of medium works best for other sorts of questions?	*I – R:* The student responds by posing a question
E2>>Wow, good question...	*I – R – F:* The guest speaker provides feedback on the quality of the question posed by the student before answering it
E2>>I wrote that in part as a reminder to myself and my colleagues...that when VR questions get out of control – 20 minutes and no progress toward resolution – we shouldn't be locked into thinking we have to stay online to answer their question, no matter how long it takes we can eventually figure out that we and the patrons are so confused that we should just write, "Hey, can I call you?" I can't generalize well about what types of questions work well in which media, except to say that some questions – maybe the vague, ill defined ones – and some patrons...I'm thinking of the ones who are very unfamiliar with the library try to chat with us and nothing we say makes sense, and chatting takes so darn long, so it doesn't seem like the medium when you and the patron are confused. END.	*I – R – F – R:* After providing feedback to the student, the guest speaker answers the question
F1>>S3, does that answer your question?	*I – R – F – R – P:* After answering the question, the guest speaker probes the student to confirm if the answer is consistent with her expectations
S3>>yes	*I – R – F – R – P – R:* The student confirms that the answer was fine
S3>>thank you.	*I – R – F – R – P – R – A:* The student acknowledges the response to her question

Table 3.7: Conversation analysis of a discourse sequence

The full set of actions and sequences representing the communication behavior of the participants in the excerpt of the synchronous conversation shown in Table 3.7 is as follows:

F1 > (O)
F1> (A)
F1 > (I)
S3 > (I – R)
E2 > (I – R – F)
E2 > (I – R – F – R)
F1 > (I – R – F – R – P)
S3 > (I – R – F – R – P – R)
S3 > (I – R – F – R – P – R – A)

The set of actions and discourse sequences identified for each conversation was also analyzed in terms of other conversational features of interest, such as *overlapping* and *delay* in turn-taking. The role of each participant and the role of the media supporting the interactions among participants were also analyzed for each conversation.

Appendix B illustrates the researcher's attempt to describe the roles of instructors, learners, and media in the teaching/learning process within diverse learning paradigms. These roles were derived from constructs and concepts representing the connections among several learning paradigms (Greeno, Collins & Resnick, 1997; National Research Council, 2001) and several communication models (Rogers, 1980; Schramm, 1971; Shannon & Weaver, 1964; Vickery & Vickery, 2004). These connections guided the analysis of the participants' roles as well as the role of the CSCL environment in the course selected for the study.

The categories guiding the *analysis of the instructors' roles* are (a) planning and delivering instruction, (b) providing course content, (c) providing opportunities for students to assemble knowledge, (d) providing opportunities for students to collaborate and exchange ideas, (e) modeling and guiding the knowledge-construction process, (f) moderating or guiding collaborative processes such as argumentation and knowledge sharing, (g) encouraging students to develop cognitive strategies, and (h) encouraging students to develop self-regulation strategies (Appendix B).

The categories guiding the *analysis of the students' roles* are (a) apparently passive, (b) actively selecting and interpreting information, (c) actively participating in assessment, (d) assessing personal progress, (e) reflecting on personal learning strategies, and (f) creating personal interpretations of the world (Appendix B).

The categories guiding the analysis of the role of *a CSCL environment* are (a) a communication space for information dissemination; (b) an information space for information acquisition, information processing, knowledge representation, and knowledge integration; (c) an interactive space for information discovery, information exploration, knowledge construction, knowledge integration, and self-regulation; and (d) a collaboration space enhancing collaborative problem-solving and decision-making, collaborative argumentation, knowledge sharing, and knowledge integration (Appendix B).

The phase of elaboration was conducted by analyzing the conversation charts created to contrast and compare the main conversational features within and across each type of conversation. The data provided evidence that the participants' discourse in these synchronous conversations was *well-structured* and composed of a set of

phases – opening, instructional delivery, and closing – identified in the literature of classroom-discourse research (Mehan, 1985). In contrast, the asynchronous conversations can be characterized as *ill-structured*, since only the opening phase or the instructional delivery phase was represented in the participants' discourse.

The synchronous conversations were moderated by a faculty member, a structure that did not encourage interactions among students. The asynchronous conversations provided extensive evidence of interactions among students as opportunities for information sharing and collaborative learning processes, as discussed in chapter 4.

3.6.2 Content analysis

Content analysis provides procedures that allow researchers to make valid inferences from text by describing trends in communication content; auditing communication content against standards or specific objectives; and reflecting cultural patterns of groups, institutions, and societies (Weber, 1990). In computer-mediated communication (CMC) research, content analysis is one of the most widely used research methods for the analysis of communication behavior (Herring, 2004a; Romiszowski & Mason, 2004). The research questions guiding the content analysis in the study are shown in Table 3.8. The following sections describe the frameworks and the procedures used to address those questions.

Unit of analysis: Each message within each conversation was considered a unit of analysis that could be broken into several ideas or arguments. Therefore, all ideas and arguments within each message were analyzed in the context of the conversation in which that message took place.

Method	Level of analysis	Unit of analysis	Research questions being addressed
Content analysis	Micro	Messages	Q#1: What types of interactions are supported and enhanced by CSCL systems for adult learners in constructivist distance education environments? What types are discouraged or impeded? Q#4: How and to what extent do online conversations serve as evidence of learning processes and learning outcomes?

Table 3.8: Research questions guiding the content analysis

Procedures: The analysis was based on the methodology introduced by Strauss and Corbin (1998) as *open coding,* which is an iterative process of data interpretation. The researcher began by analyzing *salient phrases*, line-by-line, within each message representing a turn by a participant in a conversation. Then, the analysis was conducted by sentence, helping the researcher understand sets of ideas and concepts within each message. Finally, the analysis focused on complete messages within each conversation to capture the nature of the interactions among participants and the cognitive processes represented by those interactions.

The entire content-analytic process involved the development and application of an extensive coding scheme designed to address four distinct perspectives on the data: (1) computer-mediated conversation events, (2) interaction types, (3) learning processes, and (4) learning outcomes. A preliminary coding scheme created to represent the main concepts and constructs guiding the analysis drew upon five broad categories derived from the literature in the field of CMC research (Chong, 1998; Davidson-Shivers, Muilenburg & Tanner, 2001; Herring, 2002; Romiszowski & Mason,

2004). These initial categories included: (1) *communication structures*, the social structures in which students participate and collaborate within a CSCL environment; (2) *communication styles*, the various formats in which online conversations can be sustained by computer-mediated tools; (3) *communication channels*, the computer-mediated tools used as communication spaces; (4) *instructional interactions*, the basic teaching/learning modes in distance education environments; and (5) *cognitive processes*, the cognitive dimensions of the teaching/learning process. The relationships among the categories in the preliminary coding scheme and the research questions guiding the "micro" level of analysis in the study are shown in Table 3.9.

Categories in preliminary coding scheme	**Research questions being addressed**
(1) Communication structures (2) Communication styles (3) Communication channels (4) Instructional interactions	Q#1: What types of interactions are supported and enhanced by CSCL systems for adult learners in constructivist distance education environments? What types are discouraged or impeded?
(5) Cognitive processes	Q#4: How and to what extent do online conversations serve as evidence of learning processes and learning outcomes?

Table 3.9: Categories in preliminary coding scheme

Codes for these concepts as well as "in vivo" codes were used in the pilot study to identify core concepts and to group related concepts into main categories. All new constructs and themes that emerged from the data in the pilot study – such as new interaction types and a knowledge dimension – were included in the revised coding scheme that was used for this study. Three of the categories in the preliminary

scheme do in fact represent concepts relevant to the study – communication structures, communication styles, and communication channels – but were eliminated from the revised coding scheme because they represented broader concepts than the "micro" focus of the content analysis. These broader categories were used instead during the data-interpretation phase at the "macro" level of analysis. The revised coding scheme (Appendix C) includes only two of the original categories – *(1) instructional interactions* and *(2) cognitive processes* – as well as a new category that emerged from the pilot study – *(3) knowledge type* (Table 3.10). Although this final category accompanies the "cognitive processes" dimension in Anderson and Krathwohl (2001) taxonomy, it was not included in the original scheme because it was not clear before the pilot study that the data would support inferences about specific types of knowledge that students displayed.

Categories in revised coding scheme	**Research questions being addressed**
(1) Instructional interactions	Q#1: What types of interactions are supported and enhanced by CSCL systems for adult learners in constructivist distance education environments? What types are discouraged or impeded?
(2) Cognitive processes (3) Knowledge type	Q#4: How and to what extent do online conversations serve as evidence of learning processes and learning outcomes?

Table 3.10: Categories in revised coding scheme

Codes for the preliminary coding scheme were also developed to capture the interaction types represented in the data. These codes were based on the basic interaction modes for distance education environments introduced by Moore (1989) and Anderson (2003): (1) *student – content interactions,* (2) *student – instructor interactions,* (3) *student – student interactions,* (4) *instructor – content interactions,* (5) *instructor – student interactions*, and (6) *instructor – instructor interactions.* Additional interaction types emerged from the data in the pilot study, and codes were included for them in the revised coding scheme as follows: (7) *student – class interactions,* (8) *student – group interactions,* (9) *instructor – class interactions,* and (10) *instructor – group interactions.* Note that the word "instructor" was substituted for Anderson's "teacher" to account for instructors other than the lead teacher in the data set.

The coding scheme also included codes for the types of knowledge and the cognitive processes derived from the taxonomy representing the knowledge dimension and the cognitive dimension of the teaching/learning process presented by Anderson and Krathwohl (2001). The types of knowledge are (1) *factual knowledge:* knowledge of the basic terminology or isolated bits of information representing the main elements within a discipline or domain; (2) *conceptual knowledge:* knowledge of the categories and the classifications of the main elements together with their relationships, within a discipline or domain; (3) *procedural knowledge:* knowledge of the steps, skills, algorithms, techniques or methods within a discipline or domain, together with the criteria to determine when to use them; and (4) *metacognitive*

knowledge: knowledge about cognition in general as well as awareness of and knowledge of one's own cognition (Anderson & Krathwohl, 2001).

The cognitive processes are (1) *remembering*, retrieving relevant knowledge from long-term memory; (2) *understanding*, constructing meaning from instructional messages; (3) *applying*, carrying out procedures in given situations; (4) *analyzing*, breaking materials into constituent parts and determining how those parts relate to one another and to an overall structure or purpose; (5) *evaluating*, making judgments based on criteria and standards; and (6) c*reating*, putting elements together to form a coherent or functional whole (Anderson & Krathwohl, 2001). Each cognitive process includes subprocesses, allowing more specificity when analyzing the cognitive dimension in online conversations. In the study, the analysis of cognitive processes was done at the level of the 19 subprocesses rather than at the more general process level.

Identifying and coding the types of knowledge and the cognitive processes as represented in the participants' discourse was the most intensive phase of the analysis at the micro level. Each message was conceptualized as a "turn" taken by a participant within each conversation; each turn was analyzed in terms of four factors: (a) the audience being addressed by the participant, (b) the nature of the participant's interaction with the course content, (c) the participant's ability to share and construct knowledge in relation to the course content or from previous experience, and (d) the participant's cognitive activity in relation to the course content or from previous experience. A single turn taken by a participant within a conversation generally represented more than one type of interaction, more than one type of knowledge, and

more than one type of cognitive process. Table 3.11 shows the types of interactions, the type of knowledge, and the cognitive processes identified and coded for the excerpt from a synchronous conversation shown in Table 3.7.

Overall, the data provided evidence that all types of interactions in the coding scheme were represented by the participants' discourse in asynchronous conversations, with extensive interactions among students. However, not all types of interactions were represented in synchronous conversations, which did not encourage interactions among students. This analysis is relevant when characterizing online conversations as teacher-centered, student-oriented, or a combination of both, depending on the type of interactions among participants.

The analysis of conversations at the "micro" level also allowed the researcher to identify the types of knowledge and the cognitive processes represented by the participants' discourse. The data provided extensive evidence of cognitive activity in the students' discourse – representing the students' ability to understand, apply, analyze, and evaluate the information delivered as course content by the instructors and guest speakers. However, not all the types of knowledge introduced by Anderson and Krathwohl (2001) were represented in all conversations, nor were all types of knowledge constructed and shared by all participants.

Expert Chat with E2			
Participants' discourse	**Interaction type**	**Cognitive processes**	**Knowledge type**
F1>>We are ready to get started.	Instructor – Group	NONE	NONE
F1>>Thanks for joining us today, E2.	Instructor – Instructor	NONE	NONE
F1>>S3, do you have a question?	Instructor – Student	NONE	NONE
S3>>You indicate in [your article] that librarians should consider switching a conversation with a patron into another medium (e.g., from chat to phone) if they feel the conversation would work better there? I can see that chat works best when the question involves co-browsing; could you make any generalizations about which sort of medium works best for other sorts of questions?	Student – Content Student – Instructor	Interpreting Attributing Comparing	Conceptual Procedural
E2>>Wow, good question...	Instructor – Student	Critiquing	NONE
E2>>I wrote that in part as a reminder to myself and my colleagues that when VR questions get out of control -- 20 minutes and no progress toward resolution…that we shouldn't be locked into thinking we have to stay online to answer their question, no matter how long it takes, that we can eventually figure out that we and the patrons are so confused that we should just write, "Hey, can I call you?" I can't generalize well about what types of questions work well in which media, except to say that some questions -- maybe the vague, ill defined ones -- and some patrons...I'm thinking of the ones who are very unfamiliar with the library try to chat with us and nothing we say makes sense, and chatting takes so darn long, so it doesn't seem like the medium when you and the patron are confused. END.	Instructor – Content Instructor – Group	Exemplifying Attributing Explaining Organizing	Conceptual Procedural
F1>>S3, does that answer your question?	Instructor – Student	Checking	NONE
S3>>yes, thank you.	Student – Instructor	Critiquing	NONE

Table 3.11: Content analysis of a discourse sequence

3.7 Criteria for verification

Sound qualitative research efforts adhere to standards of coherence and credibility (Behrens & Smith, 2004). However, the trustworthiness of the inferences drawn from data has always been a source of concern for researchers across disciplines (Eisenhart & Howe, 1992). There is an ongoing debate among researchers and practitioners regarding the extent to which the findings from a qualitative case study apply to other instances of the same phenomenon in similar contexts.

For instance, Savenye and Robinson (2004) claim that case study results can not be generalized but may be used to derive questions to be explored and analyzed later in experimental designs. Becker (1990) states that generalizations can be developed by seeing how each case study represents different instances of some generic phenomenon or process in which variations in conditions may create variations in results. Even today, Guba's (1981) constructs of credibility, transferability, dependability, and confirmability help to resolve the lack of agreement regarding the criteria for determining the "generalizability" of qualitative research and the extent to which such research efforts can be replicated by providing a basic set of "naturalistic inquiry criteria for adequacy" (p. 88).

Credibility is the extent to which a qualitative study accurately represents the constructs or phenomena that the researcher attempts to understand and interpret (Guba, 1981). Therefore, a qualitative study must be credible to all the constructors of the original multiple realities (Marshall & Rossman, 1995). In this study, the concepts and constructs guiding the research questions were derived from the connections across multiple theories involved in the phenomenon of interest: learning theory,

distance education theory, and communication theory. Therefore, the researcher's interpretations derived from evidence in the data were grounded in the perspectives from several theories, contributing with theoretical descriptions and meanings consistent with *theory triangulation* (Denzin, 1997). Explicitly stating the scope of the study and providing definitions of the constructs and concepts guiding the research enhances the credibility of the study within the boundaries of the theoretical framework of the study (Marshall & Rossman, 1995).

Further, to address any potential researcher bias in the analysis itself, two other researchers were asked to use the revised coding scheme for the content analysis of a sample of online conversations at the "micro" level. The level of agreement among coders and the researcher was calculated by dividing the number of codes all three coders agreed on by the total number of codes in the sample. The inter-rater agreement was 94.77% for the interaction type category, 85.79% for the knowledge type category, and 66.35% for the cognitive process category. The areas of disagreement among coders for the interaction type and the knowledge type categories were discussed and revised until there was a 100% of agreement and all parties were satisfied with the results.

The areas of disagreement among coders for the cognitive process category were carefully discussed and revised to account for the non-sequential, overlapping nature of the subprocesses within each main cognitive process in the taxonomy introduced by Anderson and Krathwohl (2001). An important characteristic of the cognitive dimension in this taxonomy is that "in order to conform to the language that teachers use, the six categories are allowed to overlap" (p. 267). The inherent

complexity of the main cognitive processes as well as the potential overlap at the level of cognitive subprocess make it difficult for the codes within the cognitive dimension to address specific cognitive activity definitively. Therefore, individual messages representing the students' cognitive activity should be analyzed in the context of the conversation in which they were taking place.

Member checking procedures were included to check the accuracy and plausibility of the findings drawn from the data. Two members of the instructional team – the faculty member (F1) and the teaching assistant (F2) – read a draft document with a comprehensive description of the course, the instructional team, the students, the CSCL environment, and the researcher's interpretations that emerged from the analysis. F2 confirmed by e-mail the accuracy and plausibility of the researcher's interpretations, while F1 provided comprehensive feedback during an interview conducted by the researcher. The comments received from F1 and F2 expressed support for the researcher's interpretations as well as for the findings and implications emerging from the study. Minor suggestions were received from F1 regarding the researcher's descriptions of the course content and the features of the CSCL environment used in the course. Those suggestions have been incorporated in sections 3.4.2 and 3.4.5, respectively.

Transferability is the extent to which the insights and findings from a study can be applied to other instances of a given phenomenon in similar settings (Guba, 1981). As one of the assumptions of the qualitative research paradigm is that all social action is situated and unique, it is not realistic to expect that the same perspectives, behaviors, and experiences could be observed twice, even as part of

similar processes, events, and contexts (Denzin, 1997). However, to increase the transferability of the results of this study, a theoretical construct sampling strategy was used to maximize the range of evidence and insights from a situated context. Where possible, findings were compared and contrasted to related research.

Dependability has been defined as the extent to which the findings of a qualitative study reflect a true understanding of the particular environment and circumstances under which the study was conducted (Guba, 1981). It is enhanced by providing extensive details about the research, including a description of any instrumental shifts in the research design resulting from an emerging and refined understanding of the setting (Marshall & Rossman, 1995). *Confirmability* is the extent to which the findings of a qualitative study could be confirmed by another person, in terms of both the data gathered as evidence and the researcher's interpretations of that data (Guba, 1981; Marshall & Rossman, 1995).

To address both the dependability and the confirmability of this study, the research materials are available for other researchers to use to confirm the plausibility of the researcher's analytic techniques and final interpretations. A comprehensive case study database provides access to all transcripts, memos, and evidence gathered during data collection and data analysis. To protect the participants' privacy, names and affiliations have been edited and will remain confidential in all documents within the case study database.

Chapter 4: Findings

The major assumption underlying this study is that instructional situations can be conceptualized as communication spaces in which several communication events, communication media, and communication behaviors converge to provide instructional experiences. As Heinich, Molenda, and Russell (1999) have stated, "effective instruction will not take place unless effective communication has taken place" (p. 12). In communication research, a *communication event* is defined as an activity beginning with the same general purpose and the same topic, involving the same participants, generally using the same language variety, and maintaining the same tone and the same rules for interaction in the same setting (Saville-Troike, 1989).

In this study, the focus was on instructional communication events – interactions among instructors, students, and content in which all participants share the same learning goals, focus on particular topics, have defined roles, and follow specific rules guiding the events. The events were analyzed from three theoretical perspectives: interaction analysis (Anderson, 2003; Moore, 1989), classroom-discourse analysis (Cazden, 2001, Mehan, 1985), and learning analysis (Anderson & Krathwohl, 2001). This chapter first describes the events at a general level; next, it reports findings related to each theoretical perspective; finally, it describes commonalities suggested by combining the perspectives.

4.1 Interaction analysis

Early research on instructional interactions in both traditional and electronic environments assumed a teacher-centered view of the teaching/learning process. However, as advances in learning theory have suggested new paradigms with diverse views of teaching and learning, a shift from a model of information transmission from teacher to students has evolved into a focus on student-centered instructional interactions (Kumpulainen & Wray, 2002). In this study, two primary types of teaching/learning events –"Dialogues with Experts" and bulletin board discussions – were analyzed in depth to identify and describe their interaction patterns.

Over 630 specific instances of instructional interactions among participants occurred within the conversations in the data set. Of these, 417 (66.19%) occurred in the synchronous conversations and 213 (33.80%) in the asynchronous. Six types of teaching/learning interactions drawn from the literature *(student – content, student – instructor, student – student, instructor – content, instructor – instructor,* and *instructor – student)* were evident in this study, as were four additional types that emerged from the pilot study *(student – class, student – group, instructor – class,* and *instructor – group).*

Table 4.1 shows that the types of interactions among participants in the synchronous conversations were different from the types in the asynchronous conversations. Although the "Dialogues with Experts" sessions did not seem to promote interactions among the students *(student – student interactions),* they provided extensive opportunities for the students to extend their understanding and to share their knowledge of the domain through exposure to the guest speakers' insights

(student – instructor interactions) and through their own articulation of questions related to diverse topics of interest *(student – content interactions)*. In contrast, the participants' discourse in bulletin board discussions expanded the types of interactions that occurred, with a number of interactions initiated by students.

Instructional interaction types	**Synchronous Conversations**				**Asynchronous Conversations**			
	1	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Student – instructor	X	X	X	X			X	
Student – student					X	X	X	
Student – class					X	X		X
Student – group							X	
Instructor – student	X	X	X	X			X	X
Instructor – class					X	X		X
Instructor – group	X	X	X	X			X	
Instructor – instructor	X	X	X	X				
Student – content	X	X	X	X	X	X		
Instructor – content					X	X		

Table 4.1: Interaction types identified for each type of conversation

NOTES: *Synchronous 1:* Dialogue with E1
2: Dialogue with E2
3: Dialogue with E3 and E4
4: Dialogue with E5

Asynchronous 1: Two points-of-view discussion
2: Listserv discussion
3: Software tools discussion
4: Course evaluation discussion

These findings are consistent with collaborative learning theory and research suggesting that there are significant differences in the ways that students participate in synchronous and asynchronous online discussions (Davidson-Shivers, Muilenburg & Tanner, 2001).

The findings also support research that suggests that the combined use of synchronous and asynchronous discussions in CSCL environments provides more diverse and useful means for students to engage in discussion and learning than the exclusive use of either type (Hathorn & Ingram, 2002; McInnerney & Roberts, 2004; McWhaw, Schnackenberg, Sclater & Abrami, 2003).

4.1.1 Student-centered interactions

Student-centered interactions involved a student addressing an instructor, another student, the whole class, or a small group of fellow students, with instructional or social purposes.

Student – instructor interactions: The students' discourse in the synchronous conversations provided extensive evidence of their interactions with guest speakers and the faculty member offering the course. Examples of interactions with the faculty member appear throughout this chapter, while the following excerpts from two "Dialogue with Experts" sessions illustrate the interactions of students (S17 and S16) with two of the guest speakers (E2 and E3). The first excerpt shows the way in which S17 poses a question and then probes E2 to obtain more information related to E2's answer to her question:

Expert Chat with E2

S17>>How is [your virtual reference tool] to work with as far as users suggesting improvements or upgrades to the software?

E2>>Generally good...
E2>>the privacy measure I was talking about was sort of B+ for a while..
E2>>because it stripped the patron's name from some places but left it in...
E2>>other places in the transcripts, but now they've improved that. A good sign.

S17>>It seems to me that they would seek the users input in order to improve…

E2>>Yes, good point. I think they do….

In the second excerpt, a student (S16) asked a question to a guest speaker (E3), who answered the student's questions and then probed for the student's own ideas on the subject:

Expert Chat with E3 & E4

S16>>Do you think that you will find better ways to market the potential of your product as time goes on? I say this because it is my feeling that such services are underrepresented in the public mind

E3>>Absolutely true…we are in the middle of launching a new program for our clients… it helps them plan for a whole year….I think this will help...marketing needs to go on and on and on...do you have some ideas, S16?

S16>>I don't really, no.

Table 4.1 shows that the students' discourse in one of the asynchronous conversations represented interactions among individual students and instructors. Since the conversation involved the use of diverse software tools, the nature of the interactions between these students and F1 and F2 involved the communication of basic procedures and tips to access and to use the tools. The following excerpt from

this discussion illustrates the interactions of a student (S28) posing a question and being answered by F1 and F2:

Software tools discussion
Saturday, June 5, 10:53 am – Friday, July 2, 6:34 pm

Message no. 2968
Author: S28
Date: Monday, June 28, 7:57pm
Subject: transcripts
Are we supposed to receive transcripts from the software tool?

Message no. 2981[Branch from no. 2968]
Author: F1
Date: Monday, June 28, 10:33pm
Subject: Re: transcripts
F2 will correct me if I am wrong about this, but the patron receives the transcript. According to the software tool website: "The patron receives a transcript of the session by e-mail. The librarian can view the transcript in the librarian module."

Message no. 2990[Branch from no. 2981]
Author: F2
Date: Tuesday, June 29, 6:41am
Subject: Re: transcripts
I found this FAQ on the software tool page (which seems to imply that you do get a transcript): "I did not receive a transcript of a chat session I had with a patron. Did I do something wrong? You may have left some chat windows open or logged off the chat monitor. To retrieve the chat session, log back, go to the chat monitor, and end any incomplete chat sessions. You should then receive any e-mail transcripts." I did a little testing this morning and am still waiting for a transcript of a session I closed. I was able to retrieve earlier sessions on the blue tab. They are filed by status. You had a lengthy transcript in the active file.

Student – student interactions: The synchronous conversations in the data set did not reflect extensive interactions among students, since the students' participation was moderated by a faculty member (F1). In contrast, the asynchronous

conversations seemed to promote and support extensive interactions among students in several instructional activities.

In the following excerpt from a bulletin board discussion, a student (S13) shares her opinion and insights regarding a discussion topic in a listserv related to the course content. S13 initiates a conversation on a topic of her interest and shares specific resources on that topic with all the students in the class. Another student (S27) responds to S13's message by asking for more information on those resources. S27's message also acknowledges S13's willingness to share her insights with the class:

Listserv discussion
Wednesday, June 2, 9:38 am – Friday, July 9, 2:35 pm

Message no. 1869
Author: S13
Date: Sunday, June 6, 8:24pm
Subject: Shutting Down Chat Ref
Hi all. An interesting recent discussion on the listserv discussed the "shutting down" or discontinuation of chat software for reference. The majority of the comments were from academic libraries who cited that it was either too expensive to maintain or that there was not enough use of the system. I thought this was an interesting bit of information that could supplement the two points of view readings. Interesting note is that MIT stopped using chat for reference a year and a half ago. If you want to read all the threads of the discussion you can go to the archives operated through Yahoo Groups.

Message no. 1895[Branch from no. 1869]
Author: S27
Date: Monday, June 7, 4:02pm
Subject: Re: Shutting Down Chat Ref
S13, could you please send more detailed citation for the article you suggested? This link brings me to the information page of the listserv for new subscribers and I couldn't find the article. Thank you.

In the same conversation, the message posted by S13 elicits responses from S19 and S9, respectively:

Listserv discussion
Wednesday, June 2, 9:38 am – Friday, July 9, 2:35 pm

Message no. 1933[Branch from no. 1869]
Author: S19
Date: Tuesday, June 8, 7:18am
Subject: Re: Shutting Down Chat Ref
As is the case with so many services a library offers, it is very difficult to perform a cost benefit analysis to justify funding. It would be interesting look at some of the details of the services that are being discontinued. Did they market the service effectively? How well supported was it by staff and the administration? What was the initial funding?

Message no. 2065[Branch from no. 1933]
Author: S9
Date: Wednesday, June 9, 10:00pm
Subject: Re: Shutting Down Chat Ref
Hi S19, I understand that a library is not expected to make a profit, however, what exactly is it that determines if a service is eliminated, other than not enough patron use?

Message no. 2303[Branch from no. 2065]
Author: S19
Date: Wednesday, June 16, 7:02am
Subject: Re: Shutting Down Chat Ref
A cost benefit analysis is performed on the service. The cost of providing the service is relatively easy to perform. The benefit portion is much harder. How do you place a value on the correct answer to a question? There are some qualitative and quantitative methods, such as asking how much of a tax refund a person would want if the service was no longer offered, or determining the cost of what the patron would do if the service was not offered. If you are interested I could send you some references. The point is to be able to perform a Return on Investment. Is this program the best bang for the buck when our budget is shrinking?

These messages representing interactions among students were characterized by the researcher as an instance of collaborative learning, as discussed in section 4.3.

Student – class interactions: The "Dialogue with Experts" sessions did not promote any interactions in which individual students engaged the whole class. In contrast, the bulletin board discussions provided diverse opportunities for the students to share their insights and pose questions to the class as a whole.

The following messages from a bulletin board discussion illustrate the richness of the interactions of individual students with their classmates:

Listserv Discussion
June 2, 9:38am – July 9, 2:35pm

Message no. 1676
Author: S22
Date: Wednesday, June 2, 9:38am
Subject: Virtual Reference Desk listserv
Hello all. I have subscribed to "A listserv to explore the growing area of digital reference services."

Message no. 2078
Author: S26
Date: Thursday, June 10, 9:09am
Subject: What do we call it discussion
An interesting discussion has begun on the listserv about naming our new reference tools. The originator of the discussion indicated that she does not like the word "virtual." However, her objection was based on the American Heritage Dictionary of the English Language definition. I agree with…that we should use the technical definition. He references "An adjective that expresses a condition without boundaries or constraints." Since we are using technology to provide our reference services, we should use the technological definition.

Student – group interactions: The bulletin board discussions in the data set promoted and supported interactions among students participating in group assignments. The following messages illustrate the interactions of students as part of an assignment involving the use of a particular software tool:

Software tools discussion
Saturday, June 5, 10:53 am – Friday, July 2, 6:34 pm

Message no. 2092
Author: S1
Date: Thursday, June 10, 1:48pm
Subject: Patron Login
When I've tried to have someone login as the patron when I am logged in as the librarian, the patron gets the message that there is no one available at that time. I tried this a couple of times. Does anyone know--is there another step that I am missing? Thanks!!

Message no. 2545
Author: S13
Date: Monday, June 21, 4:21pm
Subject: Partners?
Is anyone looking for more practice? I'm looking for a partner for sometime in the afternoon and early evening (say from 5 to 8). Please respond to me privately if you are interested. Thanks.

Message no. 3393
Author: S1
Date: Friday, July 2, 6:34pm
Subject: Partners?
I have about 45 more minutes left to act as the librarian and I'm wondering if anyone who also has some time left/needed for their log would like to role play patron/librarian. Please reply privately if you'd like to do so. (I have a couple of friends in stand-by mode, but I'd like to log some more time with someone in-class if possible.) Thanks!

The "Dialogue with Experts" sessions did not provide evidence of students interacting with other students. However, a module within the course content makes reference to a team assignment called "Electronic Reading Groups," in which small groups of students were instructed to meet in synchronous workspaces to discuss the details of their assignments. Since the transcripts from those sessions were not available to the researcher, the analysis of those interactions is beyond the scope of this study.

4.1.2 Instructor-centered interactions

Instructor-centered interactions involved an instructor addressing a student, the whole class, a small group of students, or another instructor, with instructional or social purposes.

Instructor – student interactions: As was to be expected, the participants' discourse in both the synchronous and the asynchronous conversations provided extensive evidence of interactions among instructional team members – F1, F2, E1, E2, E3, E4 and E5 – and individual students. In the synchronous conversations, instructor – student interactions were initiated when F1 invited students to pose questions or a guest speaker probed students for more information. For instance, the following excerpt from a "Dialogue with Experts" session illustrates the way in which F1 and E3 interacted with S13:

Expert Chat with E3 & E4

F1>>S13, do you have a question?

S13>>A recent comment on the listserv discussed "shutting down" chat reference. A number of comments were from libraries that had discontinued chat reference service. Have you noticed a decrease in the number of clients? Or has there been a decline in use by a particular library type? Such as academic?

E3>>I haven't seen a decrease... really it's been a shift...
E3>>libraries are starting to realize that in order to be useful…
E3>>their programs must be open longer hours..
E3>>24/7 if possible… they know that they can't staff it themselves…
E3>>so they are really moving towards partnerships..

E3>>does that answer your question?

S13>>Yes, thank you that's an interesting observation.

In the asynchronous conversations, interactions among instructors and students occurred only when an instructor responded to a question or conversation topic initiated by a student. There was no evidence of instructor – student interactions initiated by the instructors.

Instructor – class interactions: All instructor – class interactions were asynchronous. That is, no instances of instructors communicating synchronously with the class as a whole were enabled by the software and thus were not represented in the data set. Asynchronously, the information within each course section included instructions for individual and team assignments; the researcher characterized these instructions as *messages from the instructors to all the students in the class.* Therefore, the following message, in which students are instructed to share their insights on the course content and instructional activities, can be characterized as an instance of instructor – class interactions:

Course Wrap-Up

> Let us know what you REALLY thought about the course without having to identify yourself. Follow up on some of the questions we asked you in the post-assessment survey or raise a different issue.

The bulletin board discussions promoted and supported interactions of instructors with all the students in the course. The following message posted by F1 within the "Course Evaluation" discussion in the "Wrap-up" section represents an instance of instructor – class interactions:

Course evaluation discussion
Tuesday, July 6, 10:40 am – Friday, July 9, 4:52 pm

Message no. 3623
Author: F1
Date: Thursday, July 8, 12:10pm
Subject: Our To Do List
F2 is maintaining a list for revising the course. Based on feedback received, we will reduce the number of hands-on practice hours to 10 when the course is offered next time. So students taking the course in the future will thank you. One reason that…is not required is that it is an optional project in other courses. So, if students have already completed [that] project, they may want more experience with other chat software. We appreciate your suggestions…

Instructor – group interactions: Both the synchronous and the asynchronous conversations promoted interactions of instructors with small groups of students during "Dialogue with Experts" sessions and team assignments. The following messages illustrate the types of interactions between F2 and F1 and a small group of students conducting an exercise on the use of a specific software tool:

Software tools discussion
Saturday, June 5, 10:53 am – Friday, July 2, 6:34 pm

Message no. 1813
Author: F2
Date: Saturday, June 5, 10:53am
Subject: Getting Started
I created logons for you this morning and you should receive notification by email. Let me know if you don't get something by end of business on Monday. We've created a screen for patron logon. You will all be monitoring and using the same practice queue, so we may need to turn to a Reservations system if you bump into each other. It is possible for more than one librarian to monitor the same queue and, in this system, you can see the name of the patron before selecting so it may work just fine. But keep me posted! You can work together to get started -- taking turns being the patron and librarian.

Message no. 2204
Author: F1
Date: Sunday, June 13, 9:05pm
Subject: 10 hours of time as librarian
Some one asked about how the 10 hours of hands-on practice should be spent. The 10 hours are to be spent as librarian. While experience as a patron is enlightening, it is the experience as the librarian that will prepare you to work the virtual reference desk. If you do spend time as a patron/customer above and beyond your 10 hours for another practicing librarian, you may include that in your write-up along with reactions to being a customer and what you learned that will help you as a librarian. This will count as extra credit for your hands-on project.

Instructor – instructor interactions: There was no evidence of interactions among instructors in the asynchronous conversations in the data set. In contrast, the participants' discourse in the "Dialogue with Experts" sessions represented numerous interactions between F1 and the guest speakers. For instance, the following excerpt from a "Dialogue with Experts" session illustrates the interactions of F1 with a guest speaker (E1) who is trying to describe his view on future trends in software tools for e-reference services:

Expert Chat with E1

E1>>The software is evolving so quickly that we can't keep up with changing features. They will be stabilized and simplified over the next few years--my own vision for the perfect VR is an oral session (voip) that also provides a print transcript of the session.... broadband at the patron end will expand, and that will help a lot! especially for the rural libraries. end

F1>>VoIP doesn't seem ready yet..
F1>>voice seems to be the next big step.
F1>>Hadn't thought about voice and a print transcript.
F1>>Great idea!

In another conversation, a student (S26) asked a question to a guest speaker (E3). After reading E3's response to the question, F1 probed E3 for clarification of his response:

Expert Chat with E3 & E4

S26>>What percentage of your clients use [your software] in comparison to those that use a consortium?

E3>>well, I'd say we have about 30% of our clients using…
E3>>then another 30% working in a consortium…

F1>>Actually, a consortium can use contracting too, isn't that true E3?

E3>>right...and now that I think about it…
E3>>I think the number is a little higher for consortium and by consortium...

4.1.3 Content-centered interactions

The "My Progress" feature within the WebCT main menu allows each student to keep track of the sections, modules, and pages accessed during the course. This feature provides the number of content pages visited, a distribution of the types of pages visited, a date for the first and the last login to the system, as well as a log indicating the pages accessed – in order of access – and the amount of time spent at each page. These measures certainly represent each student's patterns of *physical access to the course content,* which could assist instructors in measuring the amount of time students spent with each type of course content – homepage, content pages, organizer pages, glossary, or course calendar. However, in the researcher's view, they do not provide evidence of the nature of the students' intellectual interaction with the course content.

In the study, *content-centered interactions* involved instructors and students actively selecting, organizing, transforming, and evaluating information from the course content, as a means to construct meaning and to develop new knowledge. Therefore, the information provided by WebCT regarding the frequency and distribution of each student's access to the course content was not included in the data

set, since it did not fit the definition of *student – content interactions* guiding the analysis at the micro level.

Student – content interactions: It was often difficult to determine whether the students' discourse represented concepts and procedures related specifically to the course content or to their experiences outside the course. To avoid exaggerating the extent of interactions appropriate for the analysis, the researcher characterized instances of students' discourse as student – content interactions only when they made explicit reference to the students' ability for the selection, analysis, transformation and evaluation of course materials – such as articles, conversations, or course-related Web sites.

The discourse in the synchronous conversations provided extensive evidence of students' ability to select, interpret, and/or evaluate the course content. The following questions formulated by S3, S17, and S27 within a "Dialogue with Experts" session illustrate the richness of their explicit interactions with information provided in the course:

Expert Chat with E2

S3>>You indicate in [your article] that librarians should consider switching a conversation with a patron into another medium (e.g., from chat to phone) if they feel the conversation would work better there? I can see that chat works best when the question involves co-browsing; could you make any generalizations about which sort of medium works best for other sorts of questions?

S17>>You made a cooking analogy in your article and it leads me to ask whether you think that the use of on-line reference will ultimately change how we do other things such as create the catalog in the first place or how future electronic databases are developed?

S27>>In your article…you state: "We have moved AGGRESSIVELY to get as many indexes, journals, and books as possible ONLINE." Is there a death sentence for the books in print? Are libraries that hold books in print going to disappear in the next century?

The students' discourse in the asynchronous conversations also provided extensive evidence of their ability to select, interpret, and/or evaluate the course content. The following messages posted by S29 and S6 within the "Two points of view" bulletin board discussion illustrate the richness of their explicit interactions with several course readings:

Two points of view discussion
May 31, 9:17pm – July 7, 4:54pm

Message no. 1646
Author: S29
Date: Tuesday, June 1, 2:33pm
Subject: Response
As stated in previous postings, I believe that the authors of the two articles have such different views because of the type of library they work in…In the public library setting,…many patrons are not using the reference librarians anymore…The other reason I see for the different views are the authors' attitudes towards their purpose as a librarian. [In the other article] it is evident that they would prefer their clients to come in to the library so they can "model" the research skills. In the [first] article, the authors saw that they were losing patrons and they embraced virtual reference as a way to get those patrons back. The views the authors have toward their function as librarians have a big effect on their attitudes towards virtual reference.

Message no. 1759
Author: S6
Date: Friday, June 4, 11:07am
Subject: Two Points of View
After reading the articles…I believe that several factors are responsible for the differing points of view. The settings– a public library and a small academic library - this determines the user population, and to a certain extent their needs. The authors' toleration and acceptance of new technology - some people are afraid of new technologies and avoid them, whilst others try to figure out the best way to utilize them. The authors' perception of their role as reference librarians. – [They] believe that the face to face contact is very important in reference, but as pointed out by S11 personal interactions have been replaced by technology in a lot of service areas and VR is just one of them.

Instructor – content interactions: The course content was selected, organized, and delivered in several sections: WebCT tips, Course orientation, Course content, Course resources, Communication tools, and Course wrap-up. The information within each section represented the product of extensive interactions of the instructional team with the course content.

As part of the "Course content" section, the instructional team interpreted, analyzed, and evaluated concepts and procedures relevant to the domain. The following excerpt from the "Overview of e-reference" module can be characterized as an instance of instructor – content interactions:

Course content
Two Points of View: What accounts for that?

There's no doubt that virtual reference has been a hot topic in the library world in the last few years. All the major professional associations have added the topic to its conference offerings to varying degrees. It even has its own conference being held this year for the sixth year. The most comprehensive bibliography now has over 600 entries. How is it possible to have such divergent reactions to the same technological development?

4.1.4 Discussion of interaction analysis

Effective interactions among instructors, learners, and content are a key factor in creating meaningful learning experiences in all educational environments (Flottemesch, 2000). In instructional situations based on a constructivist view of learning, learners build their own understandings and interpretations through interacting with the information and the environment in which that information is presented (Wilson & Lowry, 2000). However, as important as it is, the interaction among participants in CSCL environments does not just happen; it must be carefully planned. An interaction protocol to guide participants in asking questions, responding

to questions, collaborating, and/or making comments can certainly regulate the interactions and interchanges among participants (Mottet & Stewart, 2002).

Most of the time, the instructional design process for distance education environments begins with *instructor – student* interactions (Picciano, 2001); however, the data in the study suggest that *instructor – content, instructor – class,* and *instructor – group* interactions should be considered as well. Moreover, the interactions of students with content *(student – content)* and with other students (*student – student, student – group,* and *student – class* interactions) are very important elements of distance learning (Hathorn & Ingram, 2002; McInnerney & Roberts, 2004; McWhaw, Schnackenberg, Sclater & Abrami, 2003).

Providing for diverse types of interactions among instructors, students, and content in distance education environments is often a function of the technology available to support and to deliver the course (Shearer, 2003). Therefore, when designing teaching/learning interactions for CSCL environments, a fundamental consideration is which aspects of the communications among participants should be synchronous and which ones asynchronous (Picciano, 2003).

The data in the study suggest that the types of interactions among participants in synchronous conversations are different from the types in asynchronous conversations and that the use of both communication channels in CSCL environments seems to provide more diverse opportunities for the students to engage in discussion and learning.

4.2 Classroom-discourse analysis

Holt, Kleiber, Swenson, Rees and Milton (1998) claim that "the quantity and quality of participant-to-participant exchanges can serve as an index of learning, and deliberation can be measured by looking at the participants' patterns of engagement in collaborative processes" (p. 47). Within the teaching/learning interactions described above, a number of such patterns emerged. Drawing from theory and research on classroom discourse in face-to-face instructional settings, the following section describes these patterns to illustrate how analyzing the "discourse" component of communication can yield insights about the nature and uses of communication in CSCL environments.

4.2.1 Discourse sequences

Previous research on the analysis of face-to-face classroom discourse (Adger, 2001; Cazden, 2001; Mehan, 1985) reports that *a lesson* is generally represented by a set of discourse sequences with a single turn by each participant and a single action per turn, with a teacher initiating all sequences. As Table 4.2 shows, the participants' discourse structure in a face-to-face lesson is represented as several phases composed of one or several discourse sequences. The phases for *opening* and *closing* a lesson are clearly defined by the teacher, as is an *instructional delivery phase* in which the course content is taught and learned. (The table indicates that sequences in the instructional delivery phase are repeated, while the sequences in the opening and closing phases occur only once in each lesson.)

In Mehan's (1985) framework, discourse sequences can involve directing, informing, or eliciting students' participation in iterative sequences within a lesson. A

discourse sequence includes an *initiation (I)* by the *teacher (T)*, a *response (R)* by a *student (S),* and an *evaluation (E)* of the student's response by the teacher, resulting in the *I – R – E* sequence of conversational actions and the *T – S – T* sequence of participants.

Event	Lesson					
Phase	Opening		Instructional delivery		Closing	
Type of sequence	Directive	Informative	Eliciting		Informative	Directive
Organization of sequences	I – R – E	I – R – E	I – R – E	I – R – E	I – R – E	I – R – E
Participants	T – S – T	T – S – T	T – S – T	T – S – T	T – S – T	T – S – T

Table 4.2: Classroom discourse structure for face-to-face learning environments (Mehan, 1985). *Conversational actions.* I: initiating a topic or eliciting participation. R: responding. F: providing feedback. *Participants.* T: teacher. S: student.

Synchronous conversations: All the synchronous conversations analyzed in the study were "Dialogues with Experts." These conversations were characterized as *well-structured conversations,* since the participants' roles – as moderator, guest speaker, active member, or observer – within each phase of the conversations were defined in advance. In addition, particular instructional strategies shaped and influenced the nature of these synchronous conversations, since (1) specific readings were defined as the conversation content, (2) a small group of students was identified as the basic unit of communication, and (3) a specific date and time for the conversations to take place were defined in advance.

Table 4.3 illustrates how the classroom discourse structure defined by Mehan (1985) can be adapted to represent the participants' discourse in synchronous conversations and displays the data for a particular example. Synchronous conversations in the study often had several participants in each discourse sequence; a discourse sequence frequently included more than one turn by each participant; and a single turn usually represented one or more conversational actions by each participant.

Event	"Dialogue with Experts" – Chat with E1				
Phase	Opening		Instructional delivery	Closing	
Type of sequence	Directive	Informative	Eliciting	Informative	Directive
Organization of sequences	O A	I I – R	I I – R I – R – F I – R – F – R I – R – F – R – P I – R – F – R – P – R	I I – R	A C
Participants	F1 F1	F1 F1 – E1	F1 F1 – S1 F1 – S1 – E1 F1 – S1 – E1 – E1 F1 – S1 – E1 – E1 – E1 F1 – S1 – E1 – E1 – E1 – S1	F1 F1 – E1	F1 F1

Table 4.3: Classroom discourse structure for synchronous conversations in CSCL environments. Adapted from Mehan (1985). *Conversational actions.* O: opening a conversation. C: closing a conversation. A: acknowledging participants' contributions. I: initiating a topic or eliciting participation. R: responding. F: providing feedback. P: probing for more information or for clarification. *Participants.* F1: moderator. E1: guest speaker. S1: active student.

The conversation charts for the synchronous conversations (see Appendix G) provided evidence that – despite small variations in the numbers of guest speakers

and the numbers of discourse sequences – all such conversations were composed of (a) an *opening phase,* in which F1 welcomes the participants and acknowledges their contributions; (b) an *instructional delivery phase* with an iteration of discourse sequences, in which F1 invites the students to pose questions to the guest speakers; and (c) a *closing phase,* in which F1 asks the guest speakers for their final comments or questions before terminating the session.

Asynchronous conversations: The primary asynchronous conversations analyzed in the study were the bulletin board discussions. These conversations were characterized as *ill-structured conversations,* since the participants' roles evolved in relation to the goals and content of each conversation. The instructional strategies in these asynchronous conversations provided opportunities for a diversity of issues, ideas, and perspectives to become the content of each conversation. Moreover, the asynchronous communication features of the WebCT environment allowed the participants to contribute their ideas at diverse dates and times. Some of the discussions involved all the course participants; others were conducted in small groups, either assigned randomly by the instructional team or assigned according to the students' interests and preferences.

The conversation charts for the asynchronous conversations (see Appendix H) provided evidence that these conversations can be characterized as *ill-structured*, since only a few of the components or phases defined by Mehan (1985) were represented in the participants' discourse. The asynchronous conversations provided participants with many opportunities for collaborative problem-solving: the charts

show extensive evidence of interactions among students, which was not the case for synchronous conversations.

Table 4.4 illustrates the structure of an asynchronous conversation in which a faculty member (F2) created a discussion space *(opening phase)* in the bulletin board. Then, within the *instructional delivery phase*, a single message posted by a student (S27) generated two different discourse sequences, one *(I – R – R – P – R – R – R)* representing answers provided by F2 and two students (S21 and S24) and the other *(I – R – A – R – A)* representing a response provided by S24 at a different time.

<table>
<tr><td>Event</td><td colspan="2">Bulletin board discussion – Software tools, from June 5 to July 2</td></tr>
<tr><td>Phase</td><td>Opening</td><td>Instructional delivery</td></tr>
<tr><td>Type of sequence</td><td>Informative</td><td colspan="2">Eliciting</td></tr>
<tr><td rowspan="2">Organization of sequences</td><td rowspan="2">O
S</td><td colspan="2">I</td></tr>
<tr><td>I – R
I – R – R
I – R – R – P
I – R – R – P – R
I – R – R – P – R – R
I – R – R – P – R – R – R</td><td>I – R
I – R – A
I – R – A – R
I – R – A – R – A</td></tr>
<tr><td rowspan="2">Participants</td><td rowspan="2">F2
F2</td><td colspan="2">S27</td></tr>
<tr><td>S27 – S21
S27 – S21 – F2
S27 – S21 – F2 – F2 – S24
S27 – S21 – F2 – F2 – S24 – F2
S27 – S21 – F2 – F2 – S24 – F2 – S24</td><td>S27 – S24
S27 – S24 – S27
S27 – S24 – S27 – S27</td></tr>
</table>

Table 4.4: Classroom discourse structure for asynchronous conversations in CSCL environments. Adapted from Mehan (1985). *Conversational actions.* O: opening a conversation. S: stating isolated facts. I: initiating a topic or eliciting participation. R: responding. P: probing for more information or for clarification. A: acknowledging participants' contributions. *Participants.* F2: faculty member. S21, S24 and S27: students.

Despite small variations in the numbers of participants and the numbers of discourse sequences, the data provided evidence that all the asynchronous conversations were composed of (a) an *opening phase*, in which a faculty member (F1 or F2) welcomed the participants and provided guidelines or instructions, and (b) an *instructional delivery phase* with an iteration of discourse sequences, in which the students actively formulated and solved problems related to the course exercises. None of the asynchronous conversations in the study provided evidence of a *closing phase*.

4.2.2 Conversational features

Delay/Overlap: Not surprisingly, no evidence of delay or overlap was identified in the asynchronous conversations – which are, by definition, dispersed over time. In contrast, the conversation chart in Appendix G illustrates the fact that, even with F1 participating as moderator in all synchronous conversations, several discourse sequences represent *overlap* between the participants' contributions or questions. In the same conversation, a few discourse sequences represent *delay* in the conversation flow. However, neither the overlap nor the delay affected the conversation flow or the participants' roles in synchronous conversations.

Feedback/Probing: The data provided evidence of *feedback (F)* and *probing (P)* as instructional strategies widely used by the guest speakers in the synchronous conversations. Before providing any answers or explanations, the guest speakers gave the students feedback on the quality of their questions, an activity that can be characterized as an effort to engage students in the conversation. By probing the students for more information or for clarification, guest speakers were also able to

assess the extent to which their answers were addressing the students' interests and their levels of expertise in the domain. When providing feedback and also probing the students in the "Dialogue with Experts" sessions, the guest speakers were able to engage the students in rich and diverse interactions. These interactions could be characterized as opportunities for the students to extend their understanding and knowledge in the domain of interest.

4.2.3 Roles of the instructors

A faculty member (F1) and a teaching assistant (F2) comprised the core instructional team in the course. F1 participated as moderator in all "Dialogue with Experts" sessions, in which her role was to moderate the sessions and to allocate turns for the students and the guest speakers to participate. For each of these sessions, a small group of students were asked to sign in as active members or as observers; then, they were instructed to read several articles and formulate questions related to the readings in preparation for a synchronous conversation with a guest speaker.

As moderator, F1 was able not only to choose active students to pose questions but also to invite students participating as observers to shift into active participation. In the asynchronous conversations, F1 answered all the students' questions regarding the course content and provided summaries of the students' contributions and opinions on specific issues.

Diverse roles and behaviors were identified for F1 and F2 in the data set, and they were analyzed and interpreted in light of the concepts introduced in Appendix B. Throughout the course, F1 served as moderator, as content expert, and as facilitator in the synchronous conversations; F2 served as a facilitator. The conversations included

in the data set did not provide evidence of any member of the instructional team acting as evaluator.

F1 as moderator: F1's discourse provided evidence that her role as moderator in the synchronous conversations generally involved the following behaviors:

- Planning instruction, by selecting small groups of students as the basic communication structure, by selecting readings, and by assigning students' roles well in advance.
- Providing opportunities for students to assemble knowledge, by instructing them to prepare questions in relation to the readings for each conversation.
- Delivering instruction and modeling and guiding the knowledge-construction process, by formulating questions to guest speakers at the beginning of the session and by probing students for clarification or for more information.
- Moderating collaborative processes among students and guest speakers, by allocating turns for them to participate in each conversation.

These findings seem to be consistent with research on the characteristics and skills of instructors acting as moderators in distance education. Salmon (2003) defines the main role of *e-moderators* as "engaging the participants so that the knowledge they construct is usable in new and different situations, thus enabling meaning-making rather than content transmission" (p. 39). Holt, Kleiber, Swenson, Rees and Milton (1998) found that moderating online learning involves "creating the

environment, guiding the process, providing points of departure, managing the content, and creating community" (p. 48).

In general, instructors acting as moderators in CSCL environments seem to focus on providing students with opportunities to explore and discover information instead of "teaching" or "telling" them in the conventional sense of instruction (Bender, 2003). When participating in synchronous conversations, e-moderators tend to focus the session at the beginning, keep it running smoothly, ensure that everyone takes a turn, and summarize the content and activities (Salmon, 2003).

F1 as content expert: The data provided evidence that F1's role as expert in the asynchronous conversations generally involved the following behaviors:

- Planning instruction, by selecting diverse communication structures – small groups or large groups of students – for the diverse asynchronous conversations in the course.
- Providing course content, by inviting guest speakers who are experts in the field and by selecting readings appropriate to the topic for each conversation.
- Providing course content, by selecting online resources – journal articles, Web sites, and mailing list servers – appropriate to the topic for each conversation.
- Providing opportunities for students to assemble knowledge, by instructing them on how to share their insights and reactions in relation to the topics for each conversation.

These findings seem to be consistent with the literature on collaborative learning. Rabow, Charness, Kipperman and Radcliffe-Vasile (1994) found that the role of instructors acting as *resource experts* in collaborative discussion processes is "unique and paramount, since the quality of learning is obviously limited by the quality of the materials used. Therefore, the instructor participating as resource expert must select materials that are deep, interesting, and worthy of discussion" (p. 48). Since the asynchronous conversations were not moderated, the data provided no evidence of any participant modeling, moderating, or guiding the knowledge-construction process in these conversations.

F2 as facilitator: The data provided no evidence of F2's participation in any of the synchronous conversations in the data set. However, F2's discourse provided evidence of multiple interactions with the students in the asynchronous conversations. In particular, F2 facilitated the students' access to and use of the resources available for an exercise involving the use of software tools. F2's role as facilitator generally involved the following behaviors:

- Providing opportunities for students to extend their procedural knowledge, by assisting them to access the diverse tools and resources available for the course exercises.
- Modeling and guiding the knowledge-construction process, by sharing resources and specific procedures to address the students' questions and technical problems in hands-on exercises.

These findings seem to be consistent with the characteristics of online instructors serving as *facilitators* (Bender, 2003), *online learning facilitators* (Holt, Kleiber, Swenson, Rees & Milton, 1998), or *resource experts* (Rabow, Charness, Kipperman & Radcliffe-Vasile, 1994).

F1 as evaluator: Although there is no conversational data reflecting the instructor's role as evaluator, it is clear that she filled that role in the course. The course syllabus posted within the "Course orientation" section included comprehensive descriptions of the course objectives, the course requirements, and the grading criteria to be used for individual and team assignments. In addition, an "Assignment clarification discussion" was created in the electronic bulletin board to provide students with a space to share their concerns regarding individual and team assignments. All these messages illustrate the ways in which F1 implemented diverse assessment tools and strategies as well as opportunities to provide constructive feedback to the students participating in this CSCL environment.

These findings are consistent with basic guidelines and principles for the assessment of adult learners' performance in online learning environments, which suggest that instructors should include diverse assessment tools and strategies as well as diverse opportunities for the students to receive regular and constructive feedback (Driscoll, 1998; Kasworm, 2003; Rudestam & Schoenholtz-Read, 2002).

4.2.4 Role of the guest speakers

The guest speakers (E1, E2, E3, E4, and E5) were content experts who participated only in the synchronous conversations, and their role was to provide students with opportunities to expand their understanding and knowledge in the

domain of interest. All guest speakers addressed the issues and questions formulated by the students; sometimes, they also provided feedback to students and probed them for clarification or for their own opinions on specific issues.

Guest speakers as experts: The data provided evidence that the guest speakers who participated as experts in the synchronous conversations generally engaged in the following behaviors:

- Providing course content, by introducing resources – journal articles and Web sites – appropriate to the topic for each conversation.
- Providing opportunities for students to assemble knowledge, by answering the questions formulated by the students and by probing for clarification and more information.

The guest speakers' participation seems to be consistent with the guidelines for *discussion-based online teaching*, which suggest that instructors acting as experts in collaborative discussions should not only communicate their knowledge and expertise but should also stimulate students without overwhelming them, offer feedback, and formulate questions for further discussion among students (Bender, 2003).

4.2.5 Roles of the students

The students' participation was shaped and influenced by the instructional strategies and roles defined by the instructional team for each conversation in the study. For each "Dialogue with Experts," students read assigned articles and formulated questions for the guest speaker based upon the readings. Students were assigned to be either "active participants" or "observers" – although they could shift

those roles during the session at the discretion of the moderator (F1). Each student could participate in more than one of the five “Dialogue with Experts” sessions during the course.

The students’ participation in the asynchronous conversations was self-directed and evolved as the topic and the nature of the conversations changed across time. A student could pose a question in one conversation and provide advice to another student in a different conversation. Students were able to initiate discourse sequences at any time within asynchronous conversations by posing questions or by answering questions posed by other students.

Diverse patterns of engagement were identified in the students’ discourse within both the synchronous and the asynchronous conversations. Those patterns were analyzed and interpreted in light of the student roles introduced in Appendix B and the roles identified for adult learners in distance education. These roles included students as information users, as active participants, as participant observers, as problem solvers, and as self-regulators.

Students as information users: Adult learning involves a process of guided interaction in which learners engage in learning activities and tasks as part of self-directed inquiry in which the locus of responsibility for learning is in the learners themselves (Kasworm, 2003; Knowles, 1970). The students’ discourse provided evidence that they were actively selecting and interpreting information in relation to both the synchronous and the asynchronous conversations. The students’ role as information users in the study involved the following behaviors:

- Actively selecting and interpreting information obtained from the course content or from the students' individual experiences.
- Creating personal interpretations of the world.

Students as active participants: Not all the students in the course participated in all the synchronous conversations in the study, nor did all the ones who did participate assume an active role. However, the students' discourse provided evidence that the role of active participant in both the synchronous and the asynchronous conversations involved the following behaviors:

- Actively selecting and interpreting information obtained from the course modules – journal articles, Web sites, and instructor's notes – or from the students' individual experiences.
- Creating personal interpretations of the world, by formulating questions and being exposed to the questions and answers from other participants.

These findings are consistent with previous research on adult learners in distance education, which suggests that such learners tend to construct new representations and models of reality individually and then to negotiate and validate those representations and meanings through cooperative processes and social practices, such as discussions or debates (Kasworm, 2003).

Students as participant observers: Although the discourse emanating from the participant observers in the synchronous conversations is limited, it suggests the following behaviors:

- Apparently passive, since not all students who signed in as participant observers for diverse synchronous conversations had an opportunity to pose questions to guest speakers.
- Creating personal interpretations of the world, since participant observers had to read the assigned resources for each conversation to be prepared with questions for the guest speakers in case there was time to shift to active participation during each session.

Students as problem solvers: The students' discourse provided evidence that their participation in collaborative processes as problem solvers in the asynchronous conversations involved the following behaviors:

- Actively selecting and interpreting information obtained from the course content, from online sources, or from the students' individual experiences.
- Creating personal interpretations of the world, by formulating questions to the teaching assistant (F2), by exchanging ideas, and by testing procedures shared by other students participating in the same exercises.

These findings are consistent with the characterization of adult learners in distance education as preferring a task-centered, problem-solving approach to learning to which they can bring a wealth of real-life experience as a powerful learning resource (Driscoll, 1998; Long, 1990). In particular, when adult learners need to learn how to use new technologies, they tend to rely on self-directed learning and informal knowledge sharing with their colleagues (Cahoon, 1998; Nealand, 1992).

Students as self-regulators: In principle, collaborative learning environments provide adult learners with opportunities to confirm their ideas and interpretations as well as opportunities for self-assessment and self-reflection (Eastmond, 1998; Morrison, Ross & Kemp, 2001). In the study, the students' discourse provided evidence that their role as self-regulators in the asynchronous conversations involved the following behaviors:

- Actively selecting and interpreting information, by assessing the extent to which the diverse instructional activities in the course contributed to the development of their knowledge and their skills.
- Assessing personal progress, by comparing the knowledge and skills they had possessed before participating in the course with the ones they acquired and developed through the course.
- Reflecting on personal learning strategies, by comparing the ways in which they learn in face-to-face environments with the learning strategies they applied in a CSCL environment.

In distance education that involves collaboration, students might be assigned roles and might also assume a variety of roles (Bonk & Dennen, 2003). The literature on collaborative learning theory and research has identified *the nonparticipating student* (Bender, 2003) and *students' nonproductive behaviors* (Rabow, Charness, Kipperman & Radcliffe-Vasile, 1994) as variables to which all participants in collaborative processes are vulnerable.

Therefore, instructors should clearly state the structure and goals of each conversation as well as the roles for each participant (Salmon, 2003). However, it is the responsibility of all participants to contribute and to limit inappropriate behaviors.

4.2.6 Roles of media

WebCT served as an information space for information acquisition, information processing, and knowledge construction in all the online conversations. All the synchronous conversations provided students with opportunities to formulate questions to the guest speakers and to learn from the speakers' answers. In the asynchronous conversations, WebCT supported collaborative problem solving between instructors and students and among the students as well.

WebCT also supported the interactions among instructors, students, and content by providing (a) an information dissemination space and (b) an interactive information space. These "roles" were derived from constructs and concepts representing the role of media in several learning paradigms (Greeno, Collins & Resnick, 1997; National Research Council, 2001).

WebCT as an information dissemination space: In the study, WebCT served as an effective mechanism for the instructional team members to post and disseminate information to all the students in the class. Six sections were designed and delivered as the course content, and a navigation model allowed participants to access each section independently. Factual information, journal articles, Web sites, tutorials, and links to bibliographic databases were available at all times to support the students' learning experiences. This role is consistent with a behaviorist view of learning, in which instructors plan and deliver instruction while learners react to the

information and stimuli provided by the instructors rather than generating new information on their own (Heinich, Molenda & Russell, 1996).

WebCT as an interactive information space: WebCT provided diverse opportunities for participants to engage in discussion and learning activities and to construct and share knowledge from their previous experiences. Since WebCT supported diverse communication channels and diverse communication structures, the students were able to collaborate with one another in small groups, to engage in discussions with guest speakers acting as experts in the domain of interest, and to reflect on their learning experiences in distance education. These behaviors are consistent with a constructivist view of learning, in which learning is the result of the learners' active engagement in meaningful learning experiences (Greeno, Collins & Resnick, 1997) and learners create their own interpretations of the course content and reflect on those interpretations in collaboration with other learners (National Research Council, 2001).

4.2.7 Discussion of classroom-discourse analysis

Understanding the patterns of engagement and interactions among participants in online collaborative processes has been suggested as a necessary research area for educational technologists (Mazur, 2004; Stahl, 2005; Winiecki, 2003). To extend our understanding of the discourse structures and conversational actions involved in constructivist CSCL environments, this study included the systematic analysis of the participants' discourse at the "macro" level, which was grounded in the theory of classroom discourse and the theory and research of conversation analysis.

The analysis allowed the researcher to identify and to describe the instructional phases and the participants' roles involved in the main teaching/learning events – "Dialogue with Experts" sessions and bulletin board discussions – in a CSCL environment. The data suggest that the differences in the organization and delivery of instruction for these teaching/learning events are reflected in different conversational actions and instructional phases as well as different roles for instructors, learners, and media for each type of event.

The set of conversational actions that emerged from the study provides researchers and practitioners with a means to understand and describe the participants' discourse structures and patterns of engagement in online conversations. Such an understanding of the nature of the instructional communication process can inform the design and evaluation of instruction in CSCL environments. For instance, when designing instructional strategies for a particular type of conversation – synchronous or asynchronous – designers should carefully consider which instructional phases – opening, instructional delivery, or closing – would profit from specific strategies and which roles and behaviors can be expected for participants and media for each phase. Moreover, the analysis of the participants' interactions in terms of discourse structures and conversational actions provides both a perspective on instructional interactions as a process and as a description of the sequences and structures representing those interactions (Norman & Thomas, 1990). Such descriptions could serve as beginning guidelines to inform the design and evaluation of instructional interactions in CSCL environments.

4.3 Learning analysis

Ultimately, the success of instructional communication in any environment can be gauged only by the learning that emerges from that communication. The following section draws on the constructivist literature about learning processes as well as the cognitive literature on learning outcomes to illustrate how the communication structures in the course contributed to the students' learning.

4.3.1 Online conversations as evidence of learning processes

In early distance education research, the terms "cooperation" and "collaboration" were used to describe the same construct (McConnell, 2000; Riel, 1990). However, more recent research has found substantial distinctions between them (Hathorn & Ingram, 2002; McInnerney & Roberts, 2004; McWhaw, Schnackenberg, Sclater & Abrami, 2003).

Cooperation is now defined as acting together in a coordinated way at work or in social relationships in the pursuit of shared goals, the enjoyment of a joint activity, or simply furthering relationships (McConnell, 2000). In instructional settings, learners cooperate under the supervision of a teacher to achieve external rewards, to develop and sustain friendships, or to share in what they are doing (McInnerney & Roberts, 2004; McWhaw, Schnackenberg, Sclater & Abrami, 2003). *Cooperative learning* involves students working together in a structure of interaction designed and allocated by a teacher to facilitate the accomplishment of a task or end-product involving the construction and sharing of factual or procedural knowledge (Hathorn & Ingram, 2002; McInnerney & Roberts, 2004; McWhaw, Schnackenberg, Sclater & Abrami, 2003). In principle, *cooperative learning environments* not only provide

opportunities for students to learn through the expression and exploration of diverse ideas and experiences with diverse resources but also encourage students to deepen their understanding, sharpen their judgment, and extend their knowledge within learning groups (McConnell, 2000).

Collaboration is defined as a philosophy of interaction and personal lifestyle in which individuals work together but are ultimately responsible for their own actions (Panitz, 1996). In instructional settings, a group of learners collaborate by sharing ideas and reaching conclusions while assuming responsibility for their own learning. There is a common goal, which has often been defined and assumed by the learners themselves. *Collaborative learning* involves self-directed students working together within ill-structured processes to share ideas and reach conclusions. Therefore, a *collaborative learning environment* empowers students to assume responsibility for their individual learning while promoting the engagement of all group members and the social construction of conceptual and metacognitive knowledge (Hathorn & Ingram, 2002; McInnerney & Roberts, 2004; McWhaw, Schnackenberg, Sclater & Abrami, 2003).

Despite these differences, both cooperative and collaborative learning can be characterized as instances of constructivist learning in which the role of peer interaction is influential in sharing and constructing knowledge in an interdisciplinary and team-oriented environment (McConnell, 2000). The conversations among students in CSCL environments can be characterized as evidence of both collaborative and cooperative learning processes. In the study, these conversations provided students with opportunities to share their perspectives and knowledge, to

receive constructive feedback from the instructional team or other students, and to construct new knowledge through small-group processes as well as individual ones. To characterize *online conversations as collaborative or cooperative learning processes*, the researcher analyzed the conversational actions and discourse sequences represented by the students' discourse within each conversation.

Several discourse sequences initiated by students in the asynchronous conversations represented collaborative learning processes in which small groups of students were engaged in *student-student interactions* while sharing and constructing knowledge in relation to specific topics. The researcher's analysis of discourse sequences as collaborative learning among students is illustrated in Table 4.5.

As part of a conversation on the bulletin board, a student (S13) initiates a discourse sequence *(I)* by sharing her opinion and insights regarding a discussion topic related to the course content. S13 also shares additional resources relevant to that topic with all the students in the class. A student (S27) responds to S13's message *(I – R)* by asking her for more information and acknowledging *(I – R – A)* her willingness to share her insights with everyone in the class. The following day, the message posted by S13 elicits one more response *(I – R)* from another student (S19) within the same discussion space. A student (S9) responds to S19's message (*I – R – R)* by asking for more details on his insights and experiences on the topic of the conversation. After a few days, S19 responds to S9's inquiry *(I – R – R – R)* and offers to share with her more specific resources, if she is interested.

Listserv discussion **Wednesday, June 2, 9:38 am – Friday, July 9, 2:35 pm**	
Participants' discourse	**Discourse sequences**
Message no. 1869 **Author: S13** **Date: Sunday, June 6, 8:24pm** **Subject: Shutting Down Chat Ref** *Hi all. An interesting recent discussion on the listserver discussed the "shutting down" or discontinuation of chat software for reference. The majority of the comments were from academic libraries who cited that it was either too expensive to maintain or that there was not enough use of the system. I though this was an interesting bit of information that could supplement the two points of view readings. Interesting note is that MIT stopped using chat for reference a year and a half ago. If you want to read all the treads of the discussion you can go to the archives operated through Yahoo Groups.*	*I:* A student (S13) shares her opinion and insights regarding a discussion topic in a listserv related to the course content. S13 initiates a conversation on a topic of her interest and shares specific resources on that topic with all the students in the class.
Message no. 1895[Branch from no. 1869] **Author: S27** **Date: Monday, June 7, 4:02pm** **Subject: Re: Shutting Down Chat Ref** *S13, could you, please sent more detailed citation for the article you suggested? This link brings me to the information page of the listserv for new subscribers and I couldn't find the article. Thank you.*	*I –R: A* student (S27) responds to S13's message by asking for more information on the resources shared with the class *I – R – A:* S27's message also acknowledges S13's willingness to share her insights with the class.
Message no. 1933[Branch from no. 1869] **Author: S19** **Date: Tuesday, June 8, 7:18am** **Subject: Re: Shutting Down Chat Ref** *As is the case with so many services a library offers, it is very difficult to perform a cost benefit analysis to justify funding. It would be interesting look at some of the details of the services that are being discontinued. Did they market the service effectively?*	*I – R:* The message posted by S13 elicits one more response from another student (S19) within the same conversation.

Table 4.5: A discourse sequence as evidence of collaborative learning

Listserv discussion **Wednesday, June 2, 9:38 am – Friday, July 9, 2:35 pm**	
Participants' discourse (continued)	**Discourse sequences (continued)**
Message no. 2065[Branch from no. 1933] **Author: S9** **Date: Wednesday, June 9, 10:00pm** **Subject: Re: Shutting Down Chat Ref** *Hi S19, I understand that a library is not expected to make a profit, however, what exactly is it that determines if a service is eliminated, other than not enough patron use.*	*I – R – R:* A student (S9) responds to S19's message, asking for more information within the same conversation.
Message no. 2303[Branch from no. 2065] **Author: S19** **Date: Wednesday, June 16, 7:02am** **Subject: Re: Shutting Down Chat Ref** *A cost benefit analysis is performed on the service. The cost of providing the service is relatively easy to perform. The benefit portion is much harder. How to you place a value on the correct answer to a question? There are some qualitative and quantitative methods, such as asking how much of a tax refund a person would want if the service was no longer offered, or determining the cost of what the patron would do if the service was not offered. If you are interested I could send you some references. The point is to be able to perform a Return on Investment. Is this program the best bang for the buck when our budget is shrinking.*	*I – R – R – R:* After a few days, S19 responds to S9's inquiry. He also offers to share with S9 more specific resources on the topic of their conversation.

Table 4.5: A discourse sequence as evidence of collaborative learning (continued)

The sets of discourse sequences resulting from the interactions among S13, S27, S19, and S9 as described in Table 4.5 are:

Set I:

S13> (I)

S27> (I – R)

S27> (I – R – A)

Set II:

S13> (I)

S19> (I – R)

S9 > (I – R – R)

S19> (I – R – R – R)

These discourse sequences represent sets of *student – student interactions* initiated by the students themselves. They also represent the students' willingness to share their ideas and resources to increase their individual learning through their participation in bulletin board discussions. Therefore, the students' discourse in this example fully represents the behaviors expected of self-directed students in a collaborative learning environment as defined in the literature (Hathorn & Ingram, 2002; McInnerney & Roberts, 2004; McWhaw, Schnackenberg, Sclater & Abrami, 2003).

Confirming whether other students in the class had access to the insights and resources shared by S13, S9, and S19 or the extent to which the students' cognitive abilities allowed them to extend their understanding and knowledge in the domain of interest is beyond the scope of this analysis. However, this study does illustrate how the systematic analysis of the students' discourse can serve as evidence of opportunities for collaborative learning in distance education environments.

4.3.2 Online conversations as evidence of learning outcomes

There is an ongoing debate among researchers and practitioners over the extent to which the benefits of online teaching/learning practices can be evaluated and the extent to which higher-order learning outcomes are feasible in online learning environments (Hedberg, 2001). Typical tools for the assessment of collaborative work in face-to-face environments include procedures and instruments to measure students' cognitive, social, attitudinal and work habits: observation, compositions, presentations, essays, and tests (Johnson & Johnson, 2004).

Since only a few of these approaches can be transferred to the online teaching/learning environment, there is a need for more research to inform the assessment of students' performance in such environments (Pallof & Pratt, 2005).

As an attempt to address the issue of assessment, the cognitive activity and knowledge-construction processes represented in the participants' discourse were characterized as evidence of learning outcomes in the study. The framework for this analysis was provided by Anderson and Krathwohl's (2001) taxonomy of educational objectives. This two-dimensional model identifies four types of knowledge and six levels of cognitive processes. It provides an effective scaffold for analyzing discourse to reveal the learning outcomes it represents.

4.3.2.1 Knowledge dimension

The knowledge dimension in the Anderson and Krathwohl (2001) taxonomy includes definitions for factual, conceptual, procedural, and metacognitive knowledge. In the conversations selected for the study, all these types of knowledge were represented by the participants' discourse. However, not all types of knowledge

were represented in all conversations (Table 4.6), nor were all types of knowledge constructed and shared by all groups of participants (Table 4.7).

Knowledge type	Synchronous Conversations				Asynchronous Conversations			
	1	2	3	4	1	2	3	4
Factual	X	X	X					
Conceptual	X	X	X	X	X	X		
Procedural	X	X	X	X		X	X	X
Metacognitive								X

Table 4.6: Types of knowledge identified for each type of conversation

Knowledge type	Instructors	Guest speakers	Students
Factual	X	X	X
Conceptual	X	X	X
Procedural	X	X	X
Metacognitive			X

Table 4.7: Types of knowledge identified by group of participants

Factual knowledge: As described by Anderson and Krathwohl (2001), factual knowledge involves "the basic elements students must know to be acquainted with a discipline or solve problems in it" (p. 45). This type of knowledge involves specific verbal and nonverbal labels and symbols existing at a relatively low level of abstraction.

The students' discourse in the synchronous conversations represented diverse instances of their knowledge of basic elements and facts explicitly related to the course content. For instance, the following question extracted from a conversation with E1 illustrates how a student (S8) draws from the course content to include factual knowledge in his question:

Expert Chat with E1

S8>>In your article you mentioned history, training and tech support as key elements to look for in a vendor. Is there any other thing we should be looking at as new librarians?

In another conversation, a student (S13) draws from the topics discussed in a listserv – which is part of one of the course's individual assignments – to pose a question to the guest speakers (E3 & E4) involving factual information about trends in virtual reference services for specific types of libraries:

Expert Chat with E3 & E4

S13>A number of comments in the listserv were from libraries that have discontinued chat reference services. Have you noticed a decrease in number of clients? Or has there been a decline in use by a particular library type, such as academic?

The students' discourse in the asynchronous conversations represented several instances of factual knowledge; however, since these conversations provided no evidence of how that knowledge was created or discovered by the students in relation to the course content, they were not coded as instances of factual knowledge.

Conceptual knowledge: Anderson and Krathwohl (2001) define conceptual knowledge as "the interrelationships among the basic elements within a larger structure that enable them to function together" (p. 48). This type of knowledge represents the schemas, models, and theories that students have about a subject matter, its organization, and the ways in which its parts or bits of information are connected.

The students' discourse provided extensive evidence of their understanding of the basic concepts in the domain and of their interrelationships. For instance, the following questions extracted from a conversation with E1 illustrate the richness of the conceptual knowledge constructed by students S6 and S3 when posing their individual questions to guest speakers in the "Dialogue with Experts" sessions:

Expert Chat with E1

S6>>Quoting from your article at times it seems that librarians have boarded a train without knowing where its going with more and more travelers climbing on every day. Is the situation any better today? End

S3>>You've mentioned several obstacles to the success of e-reference. What is the single biggest of these obstacles? In other words, if you were allowed to have one wish granted about a change in e-reference, what would your wish be?

The students' discourse in asynchronous conversations provided extensive evidence of their conceptual knowledge as well. In the "two points of view" discussion, the students were asked to analyze and compare diverse points of view in the literature regarding the feasibility and complexity of e-reference services. The following message posted by S13 illustrates how the students created and shared conceptual knowledge in such conversations:

Two points of view discussion
May 31, 9:17pm – July 7, 4:54pm

Message no. 1671
Author: S13
Date: Tuesday, June 1, 10:12pm
Subject: Reaction and Archivist View
The tone of these articles was divergent but I think the overall message was the same. The authors of both articles are promoting what they believe to be the best way to serve their users. And, as it has been noted, the environments and the patrons they serve have different needs and different expectations. Each library has to determine for itself how best to use its resources and how best and to what level to implement new technology. From an archivist's standpoint, digital reference has improved and increased the use of collections.

Procedural knowledge: Anderson and Krathwohl (2001) define procedural knowledge as "the methods and criteria for determining when to use appropriate procedures" (p. 52). This type of knowledge involves skills, algorithms, techniques, and methods – collectively known as procedures.

Several exercises in the course content were designed to develop the students' procedural knowledge. Instructional strategies as diverse as role playing, transcript analysis, case analysis, and project-based learning focused on the students' procedural abilities.

The students' discourse in the synchronous conversations provided extensive evidence of procedural knowledge construction and sharing. For instance, the following excerpt illustrates the way in which a student (S3) develops procedural knowledge related to specific types of virtual reference transactions from one of the articles assigned as a reading for a "Dialogue with an Expert" session:

Expert Chat with E2

S3>>You indicate in your article that librarians should consider switching a conversation with a patron into another medium (e.g. from chat to phone) if they feel the conversation would work better there. I can see that chat works best when the question involves co-browsing; could you make any generalizations about which sort of medium works best for other sorts of questions?

The students' discourse in the asynchronous conversations also provided evidence of their ability to develop procedural knowledge in relation to the skills and methods involved in the course exercises. For instance, the following excerpt from the "course evaluation" discussion illustrates the way in which a student made appropriate use of the diverse resources available for one of the individual exercises:

Course evaluation discussion
July 6, 10:40am – July 9, 4:52pm

Message no. 3628[Branch from no. 3625]
Author: Anonymous
Date: Thursday, July 8, 1:31pm
Subject: course evaluation
In regard to the [hands-on practice], I used the coordinator, as my mentor. I utilized the "need help" button to contact her when I had a problem or question. I also emailed her a couple of responses before I sent them to the patron to see if they were on track. I figured this is supposed to be a learning experience, and she offered her help so I took her up on it. She was very willing and always quick to respond!

Metacognitive knowledge: Anderson and Krathwohl (2001) define metacognitive knowledge as "the awareness and knowledge of one's own cognition" (p. 55). This type of knowledge involves self-awareness, self-reflection, and self-regulation. In the study, the students' discourse in the asynchronous conversations represented the richness of their self-reflections and self-knowledge, providing extensive evidence of the type of metacognitive knowledge they constructed and shared. In particular, an activity within the "Course Wrap-up" section invited students to share their insights anonymously about the course content, the instructional strategies, and the instructional team members. The following messages illustrate the richness of the metacognitive knowledge constructed and shared by the students about these aspects of the course:

Course evaluation discussion
July 6, 10:40am – July 9, 4:52pm

Message no. 3519
Author: Anonymous
Date: Tuesday, July 6, 10:40am
Subject: Some thoughts...
First, I loved this course! I learned so much, and feel I have stretched myself professionally which is always a good thing. The work involved real patrons which I found was much better than the artificial atmosphere of the chat reference. The work experience was invaluable…

Message no. 3538
Author: Anonymous
Date: Tuesday, July 6, 2:54pm
Subject: course evaluation
This has been a fantastic learning experience for me. The course was extremely well designed and should be an exemplary model for all faculty. The methods of instructional delivery were appropriate for the content of the course. The expert chats were a good way to gather students for a discussion and the posted transcripts were an effective way to share the discussion with all class members and continue the conversation. The role playing exercises helped me to connect with other students in the class and learn, in an authentic way, the essential components of e-reference skills.

4.3.2.2 Cognitive-processes dimension

Figure 4.1 displays the cognitive processes described in Anderson and Krathwohl's (2001) taxonomy, along with the definitions for each process and subprocess. This schema provided the framework for the analysis of the kinds of cognitive activities displayed by the students in the study.

Cognitive processes *(adapted from Anderson and Krathwohl, 2001)*	
Remembering	Retrieving relevant knowledge from long-term memory
Recognizing	Locating knowledge in long-term memory that is consistent with presented material.
Recalling	Retrieving relevant knowledge from long-term memory.
Understanding	Constructing meaning from instructional messages.
Interpreting	Clarifying, paraphrasing, representing, translating, or changing from one form of representation to another.
Exemplifying	Finding specific instances or illustrations of a concept or a principle.
Classifying	Determining that something belongs to a category.
Summarizing	Abstracting a general theme or major point.
Inferring	Concluding, predicting, extrapolating, interpolating or drawing logical conclusions from presented information.
Comparing	Contrasting, mapping, matching, or detecting correspondences between ideas, objects, and the like.
Explaining	Constructing cause-effect models of a system.

Figure 4.1: Taxonomy of cognitive processes and subprocesses

Cognitive processes (continued)	
Analyzing	Breaking materials into constituent parts and determining how those parts relate to one another and to an overall structure or purpose.
Differentiating	Discriminating, distinguishing, and selecting relevant from irrelevant parts or important from unimportant parts of presented material.
Organizing	Integrating, structuring, and determining how elements fit or function within a structure.
Attributing	Determining a point of view, bias, values, or intent underlying presented materials.
Evaluating	Making judgments based on criteria and standards.
Checking	Coordinating, monitoring, and detecting inconsistencies within a process or product. Determining whether a process or product has internal consistency. Detecting the effectiveness of a procedure as it is being implemented.
Critiquing	Detecting inconsistencies between a product and external criteria. Determining whether a product has external consistency. Detecting the appropriateness of a procedure for a given problem.

Figure 4.1: Taxonomy of cognitive processes and subprocesses (continued)

Cognitive processes (continued)	
Creating	Putting elements together to form a coherent or functional whole. Reorganizing elements into a new pattern or structure.
Generating	Developing alternative hypotheses based on criteria.
Planning	Designing and devising a procedure for accomplishing some task.
Producing	Inventing and constructing a product.

Figure 4.1: Taxonomy of cognitive processes and subprocesses (continued)

Table 4.8 and Table 4.9 show that the students' discourse provided no evidence of their ability to retrieve information from long-term memory *(remembering)* nor of their ability to reorganize elements into new products, patterns, or structures *(creating).* However, the discourse represented extensive evidence of their ability to understand, apply, analyze, and evaluate the information delivered as course content by the instructors and guest speakers. The following sections provide an overview of these cognitive processes and subprocesses identified in the discourse of all the participants by type of conversation (Table 4.8) and by group (Table 4.9). Because the purpose of the analysis was to shed light on how student performance can be assessed in an online learning environment, the section focuses specifically on examples of learning outcomes achieved by the students.

Cognitive processes and subprocesses	Synchronous Conversations				Asynchronous Conversations			
	1	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Remembering								
Recognizing								
Recalling								
Understanding								
Interpreting	X	X	X	X	X	X	X	
Exemplifying	X	X	X	X		X	X	
Classifying						X		
Summarizing					X	X		
Inferring	X	X	X	X	X	X		X
Comparing	X	X	X	X	X	X	X	X
Explaining	X	X	X	X		X		X
Applying								
Executing						X	X	X
Implementing								
Analyzing								
Differentiating	X		X	X	X			X
Organizing	X	X	X	X		X		
Attributing	X	X	X	X	X	X	X	X
Evaluating								
Checking	X	X	X	X		X	X	
Critiquing	X		X	X	X	X		X
Creating								
Generating								
Planning								
Producing								

Table 4.8: Cognitive processes identified for each type of conversation

Cognitive processes and subprocesses	Instructors	Guest speakers	Students
Remembering			
Recognizing			
Recalling			
Understanding			
Interpreting	X	X	X
Exemplifying	X	X	X
Classifying	X		X
Summarizing	X	X	X
Inferring	X	X	X
Comparing	X	X	X
Explaining	X	X	X
Applying			
Executing	X		X
Implementing			
Analyzing			
Differentiating	X	X	X
Organizing	X	X	X
Attributing	X	X	X
Evaluating			
Checking	X	X	
Critiquing	X	X	X
Creating			
Generating			
Planning			
Producing			

Table 4.9: Cognitive processes identified for each group of participants

Understanding: The students' discourse provided extensive evidence of their ability to select and understand relevant information from the course content. Many instances of the students' ability to interpret, exemplify, classify, explain, summarize, infer, compare, and explain the main concepts and procedures in the domain of interest were identified in the study. The following sections illustrate how each of these cognitive subprocesses was represented.

Interpreting: The students' discourse in the "Dialogue with Experts" sessions provided evidence of their ability to interpret the concepts and procedures being discussed by clarifying and paraphrasing them in the context of each conversation. For instance, the following excerpt illustrates a student (S3) posing a question to clarify her interpretation of the materials posted by a guest speaker (E1) in a Web site:

Expert Chat with E1

> *S3>>Your website says that your specific project involves collaboration of "all kinds" of libraries. I'm assuming this means that sometimes you have academic librarians helping public-library users, and public librarians helping academic users, and so forth. Am I right?*

The bulletin board discussions also represented diverse instances of the students' ability to paraphrase and interpret the concepts and procedures being discussed. For instance, the following excerpt illustrates a student's (S22) ability to interpret and describe the views presented by different authors in the readings assigned as part of an individual assignment:

Two points of view discussion
May 31, 9:17pm – July 7, 4:54pm

Message no. 1639
Author: S22
Date: Tuesday, June 1, 10:55am
Subject: Re: Two Points of View
The first article describes a public library in an affluent town in New England that implements innovative e-reference strategies based on patron needs and requests for more online services. The second article presents a counter argument against the technological movement toward e-reference by claiming slow forms of digital reference, administrative difficulties and lack of human interaction.

Exemplifying: The "Dialogue with Experts" sessions were centered specifically on the speakers themselves and did not provide evidence of the students' ability to identify specific instances of concepts or procedures related to the conversation topics. In contrast, the bulletin board discussions did provide such evidence. For instance, the following excerpt illustrates a student (S13) describing specific procedures that increase the use of collections with digital reference transactions:

Two points of view discussion
May 31, 9:17pm – July 7, 4:54pm

Message no. 1671
Author: S13
Date: Tuesday, June 1, 10:12pm
Subject: Reaction and Archivist View
From an archivist's standpoint, digital reference has improved and increased the use of collections. Researchers who find a collection online through a webpage or online catalog can e-mail the archivist a question and potentially save themselves a costly trip. On the other hand, if the archivist informs the researcher that the collection is rich in information relevant to their research topic, the researcher could visit the repository and spend numerous hours or days with the collection.

In the same discussion, another student (S11) described specific facts to illustrate the way in which digital reference transactions can be perceived as less personalized by patrons:

Two points of view discussion
May 31, 9:17pm – July 7, 4:54pm

Message no. 1726
Author: S11
Date: Thursday, June 3, 5:44pm
Subject: Two sides...
There is much less personalization with digital tools, and although "a quick response" is often a draw to using a "live chat" interfaces, studies (and reality) show that much more time is spent using the digital tools than would have been spent in person or on the phone (primarily because it takes so much longer to type than speak). I use the software LivePerson where I work, and even simple questions about hours, circulation, and other basic "where do I find encyclopedia" type of questions submitted through LivePerson take about 3 - 5 minutes to answer, whereas had the person come in or called, they would have had the answer in a matter of 45 seconds to a minute.

Classifying: Similarly, the participants' discourse in "Dialogues with Experts" did not provide evidence of this cognitive subprocess, while the bulletin board discussions included several instances of the students' ability to determine whether a concept or procedure belongs to a specific category.

For instance, the following excerpt illustrates a student's (S3) attempt to determine whether specific kinds of Web sites can be categorized as digital libraries:

Listserv discussion
June 2, 9:38am – July 9, 2:35pm

Message no. 2170
Author: S3
Date: Saturday, June 12, 10:14pm
Subject: "what is a digital library?"
I was reminded of a recent attempt at definition by a thread called "What is digital library?" People commenting on this thread were eager to define "digital" as loosely as possible, to allow for advances in technology. As a result a couple of the contributors lost sight of the importance of that second word, "library." They suggested that web sites such as "Amazon" and "iTunes," as collections that were created on certain principles, managed, to some extent preserved, and easily searched, might qualify as "digital libraries." Recalling these writers to their senses in an email, someone reminded them that a digital library needs to be not just digital but a library—a place that serves a specific community. I enjoyed this reminder that, digital or not, libraries are places that serve.

Summarizing: Although evidence of the students' ability to abstract general themes or major points form the course content is also absent from the synchronous conversations, the bulletin board discussions represented several instances of this behavior. For instance, the following excerpt illustrates a student's (S22) ability to understand and describe the main themes discussed in the readings assigned as part of an individual assignment:

Two points of view discussion
May 31, 9:17pm – July 7, 4:54pm

Message no. 1639
Author: S22
Date: Tuesday, June 1, 10:55am
Subject: Re: Two Points of View
The authors present a positive and uplifting approach to incorporating new technologies into the public library experience for the librarians and the patrons. The authors describe the enthusiastic response to new technology library tools yet also presented a balanced approach to writing the article in describing the time consuming and expensive experimentation with and evaluation of the e-reference software. The article offers numerous instances of evidence of direct response to patron feedback and librarian trouble-shooting in the form of direct quotations.

Inferring: The students' discourse in the "Dialogue with Experts" sessions provided evidence of their ability to make predictions and to draw conclusions in the context of each conversation. For instance, the following excerpt illustrates a student's (S17) ability to predict the implications for digital reference transactions when these services are expanded to an international level:

Expert Chat with E5

S17>>I'm curious about collection development issues...
S17>>we are used to a goal of meeting the needs of the users…
S17>>but what if the users are around the world...
S17>>and you may not be interacting with the same library twice…
S17>> through a Virtual Reference service...
S17>>It seems like a daunting task…
S17>>I guess the real question is…
S17>>do you see libraries coming up with ways to overcome this issue?

The bulletin board discussions also represented diverse instances of the students' ability to make predictions and draw conclusions from the themes within each conversation. For instance, the following excerpt illustrates a student's (S23) ability to infer the impact of digital reference services for specific user groups who are not being considered by all service providers:

Listserv discussion
June 2, 9:38am – July 9, 2:35pm

Message no. 2618[Branch from no. 2609]
Author: S23
Date: Wednesday, June 23, 11:15am
Subject: Re: Digital Reference for Homeschooling
Some reasons parents decide to homeschool their children include: religious reasons, not being happy with public school options, and the belief they can provide a better learning environment at home. I believe e-reference could be an effective instructional tool in the homeschool environment.

Comparing: The participants' discourse in both the synchronous and the asynchronous conversations provided evidence of their ability to contrast, map, and detect correspondences among the ideas, concepts, and procedures being discussed. For instance, the following excerpt from a "Dialogue with Experts" session illustrates the ability of a student (S3) to draw from the course content to compare the ways in which diverse types of libraries address their patrons' questions:

Expert Chat with E1

S3>>In face-to-face settings, reference librarians and public librarians typically address questions rather differently, don't they? I was wondering if this distinction tended to get blurred in the virtual setting or, if not, whether it posed any problems.

The following excerpt from the "listserv" discussion illustrates S21's ability to compare and contrast the implications of information services provided to diverse student populations:

Listserv discussion
June 2, 9:38am – July 9, 2:35pm

Message no. 2639[Branch from no. 2618]
Author: S21
Date: Wednesday, June 23, 5:29pm
Subject: Re: Digital Reference for Homeschooling
I know of a youth services librarian in a public library who worked a lot with home schoolers and their families. It is a relationship you need to cultivate but it can be done. A typical student in school would first go to their school library (hopefully, because that's where I am!) as a class to start a research project and obtain resources. Home schoolers don't have this resource. They go right to the public library when they need information. I think virtual reference would appeal to, and be well used by, home school families if they knew more about it.

Explaining: The students' discourse provided diverse examples of their ability to construct cause-effect models regarding the interactions among diverse factors influencing digital reference transactions. For instance, the following excerpt from the "two points of view" discussion illustrates a student's (S6) description of the way in which particular settings and roles influence the information services provided by diverse types of libraries:

Two points of view discussion
May 31, 9:17pm – July 7, 4:54pm

Message no. 1759
Author: S6
Date: Friday, June 4, 11:07am
Subject: Two Points of View
After reading [the articles], I believe that several factors are responsible for the differing points of view. The settings– a public library and a small academic library - this determines the user population, and to a certain extent their needs. The authors' toleration and acceptance of new technology - some people are afraid of new technologies and avoid them, whilst others try to figure out the best way to utilize them. The authors' perception of their role as reference librarians. – the authors believe that the face-to-face contact is very important in reference, but as pointed out by S11, personal interactions have been replaced by technology in a lot of service areas and virtual reference is just one of them.

Applying: The discourse in the synchronous conversations provided no evidence of the students' execution or implementation of any of the exercises or assignments from the course. In contrast, the students' discourse in the asynchronous conversations provided extensive evidence of their ability to understand and apply relevant concepts and procedures from the course content when conducting various exercises. For instance, the following excerpt from the "software tools" discussion illustrates S1's effort to understand how to use a new software tool as part of a digital

reference transaction *(executing),* instructions received from F1, and a second message from S1 confirming her ability to use the software tool:

Software tools discussion
June 5, 10:53am – July 2, 6:34pm

Message no. 2092
Author: S1
Date: Thursday, June 10, 1:48pm
Subject: Patron Login
When I've tried to have someone login as the patron when I am logged in as the librarian, the patron gets the message that there is no one available at that time. I tried this a couple of times. Does anyone know--is there another step that I am missing? Thanks!!

Message no. 2098[Branch from no. 2092]
Author: F1
Date: Thursday, June 10, 3:42pm
Subject: Re: Patron Login
F2 and I just tested this and it seems to work fine. Make sure that your patron is using the [right] URL…Let us know if this works.

Message no. 2101[Branch from no. 2098]
Author: S1
Date: Thursday, June 10, 3:58pm
Subject: Re: Patron Login
Thanks! It seems to be working fine for me now…Thanks again for testing, F1 !

Analyzing: The students' discourse in both the synchronous and the asynchronous conversations provided extensive evidence of their ability to analyze the course content by determining its relevant pieces *(differentiating),* identifying the main concepts and their relationships *(organizing),* and determining the main ideas and points of view underlying the course content *(attributing).* The following sections illustrate how each of these analytic subprocesses was represented in diverse conversations in the study.

Differentiating: The students' discourse in the "Dialogue with Experts" sessions provided evidence of their ability to discriminate and select relevant from irrelevant concepts and procedures as part of their contributions in the synchronous conversations. For instance, the following excerpt illustrates the way in which a student (S3) draws from previous experiences to pose a question on the impact of diverse library settings on digital reference transactions:

Expert Chat with E1

S3>>In face-to-face settings, reference librarians and public librarians typically address questions rather differently, don't they? I was wondering if this distinction tended to get blurred in the virtual setting or, if not, whether it posed any problems.

The bulletin board discussions also represented diverse instances of the students' ability to analyze and differentiate relevant from irrelevant concepts and procedures *(differentiating).* For instance, the following excerpt illustrates a student's (S22) reactions to the readings assigned as part of an individual assignment, addressing patrons with special needs:

Two points of view discussion
May 31, 9:17pm – July 7, 4:54pm

Message no. 1639
Author: S22
Date: Tuesday, June 1, 10:55am
Subject: Re: Two Points of View
One factor left out of both articles is the way digital reference tools can meet the needs of patrons with special needs. For example, a deaf patron may not be able to communicate with a librarian over the telephone or even face to face, but the computer technologies permit the ease of communication for both parties. Other patrons may not physically be able to visit the library and online access from home may be essential. The contrasting articles offer an excellent basis an introductory online discussion about e-reference.

Organizing: The students' discourse in the "Dialogue with Experts" sessions provided evidence of their ability to analyze the way in which diverse elements fit and function within a structure or procedure. For instance, the following excerpt illustrates a student (S5) describing the set of procedures she used when conducting a digital reference transaction as well as her analysis of the role that information technology plays when conducting those transactions:

Expert Chat with E3 & E4

S5>>Well, for instance, last week I was answering a reference question…
S5>>And the question was about a very technical science process....
S5>>And I found a website that had an animation that explicated it....
S5>>But I didn't know if the patron had software to run it…
S5>>so I sent along some text answers as well...
S5>>But what I thought was most interesting was…
S5>>how new technology can provide new sources of information...
S5>>But some people can't use them without the right software!

The bulletin board discussions also represented diverse instances of the students' ability to analyze the concepts and procedures being addressed to determine how diverse elements fit together in a structure or procedure *(organizing).* For instance, the following excerpt illustrates a student's (S12) reactions to a definition provided by another participant:

Listserv discussion
June 2, 9:38am – July 9, 2:35pm

Message no. 2081[Branch from no. 2078]
Author: S12
Date: June 10, 9:35am
Subject: Re: What do we call it discussion
Personally, I think most people, even those who aren't necessarily tech-savvy, have come to recognize the newer, technological meaning of the word "virtual." Especially since it's one of those words that has been used (or overused) in the media to indicate anything vaguely related to computer technology. But the semantic issue of the double meaning of something like "virtual" should not be glossed over…Other terms may be just as much of a semantic double-edged sword and if "virtual" has caught on, it will be hard to dislodge it.

Attributing: The students' discourse in the "Dialogue with Experts" sessions provided no evidence of their ability to analyze the concepts being discussed with the guest speakers by attributing the speakers' point of view or intent as part of these conversations. In contrast, the bulletin board discussions represented several instances of the students' ability to draw from the concepts being addressed by other participants to determine their points of view. For instance, the following messages posted by S7 and S10 illustrate the students' ability to determine the point of view underlying the content of two articles assigned as part of the readings for an individual assignment:

Two points of view discussion
May 31, 9:17pm – July 7, 4:54pm

Message no. 1637
Author: S7
Date: Tuesday, June 1, 10:36am
Subject: Response
Upon reading [both articles], I have determined that the widely different settings are responsible for the divergent attitudes of the authors….The authors mention, in particular, fostering solid research skills. A visit to the reference librarian would promote this better than an on-line reference chat. In the second article, the setting was completely different - a public library that, from the authors' accounts, had great community support. Both articles, separately, brought forth the pros and cons of e-reference. Technology, though, is here to stay and I appreciated the second article's authors' determination and zeal for it as opposed to the attitude in the first article.

Message no. 1663
Author: S10
Date: Tuesday, June 1, 8:40pm
Subject: Article Comparison
The polarization of views in these two articles, on first reading, was surprising. On a second reading it becomes apparent that while [the authors] seem to be opposed to virtual reference, they don't discount it as a tool. They just object to the hype being vented about the subject in general. On the other hand, the [second article] presents a much more positive view of the same attitude. It embraces virtual reference whole-heartedly and run with it. [The authors'] attitude…made entering the virtual reference world a positive experience. Overall, I think it is probably the difference in the orientation of the authors that makes the biggest difference.

Evaluating: No students' discourse in either synchronous or asynchronous conversations provided evidence of their ability to determine the effectiveness of a procedure as it was being implemented *(checking).* While the instructional team's discourse represented extensive evidence of their willingness to determine if their answers to the students' questions were actually addressing the students' concerns and questions, this discourse does not provide evidence of students' learning related to checking.

As with other cognitive subprocesses, the students' discourse in the synchronous conversations provided no evidence of their ability to evaluate the information delivered as course content, while the discourse in asynchronous conversations provided extensive evidence of this behavior. For instance, in a conversation on the topics being discussed within a listserver, the students had an opportunity to share their insights and react to the topics being discussed by others. The following message illustrates S19's ability to assess the appropriateness and feasibility of using specific tools for conducting digital reference transactions *(critiquing):*

Listserv discussion
June 2, 9:38am – July 9, 2:35pm

Message no. 3661[Branch from no. 3638]
Author: S19
Date: Friday, July 9, 7:06am
Subject: Re: using IM programs
I LOVE IM as a reference delivery service. Several professors I know use it regularly to interact with students during office hours. I believe we have an absolute obligation to open up as many communication channels as possible with our patrons. IM seems like a very reasonably priced addition.

In another conversation, students were instructed to share their insights anonymously about the course content, the instructional strategies, and the instructional team members. The following message illustrates the students' ability to assess the effectiveness of diverse aspects of the course *(critiquing):*

Course evaluation discussion
July 6, 10:40am – July 9, 4:52pm

Message no. 3580
Author: Anonymous
Date: Wednesday, July 7, 9:24am
Subject: Course evaluation
I have to agree that I felt chained to my computer during this class. The postings were overwhelming and the amount of small little tasks to be accomplished seemed to pile up. The hands on practice was the best part of the class in my opinion, however I thought too many hours were assigned. Anything more than three hours of chatting with another classmate is pushing it.

4.3.3 Discussion of learning analysis

The fundamental assumption about learning through constructivist processes is that learners construct new concepts based upon their past/current knowledge (Wilson, 1996). Therefore, the focus of the collaboration among students in constructivist learning environments should be on the learning processes that take place and on the outcomes of these processes as well as on the instructional strategies that support and enhance group communication and collaboration (Hogan, Nastasi & Pressley, 2000; Sammons, 2003).

In the study, the systematic analysis of online conversations at the "macro" level emphasized the process-oriented nature of teaching/learning interactions among participants, providing a means to understand the ways in which the participants

engaged in conversational actions and collaborative processes in the midst of teaching/learning interactions in a CSCL environment. Further analysis of the same conversations at the "micro" level provided fine-grained descriptions of the types of knowledge and cognitive processes involved in diverse teaching/learning interactions within the environment.

Additional research is suggested to analyze (1) the ways in which diverse communication structures and communication channels converge in a CSCL environment to shape and influence the students' construction and discovery of knowledge in relation to the course content and (2) the extent to which complex cognitive processes – such as problem-solving, decision-making, and critical thinking – as well as other types of knowledge – declarative knowledge, structural knowledge, tacit knowledge, and situational knowledge – converge in online conversations to support and enhance specific teaching/learning strategies in constructivist CSCL environments.

4.4 Summary of findings

The focus of the study was the communication behaviors and interactions among instructors and students in online conversations from two perspectives: a macro level of analysis, in which each conversation was analyzed in the context of the instructional unit in which it took place within the course, and a micro level of analysis, in which each message within a conversation was considered a unit of analysis.

Several instances of "Dialogues with Experts" and bulletin board discussions were characterized as teaching/learning events. Then, the participants' patterns of

engagement in these events were analyzed in terms of the conversational actions and structures represented in their discourse. The data suggest that the nature of the teaching/learning process in the "Dialogues with Experts" is different from the one in the bulletin board discussions. These differences were reflected primarily in terms of the different types of interactions among participants in each type of teaching/learning event: the participants' discourse in the "Dialogues with Experts" reflected well-structured conversations, moderated by a faculty member, while the participants' discourse in the bulletin board discussions reflected ill-structured conversations in which the participants' communication behaviors evolved in relation to the goals and content of each conversation.

Diverse roles were identified in the participants' discourse within both types of conversations. The students' roles included students as information users, as active participants, as participant observers, as problem solvers, and as self-regulators. Several roles were identified for instructors as well: instructors acted as moderators, as content experts, as facilitators, and as evaluators. The role of the CSCL environment supporting the instructional interactions among participants in the study was also analyzed in terms of diverse concepts and constructs representing the role of media in several learning paradigms. In light of the participants' roles, online conversations among students in this CSCL environment were also analyzed as collaborative learning processes. In particular, the participants' discourse in the asynchronous conversations represented several opportunities for the students (1) to share information from the course content or from their previous experiences and (2)

to receive constructive feedback from the instructional team or other students through small-group processes as well as individual ones.

These collaborative processes among students can be characterized as instances of constructivist learning in which the role of peer interaction is influential in constructing and sharing knowledge. However, it was often difficult for the researcher to determine whether the students' discourse represented (1) student – content interactions, in which students selected, interpreted, transformed, or evaluated information from the course content to create new knowledge; (2) knowledge created or discovered by students in relation to the course content; or (3) knowledge related to the students' experiences prior to the course. Thus, only those instances of students' discourse making explicit reference to the course materials – such as articles, previous conversations, or course-related Web sites – were characterized as evidence of cognitive activity and knowledge construction in the study.

The data suggest that diverse communication structures – individuals, pairs, small groups, large groups, or all students in the class – and diverse communication channels – synchronous and asynchronous – converged to support several instances of the main teaching/learning events in the study, which resulted in a variety of learning processes and learning outcomes. Since one or more instances of teaching/learning events can be sustained simultaneously, it seems that the participants were able to interact within and across events in the CSCL environment.

Therefore, the particular characteristics of each event – instructional goals and instructional phases as well as the roles of instructors, students, and media – converged to shape and influence the patterns of engagement among participants in

the environment. Based on these findings, the following chapter describes a model representing an abstraction of the instructional communication process in constructivist CSCL environments.

Chapter 5: Conclusions and Implications

The goal of this study was to deepen our understanding of the instructional communication process among participants in CSCL environments. The main theoretical contributions from this research are (a) a model that characterizes online conversations as instructional communication events among participants in CSCL environments and (b) a framework for the systematic analysis of online conversations in CSCL environments. The model and the framework integrate procedures and constructs from learning theory, distance education theory, and communication theory. The results also suggest principles for informing instructional design for CSCL environments.

5.1 An instructional communication model for CSCL environments

Early research on instructional communication in face-to-face instructional settings characterized the teacher as a *sender*, the students as *receivers*, the course content as a *message*, and the instructional technology and materials as *communication channels* (Heinich, Molenda & Russell, 1996). Over time, the characterization of the instructional communication process evolved into a transactional model that better represents the students' active participation in student-oriented environments (Heinich, Molenda & Russell, 1999). This study builds upon these theoretical constructs and characterizes *online conversations as instances of communication events* that converge to influence and shape the instructional process in CSCL environments.

The main assumption of this study is that an instructional situation should be conceptualized as a communication space in which several communication events, communication media, and communication behaviors converge to provide instructional experiences. As Heinich, Molenda and Russell (1999) have stated, "effective instruction will not take place unless effective communication has taken place" (p. 12).

The instructional communication model resulting from the study draws from *the convergence communication model* introduced by Rogers (1980), in which the main communication goal is to share information among participants and to build mutual understanding as a requisite for *convergence of meaning*. The model assumes a constructivist view of learning in which learning is the result of the learners' active engagement in meaningful learning experiences provided by diverse instructional communication events. It addresses the characteristics of adult learners as an active, self-directed audience able to select, understand, and evaluate information related to the course content (Cahoon, 1998; Eastmond, 1998; Kasworm, 2003; Knowles, 1970; Morrison, Ross & Kemp; 2001; Nealand, 1992). Figure 5.1 depicts the model of instructional communication events in CSCL environments that resulted from the data analysis. This model includes nine categories: (a) communication channels, (b) communication structures, (c) instructional phases, (d) interaction types, (e) knowledge types, (f) cognitive processes, (g) instructors' roles, (h) students' roles, and (i) roles of media. The following sections provide a comprehensive description of each of these features as well as a discussion of the implications of each for the design of instructional communication events in CSCL environments.

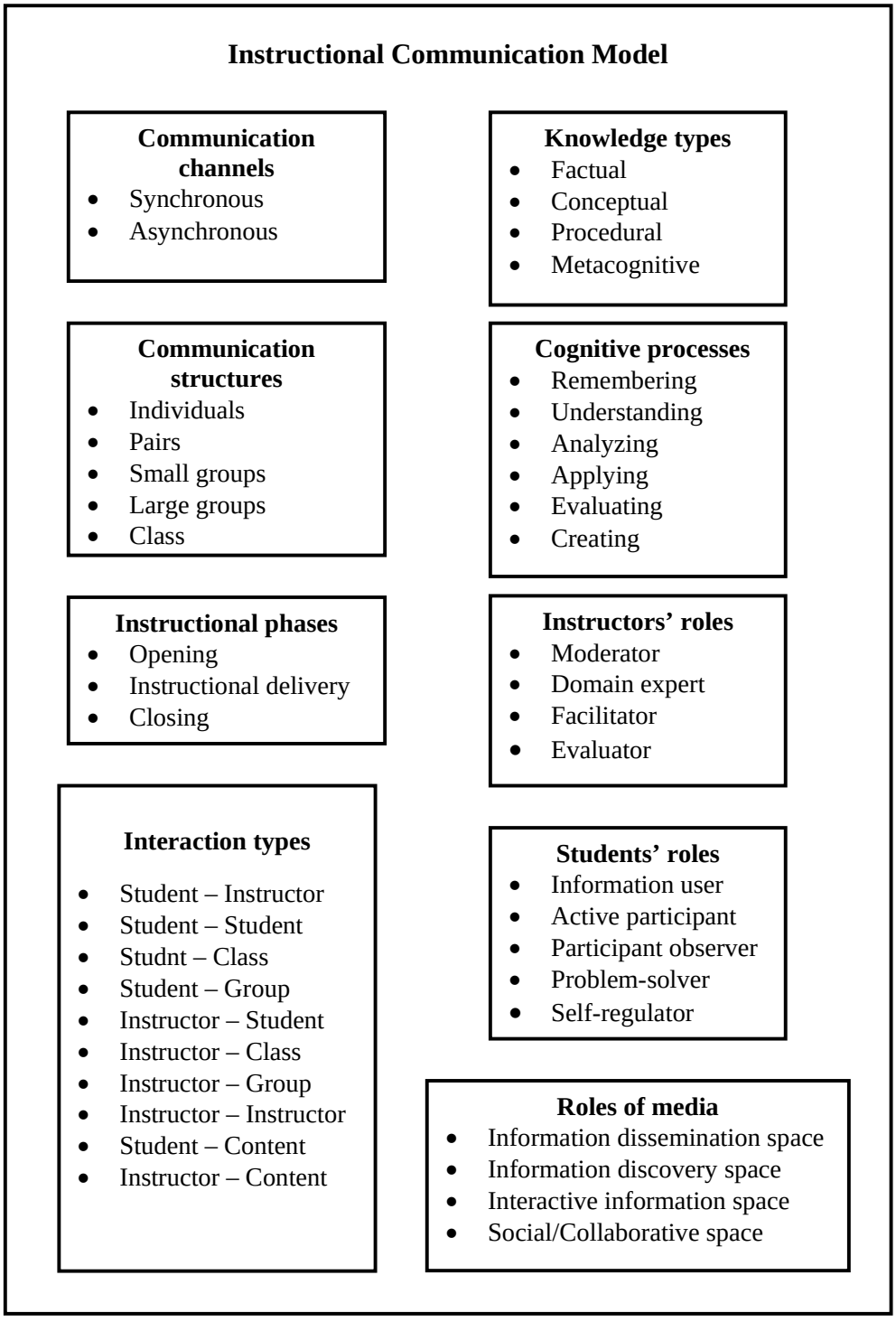


Figure 5.1: Instructional communication model for CSCL environments

5.1.1 Communication channels

The types of communication channels in the model are synchronous and asynchronous. *Synchronous communication channels* support real-time or near real-time interactions between or among two or more participants when all participants are online and available to receive and to respond to each other's messages (Pfaffenberger, 2003). Real-time chat and videoconferencing systems are examples of synchronous communication channels. *Asynchronous communication channels* support interactions in which participants are not online at the same time (Pfaffenberger, 2003). E-mail systems and electronic bulletin boards are examples of asynchronous communication channels.

In this study, synchronous communication tools seemed successful in supporting a small number of types of interactions among small groups of participants, while asynchronous communication tools seemed successful in supporting more diverse types of interactions among participants and with the course content.

The strengths and inherent characteristics of each channel must be carefully analyzed (Parker, 1999) when designing or selecting the channels or formats to support communication events in CSCL environments. Designers should choose and design particular channels to encourage the kinds of communication they believe are necessary to support particular kinds of learning (Chong, 1998; Davidson-Shivers, Muilenburg & Tanner, 2001). For example, asynchronous channels might be selected to support collaborative problem-solving, while synchronous ones might be selected to deliver content to small groups or individuals.

5.1.2 Communication structures

The communication structures in the model represent the social structures in which students can participate in communication events with instructors and/or content in a CSCL environment:

- *Individuals:* Interactions involving *only one* student at a time.
- *Pairs:* Interactions involving only *two* students at a time.
- *Small groups:* Interactions involving *three to five* students at a time.
- *Large groups:* Interactions involving *six to ten* students at a time.
- *Class:* Interactions in which all students are expected to participate at the same time.

The data in the study suggest that synchronous communication channels should be used with *small groups* as the basic communication structure, while asynchronous communication channels seem to be more suitable for *pairs, small groups, large groups,* or *the class* as communication structures. The fact that the software does not support synchronous communication with the class as a whole suggests that WebCT designers themselves recognized the infeasibility of large-scale, synchronous, online communication within current technological capabilities, instantiating a major difference between online and "traditional" education.

These findings are consistent with collaborative learning theory and research suggesting that the optimal size of a group participating in synchronous conversations should not exceed four to five people. Additionally, synchronous conversations should be no longer than 30 to 45 minutes because they demand so much energy and

concentration from participants (Bender, 2003; Holt, Kleiber, Swenson, Rees & Milton, 1998; Salmon, 2003).

5.1.3 Instructional phases

The model includes a set of basic conversational actions representing instructional phases within each communication event. The set is composed of actions derived from the literature (Adger, 2001; Cazden, 2001; Mehan, 1985) – *O, C, I, R, E, F, A* – and actions that emerged from this study – *G, P, S.*

The set of basic conversational actions are:

- *O:* opening/starting a conversation
- *C:* closing/terminating a conversation
- *I:* initiating a sequence/eliciting participation
- *R:* responding to a request for participation/elicitation
- *E:* evaluating the quality of a response
- *F:* providing feedback
- *A:* acknowledging other participants' responses
- *G:* greeting/introducing participants
- *P:* probing participants for clarification or to confirm their responses
- *S:* stating facts relevant to a topic

An instructional phase is composed of one or more conversational actions carried out by the participants in online conversations. The main instructional phases in the model are an opening phase, an instructional delivery phase, and a closing phase. In the study, the conversational actions generally included in *the opening phase* of online conversations involve a moderator or other participant formally

starting the session *(O),* a moderator greeting all participants *(G),* and a moderator or other participants sharing isolated facts of interest for the session *(S).*

The conversational actions generally included in the *instructional delivery phase* involve a moderator or a participant initiating a discourse sequence by sharing insights, asking for information, or posing a question *(I);* one or more participants responding to other participants' postings *(R);* a moderator or a participant evaluating the quality of a participant's response *(E);* a moderator or a participant providing feedback to participants *(F);* a moderator or a participant probing for clarification or to confirm responses *(P);* and a moderator or a participant acknowledging the responses from other participants *(A).*

The conversational actions generally included in the *closing phase* of online conversations involve a moderator or a student acknowledging all participants' contributions *(A),* a moderator or a student sharing information or facts of interest for future sessions *(S),* and a moderator formally ending the session *(C).*

Since each instructional phase involves diverse patterns of engagement by participants, designers of CSCL environments should carefully consider the ways in which the phases shape and influence teaching/learning interactions. For instance, online conversations moderated by an instructor in the three main instructional phases – opening, instructional delivery and closing – will provide participants with well-structured opportunities to engage in discussion and learning. In contrast, online conversations with no moderator will provide participants with opportunities to engage in collaborative processes in ill-structured conversations.

5.1.4 Interaction types

The model also draws from the types of teaching/learning interactions identified for CSCL environments in distance education (Anderson, 2003; Moore, 1989). The types of interactions in the model are: student-centered, instructor-centered, and content-centered.

a) Student-centered interactions

- *Student – instructor interactions:* Interactions between a student and an instructor, moderator, or guest speaker, initiated by the student, with instructional or social purposes.
- *Student – student interactions:* Interactions between two students for instructional or social purposes.
- *Student – class interactions:* Interactions involving a student addressing the entire group of students in the class, with instructional or social purposes.
- *Student – group interactions:* Interactions involving a student addressing a small group of students in the class, with instructional or social purposes.

b) Instructor-centered interactions

- *Instructor – student interactions:* Interactions between an instructor and a student, initiated by the instructor, with instructional, motivational or social purposes.
- *Instructor – class interactions:* Interactions involving an instructor addressing all the students participating in the course, with instructional or social purposes.

- *Instructor – group interactions:* Interactions involving an instructor addressing a small group of students in the class, with instructional, motivational, or social purposes.
- *Instructor – instructor interactions:* Interactions among two or more members of the instructional team, with instructional or social purposes.

c) Content-centered interactions

- *Student – content interactions:* Interactions in which a student selects, analyzes, and transforms the course content to construct meaning and develop new knowledge.
- *Instructor – content interactions:* Interactions in which an instructor selects, organizes, represents, adapts, or presents course content for the purpose of instruction.

Effective interactions among instructors, learners, and content are a key factor in creating meaningful learning experiences in all educational environments (Flottemesch, 2000). Because CSCL environments have both possibilities and constraints that do not exist in face-to-face settings, the type of interactions among participants must be carefully planned. An interaction protocol to guide participants in asking questions, responding to questions, collaborating, and/or making comments can certainly support the interactions and interchanges among participants (Mottet & Stewart, 2002).

Analyzing the type of interactions among course participants can help in characterizing online conversations as primarily teacher-centered, student-centered, or combined. Most of the time, the instructional design process for CSCL

environments begins with *instructor – student* interactions (Picciano, 2001); however, *instructor – content, instructor – class,* and *instructor – group* interactions should be considered as well. The interactions of students with content *(student – content)* and with other students (*student – student, student – group,* and *student – class* interactions) are very important elements of collaborative processes and should also be carefully considered when designing the instructional delivery phase within online conversations.

The data for this study suggest that the types of interactions among participants in synchronous conversations differ from those in asynchronous conversations and that the use of both communication channels in CSCL environments seems to provide the widest array of opportunities for the students to engage in discussion and learning. Although providing for diverse types of interactions among instructors, students, and content in distance education environments is often a function of the technology available to support and to deliver the course (Shearer, 2003), designers should focus on learning goals and instructional strategies rather than only on technological affordances. A fundamental design decision involves identifying which aspects of the communications among participants should be synchronous and which should be asynchronous (Chong, 1998; Davidson-Shivers, Muilenburg & Tanner, 2001; Picciano, 2003).

5.1.5 Knowledge types

The knowledge dimension in the model draws from the Anderson and Krathwohl (2001) taxonomy to identify the types of knowledge constructed, shared,

or acquired by participants in online conversations. The types of knowledge included in the model are: factual, conceptual, procedural, and metacognitive.

Basic guidelines and principles for designing effective Web-based learning environments for adult learners (Driscoll, 1998; Kasworm, 2003; Rudestam & Schoenholtz-Read, 2002) suggest diverse teaching/learning events that can be included in CSCL environments to support and enhance the construction of the specific types of knowledge introduced by Anderson and Krathwohl (2001). For instance, such environments should include conversations and interactions that:

- Introduce basic instructions and information regarding the learning goals and course assignments can provide opportunities for students to acquire and to construct *factual knowledge.*
- Incorporate collaborative argumentation and problem solving among small groups of students can provide opportunities for them to construct and share *conceptual* and *procedural knowledge.*
- Incorporate learners in planning and evaluation processes can provide opportunities for them to construct and share *procedural* and *metacognitive knowledge.*
- Encourage self-reflection and self-regulation can provide opportunities for students to construct and share *metacognitive knowledge.*

A constructivist CSCL environment supporting adult learners should provide diverse opportunities for them to assume responsibility for their individual learning

while simultaneously promoting their engagement as group members in the construction and sharing of conceptual and metacognitive knowledge (McWhaw, Schnackenberg, Sclater & Abrami, 2003).

5.1.6 Cognitive processes

The cognitive dimension in the model draws from the Anderson and Krathwohl (2001) taxonomy and provides a way to analyze the participants' discourse as evidence of levels of cognitive activity in each communication event. (The cognitive processes and subprocesses included in the model are displayed in Figure 4.1.)

In principle, computer-supported instructional systems can enhance learners' cognitive development by helping them reflect on their thinking processes through cueing, evoking, modeling, and supplementing these processes (Kozma, 1987). However, with several types of communication structures and communication channels supporting diverse instances of teaching/learning events in constructivist CSCL environments, the designers' challenge is to include those that facilitate deep and meaningful cognitive development for all learners (Sugrue, 2000).

Previous research on the implications of computer-based learning environments (Jonassen, 1995; Kozma, 1987) suggests that the following instructional strategies should be included in CSCL environments to support learners' cognitive development and improve their cognitive strategies:

- Engage learners in both individual and collaborative activities that embed learning in meaningful contexts (Jonassen, 1995).
- Make relevant, previously learned information available simultaneously with the acquisition of new information (Kozma, 1987).

- Provide opportunities for learners to structure, integrate, and interconnect new ideas with previous ones (Kozma, 1987).
- Present problems requiring diverse types of knowledge, judgment in determining appropriate applications of knowledge, and skills in prioritizing problem classification and solution phases (Jonassen, 1995).
- Display the processes – both individual and collaborative – performed by learners as opportunities for them to internalize these processes (Kozma, 1987).
- Engage learners in individual and collaborative activities to assess and reflect on what has been learned (Jonassen, 1995).

Each kind of computer-based learning tool engages a different kind of cognitive activity (Jonassen, 1999). Therefore, several instances of teaching/learning events involving diverse instructional features should be included in CSCL environments to support and enhance the cognitive processes that are consistent with the course learning goals and desired learning outcomes.

5.1.7 Instructors' roles

The role of instructors in computer-mediated instructional environments has been the focus of much research. Salmon (2003) defines that role in constructivist online environments as "engaging the participants so that the knowledge they construct is usable in new and different situations, thus enabling meaning-making rather than content transmission" (p. 39). To extend our understanding of the diverse instructors' roles in CSCL environments, the model includes a specification of the

instructors' behaviors and roles identified in the study: moderator, content expert, facilitator, and evaluator.

Moderator: Online learning involves creating the environment, guiding the course's process, providing points of departure, moderating the process, managing the content, and creating a sense of community (Holt, Kleiber, Swenson, Rees & Milton, 1998). Instructors acting as moderators in constructivist CSCL environments should focus on providing students with opportunities to explore and discover information instead of "teaching" or "telling" them in the conventional sense of instruction (Bender, 2003). An instructor acting as moderator in CSCL environments:

- Plans and delivers instruction by selecting the communication structures – individuals, pairs, small groups, large groups, or all students in the class – that best fit the goals of each conversation.
- Provides opportunities for students to assemble knowledge – factual, conceptual, procedural, and metacognitive – and informs them in advance about the rules for participation within each conversation.
- Models and guides the knowledge-construction process by formulating questions and clarifying concepts and procedures at the beginning of the session and by probing students for clarification and for more information during the session.
- Moderates collaborative processes among participants by allocating turns for them to participate and contribute in each conversation.

Content expert: Collaborative learning theory and research (Rabow, Charness, Kipperman & Radcliffe-Vasile, 1994) suggest that the role of instructors acting as content experts in collaborative discussion processes is "unique and paramount, since the quality of learning is obviously limited by the quality of the materials used. Therefore, the instructor participating as expert must select materials that are deep, interesting, and worthy of discussion" (p. 48). Instructors acting as content experts in collaborative discussions should not only communicate their knowledge and expertise but should also stimulate students without overwhelming them, offer feedback, and formulate questions for further discussion among themselves (Bender, 2003). An instructor acting as a content expert in CSCL environments:

- Provides course content and selects online resources appropriate to the topic for each conversation.
- Provides opportunities for students to assemble knowledge – factual, conceptual, procedural, and metacognitive – not only by instructing them on how to share their insights and reactions in relation to the topics for each conversation but also by answering their questions, addressing their concerns, probing for clarification, and providing constructive feedback.

Facilitator: In computer-mediated instructional environments, a facilitator provides support for participants to access, test, and use the resources available for learning purposes (Heinich, Molenda & Russell, 1999). An instructor acting as facilitator in CSCL environments:

- Provides opportunities for students to extend their procedural knowledge by assisting them in accessing and using the diverse tools and resources available for the course exercises.
- Models and guides the knowledge-construction process by sharing resources and following specific procedures to address the students' questions and technical problems in hands-on exercises.

Evaluator: Instruction, learning, and assessment are so intertwined within collaborative learning processes that it is difficult to separate them (Johnson & Johnson, 2004). Collaborative learning theory and research suggest that the effective assessment of online learning environments should be learner-centered, teacher-directed, context-specific, ongoing, and rooted in good practice (Palloff & Pratt, 2005). These findings, along with basic guidelines and principles for the assessment of adult learners in Web-based learning environments (Driscoll, 1998; Kasworm, 2003; Rudestam & Schoenholtz-Read, 2002), suggest that an instructor acting as evaluator in CSCL environments:

- Involves learners in planning and evaluating by providing comprehensive descriptions of the learning goals, the required assignments, and the grading criteria as well as by including opportunities for students to express their interests and ideas regarding assessment tools and strategies.
- Includes assessment tools and strategies involving diverse communication structures – individuals, pairs, or small groups – as well as diverse levels

of cognitive activity and types of knowledge-construction processes (Anderson & Krathwohl, 2001; Johnson & Johnson, 2004).

- Provides regular and constructive feedback in relation to the nature of the students' participation in collaborative processes – such as their ability to communicate effectively with other members in their team, their leadership, and their ability to resolve conflicts – as well as to the quality of the products resulting from those collaborations – essays, projects, or portfolios (Johnson & Johnson, 2004).

Each learning paradigm assumes that the teaching/learning process has specific characteristics and specific roles for the participants and media involved. In the study, the data suggest that several instances of instructional communication events converge in a CSCL environment, resulting in diverse opportunities for teaching/learning interactions among participants. The skills and behaviors expected from instructors participating as moderators, content experts, facilitators, and/or evaluators in online conversations should be carefully considered (Salmon, 2000). While students' roles in distance education may be assigned and fairly stable, instructors must constantly shift among diverse roles (Bonk & Dennen, 2003). Given the diversity of strategies and skills involved in each of these roles, it is not unusual to share them among several members of an instructional team in CSCL environments.

5.1.8 Students' roles

Diverse patterns of engagement were identified in the students' discourse within both the synchronous and the asynchronous conversations in the study. The

model includes specifications of the behaviors involved in diverse student roles in CSCL environments.

Students as information users: Adult learning in constructivist environments involves a process of guided interaction in which learners engage in learning activities and tasks as part of self-directed inquiry in which the locus of responsibility for learning is in the learners themselves (Kasworm, 2003; Knowles, 1970). Students should have opportunities to select and interpret information from the course content and from their individual experiences in order to maximize their role as information users.

Students as active participants: Previous research on adult learners in distance education suggests that they tend to construct new representations and models of reality as individuals and then to negotiate and validate those representations and meanings through cooperative processes and social practices, such as discussions or debates (Kasworm, 2003). To enhance students' active participation, CSCL environments should provide opportunities for students to:

- Select and interpret information obtained from the course modules – journal articles, Web sites, and instructor's notes – or from the students' individual experiences.
- Create personal interpretations of the world by formulating questions and being exposed to the questions and answers from other participants.

Students as participant observers: The students' discourse in the synchronous conversations in the study provided evidence that the role of participant observers involved the following behaviors:

- Apparent passivity, since not all students who signed in as participant observers for these conversations had an opportunity to pose questions to guest speakers.
- Apparent creation of personal interpretations of the world, since participant observers had to read the assigned resources for each conversation to be prepared with questions for the guest speakers, in case there was time for them to become active participants.

Students as problem solvers: Adult learners in distance education are characterized as preferring a task-centered, problem-solving approach to learning and to bringing a wealth of real-life experience as a powerful learning resource (Driscoll, 1998; Long, 1990). In particular, when adult learners need to learn how to use new technologies they tend to rely on self-directed learning and informal knowledge sharing with their colleagues (Cahoon, 1998; Nealand, 1992). Therefore, CSCL environments should provide opportunities for students to:

- Select and interpret information obtained from the course content, from online sources, or from the students' individual experiences.
- Create personal interpretations of the world by formulating questions to the instructional team, by exchanging ideas with other participants, and by testing procedures for trouble-shooting shared by other students participating in the same exercises.

Students as self-regulators: In principle, collaborative learning environments provide adult learners with opportunities to confirm their ideas and interpretations as well as to engage in self-assessment and self-reflection (Eastmond, 1998; Morrison, Ross & Kemp, 2001). In keeping with this principle, CSCL environments should provide opportunities for students to:

- Assess the extent to which the diverse instructional activities in the course contributed to the development of their knowledge and their skills.
- Assess their personal progress, by comparing the knowledge and skills they had before participating in the course with the ones they acquired and developed from their interactions with the course participants.
- Reflect on personal learning strategies by analyzing and evaluating the ways in which they learn by participating in the CSCL environment.

In distance education, students are often assigned roles, at least as these relate to performing specific activities. However, students might also assume various roles in collaborative processes (Bonk & Dennen, 2003). The literature on collaborative learning theory and research has identified *the nonparticipating student* (Bender, 2003) and *students' nonproductive behaviors* (Rabow, Charness, Kipperman & Radcliffe-Vasile, 1994) as variables to which all participants in collaborative processes are vulnerable. To avoid this problem, instructors should clearly state the structure and goals of each conversation as well as the roles for each participant (Salmon, 2003).

5.1.9 Roles of media

Previous research in educational technology suggests that the role of media in the teaching/learning process should be grounded in learning theory and described in terms of the cognitive and social processes by which knowledge is constructed (Kozma, 1991; Salomon, 1981). To extend our understanding of the way in which CSCL environments support the interactions among instructors, students, and content, the model includes the specification of several roles of those environments as communication media. These roles were derived from constructs and concepts representing the connections among several learning paradigms (Greeno, Collins & Resnick, 1997; National Research Council, 2001). Each paradigm suggests a particular role for media, as noted below.

A space for information dissemination: A CSCL system designed as a learning environment under a behaviorist perspective should serve as an effective mechanism for information dissemination in which instructional units and activities are presented in linear form and the structure involves one-to-many communication. The use of pre-defined tools to enhance the learner's performance, such as tutorials or drill-and-practice exercises, is consistent with this view of learning, particularly in those situations dealing with factual information and basic concept learning. Typical instances of *information dissemination strategies* supported and enhanced by this type of CSCL environment are:

- Posting course materials, including the course syllabus, the course goals, the instructional activities designed for the course, and the evaluation criteria to be used by the instructional team.
- Posting instructors' notes, including announcements and instructions for specific activities in the course.
- Providing all students with access to the transcripts from synchronous conversations among guest speakers and small groups of students.
- Providing facilities to create e-mailing lists within the environment.
- Providing an electronic calendar to keep track of deadlines for individual and team assignments.
- Providing a glossary with definitions of concepts and procedures relevant to the course content.
- Providing links to user manuals with comprehensive descriptions of the features and the technical requirements of the CSCL environment.

A space for information discovery: A CSCL system designed under an information processing/cognitivist view of learning should serve as a space for information discovery to support active, goal-directed learners in their information acquisition, information processing, knowledge representation, and knowledge integration. The system should provide features to enhance the development of the learners' metacognitive strategies as well as features to scaffold their problem-solving strategies in well-structured domains. Typical instances of *information discovery strategies* supported and enhanced by this type of CSCL environment are:

- Providing links to online resources relevant to the formulation and interpretation of diverse solutions for problem-based learning processes.
- Providing instructions and guidelines in the problem-solving context, before each problem is formulated and during the problem-solution process (Anderson, Corbett, Koedinger & Pelletier, 1995).
- Promoting an understanding of the problem-solving knowledge by providing online help and sample solutions of well-structured problems (Anderson, Corbett, Koedinger & Pelletier, 1995).
- Providing opportunities for the students to assess their progress regarding their solutions of well-structured problems (Aleven & Koedinger, 2002).
- Providing links to library resources available online (Peters, 2003), such as national and international library catalogs, specialized electronic information, specialized databases, and electronic document delivery services.

An interactive information space: A CSCL system designed according to the constructivist paradigm should serve as an interactive information space to provide learners with diverse opportunities for information discovery, information exploration, knowledge construction, knowledge integration, cooperation, collaboration, and self-regulation. System features encouraging self-assessment and

self-regulation should also be provided. Typical instances of *teaching/learning interactions* supported and enhanced by this type of CSCL environment are:

- Opportunities for students to create external structures reflecting their *individual conceptualizations* of diverse topics – for instance, personal Web sites or blogs reflecting their ability to describe and organize concepts and procedures relevant to the course content (Sugrue, 2000).
- Opportunities for *cooperative learning*, in which the students' roles and learning outcomes are specified in advance by a member of the instructional team – for instance, role-playing exercises involving authentic tasks and contexts (Reeves, Herrington & Oliver, 2004).
- Opportunities for *discussion and reflection* among learners. Examples from this study are "Dialogues with Experts" conducted in chat rooms in which small groups of students participate by posing questions to guest speakers, and a bulletin board discussion space where students shared their insights and opinions regarding those sessions.
- Diverse scaffolding strategies to improve the students' learning processes and performance (Hannafin, Oliver, Hill & Glazer, 2003).

A space for effective collaboration: CSCL environments designed under a situative/socio-cultural perspective should serve as *task-centered, effective collaboration spaces* enhancing collaborative processes among participants – such as information sharing, problem-solving, decision-making, argumentation, knowledge

construction, and knowledge integration. Features supporting shared workspaces, shared knowledge bases, and shared communication spaces should also be provided by the system. Typical instances of *effective collaboration strategies* supported and enhanced by this type of CSCL environment are:

- Opportunities for *collaborative decision-making* processes, involving shared communication spaces in an asynchronous format – such as Swikis (Jonassen, Howland, Moore & Marra, 2003) and the Knowledge Forum (Sugrue, 2000) – allowing participants to access and edit a collective repository of dialogue and knowledge.
- Opportunities for *collaborative argumentation* processes –such as the electronic reading group*s* in the study or the computer-supported collaborative argumentation (CSCA) environment introduced by Jonassen and Carr (2000) – engaging students in the analysis, evaluation, and formulation of arguments or problem solutions based on specific argument structures and guidelines.

Distance education research suggests that collaborative processes among students do not form spontaneously, and without specific instructions (Hathorn & Ingram, 2002; McConnell, 2000; McInnerney & Roberts, 2004). Therefore, it is extremely important for instructors in CSCL environments explicitly to encourage collaboration among students by providing guidelines, protocols, and diverse forms of scaffolding (Reeves, Herrington & Oliver, 2004).

Evolving roles of media: Despite a tendency of both researchers and practitioners to compare and contrast the differences among diverse learning paradigms, in fact they converge and complement each other. Therefore, the overall design and features of a CSCL environment can be initially based upon a specific learning paradigm and specific learning goals; however, a single teaching/learning event can very easily incorporate design features and roles from several learning paradigms. As Wilson (2004) noted, "CSCL environments evolve over time. Instructional designers and instructors typically control what students initially see in online courses, but then the instructors and the students respond to those resources through collaborative action, individual study, and diverse meaning-making and inquiry activities. Just as participants interact and change over time, so does the learning environment" (p. 79).

5.1.10 Discussion of the instructional communication model

The features in the instructional communication model emerging from the study provide a means to characterize and describe online conversations as teaching/learning events in CSCL environments. At the core of each teaching/learning event are the learning goals guiding the decision of which instructional phases and which roles of participants and media to include in each conversation. These features can then define the type of interactions among participants for each instructional phase as well as the communication structures – individual students, pairs, small groups, and large groups – and communication channels – synchronous and asynchronous – that best support and enhance those interactions. The extent to which the interactions among participants in online

conversations represent opportunities for collaboration and knowledge construction can be determined by identifying the sets of conversational actions and sequences in the students' discourse as well as the level of cognitive activity and the types of knowledge present in each conversation.

5.2 A framework for the systematic analysis of online conversations

The second major contribution of the study – a framework for the systematic analysis of online conversations in CSCL environments – is depicted in Table 5.1. It draws from the connections among several disciplines – learning theory, distance education theory, and communication theory – to facilitate the analysis of the teaching/learning process from diverse theoretical perspectives. Moreover, it systematically integrates the key concepts and constructs that emerged in the context of an instance of the phenomenon of interest, and it includes procedures (1) to analyze the nature of online conversations at both the "macro" and "micro" levels and (2) to structure the interrelationships of these levels.

Method	**Level of analysis**	**Unit of analysis**	**Key constructs**
Conversation analysis	Macro	Conversations	Discourse sequences Conversational features
Content analysis	Micro	Messages	Interaction types Knowledge dimension Cognitive dimension

Table 5.1: Framework for the analysis of online conversations

As illustrated in Table 5.2, the results from this study contribute to instructional communication research by analyzing the communication behaviors and interactions among participants in online conversations from two perspectives: a macro level of analysis, in which each conversation was analyzed in the context of the instructional unit in which it took place within the course, and a micro level of analysis, in which each message within a conversation was considered a unit of analysis. Moreover, the constructs and concepts in the framework provide generic representations of classroom discourse structures, interaction types, cognitive processes, and knowledge types as evidence of learning processes and learning outcomes in the midst of diverse interactions among participants in a CSCL environment.

Table 5.2 shows that similar research efforts have addressed one level or the other in the framework proposed in Table 5.1, focusing on different views of learning and diverse instructional settings (Henri, 1992; Howell-Richardson & Mellar, 1996; Gunawardena, Lowe & Anderson, 1997; Kumplainen & Wray, 2002; Zemel, Xhafa & Stahl, 2005). However, no previous research has addressed a multi-level framework for analysis in CSCL environments.

	View of learning	Level of analysis	Unit of analysis	Key Constructs
Henri (1992)	Cognitivist	Micro	Units of meaning within individual messages	Cognitive, metacognitive, interactive, participative, and social dimensions
Howell-Richardson & Mellar (1996)	Not identified	Micro	Individual illocutionary/ communicative acts	Group focus, task focus, and structural focus
Gunawardena, Lowe & Anderson (1997)	Constructivist	Micro	Individual phases of collaboration	Knowledge construction and meaning negotiation
Kumplainen & Wray (2002)	Cognitivist and socio-cultural	Micro	Small groups of students	Cognitive, social and language dimensions
Zemel, Xhafa & Stahl (2005)	Not identified	Macro	Synchronous conversations	Expository and explanatory participation
Framework emerging from this study	Constructivist	Micro	Individual messages in synchronous and asynchronous conversations	Interaction types, cognitive and knowledge dimensions
		Macro	Synchronous and asynchronous conversations	Classroom discourse sequences and conversational features

Table 5.2: Comparative analysis of instructional communication frameworks

Researchers and practitioners with an interest in identifying the cognitive processes involved in particular instructional strategies or in the construction of particular knowledge types could make extensive use of the codes and definitions provided as part of the "micro" level of analysis. In contrast, those interested in the design of online conversations as instances of teaching/learning events at the "macro" level could start by defining the roles of instructors, students, and media for each instructional phase within each event.. To obtain a finer description of the behaviors expected from participants, the nature of their interactions with the course content and with other participants should also be defined for each instructional phase in the event. Finally, a formative evaluation protocol could include the systematic analysis of online conversations in CSCL environments as a procedure to identify the roles, the patterns of engagement, and the types of knowledge represented in the discourse of individual students across time in the course.

Despite the comprehensiveness of the framework, it falls short in several areas. Given the lack of agreement among researchers and practitioners on the many aspects of communication and of the teaching/learning process, it can not capture the richness and diversity of all instructional communications in all educational settings. Therefore, it does not claim to represent all views of learning, all dimensions of the teaching/learning process, or all possible representations of communication behaviors in CSCL environments. Additionally, Anderson and Krathwohl's (2001) categories of cognitive processes and knowledge types overlap on a scale of "judged complexity" (p. 267), making it impossible for the framework to address specific cognitive activity

definitively. Thus, a detailed assessment of the participants' actual understanding and knowledge of the course content was beyond the scope of the analysis.

5.3 Future research

The research questions guiding the study addressed the concepts and constructs representing the phenomenon of interest. The following themes emerged around the main focus of this study as opportunities for future research.

The nature of online conversations in other domains: The framework for the systematic analysis of online conversations that emerged from this study encompasses discourse sequences, conversational features, interaction types, a knowledge dimension, and a cognitive-processing dimension as key constructs represented in the participants' discourse. In future studies, this framework can be used to analyze online conversations at diverse levels of granularity – "macro" or "micro" analysis – in CSCL environments in other domains. To further increase the transferability of this framework and methodological approach, providing a more comprehensive set of guidelines describing the key concepts as well as more generic examples illustrating the ways in which each level of the analysis could be conducted in other domains is also suggested as a necessary task in the future.

Analyzing online conversations as instances of specific instructional strategies: The analysis of online conversations in CSCL environments designed in terms of a particular instructional strategy – such as collaborative problem-solving or collaborative argumentation – should be addressed in future studies. The systematic analysis of those conversations would extend current research by providing evidence of the types of interactions, the cognitive processes, and the types of knowledge that

converge to support *collaborative problem-solving* (Arts, Gijselaers & Segers, 2002; Uribe, Klein & Sullivan, 2003) and *collaborative argumentation* (Cho & Jonassen, 2002; Veerman, Andriessen & Kanselaar, 2002) in CSCL environments.

Moreover, the systematic analysis of online conversations in the context of specific instructional strategies could serve as a means for researchers and practitioners to form interdisciplinary teams in which the theoretical contributions from this research could be applied to specific instructional settings and specific learning goals. Such interdisciplinary research efforts are a very important mechanism to bridge the gap between the effective application of research-based design guidelines – like the ones emerging from this study – and current design practices of CSCL environments.

The role of culture in online conversations: This study was grounded on a sociolinguistic approach to the analysis of online conversations (Cazden, 1985; 2001), which does not address the impact of the participants' individual or cultural differences in the instructional communication process. Further research is suggested to explore the extent to which distance education research conducted from *a sociocultural perspective* (Cifuentes & Murphy, 2000; Kim & Bonk, 2002) or through *an ethnography of communication approach* (Francis & Hester, 2004; Hine, 2000; Kelly & Crawford, 1997) could extend our understanding of how participants' individual and cultural differences shape and influence the instructional communication process in CSCL environments.

The affective dimension of the teaching/learning process: Research in educational technology has identified the need to address new learning paradigms in

terms of the convergence of three dimensions within the teaching/learning process: *a cognitive dimension, an affective dimension,* and *a psychomotor dimension* (Reigeluth & Squire, 1998). Researchers and practitioners in educational technology, educational psychology, and instructional design have been striving to incorporate instructional activities enhancing cognitive development (Jonassen, 1999; Lajoie, 1993; Mayer, 1999), affective development (Martin & Reigeluth, 1999; Stone-McCown & McCormick, 1999), and psychomotor development (Romiszowski, 1999) into current teaching/learning practices.

Future research suggested by this study should strive to identify and analyze evidence of *the affective dimension* within participants' discourse in CSCL environments. A preliminary coding scheme could be developed from the conceptual model introduced by Martin and Reigeluth (1999) to address the knowledge, skills, and attitudes relevant to the social, emotional, moral, spiritual, aesthetic, and motivational development of learners in particular instructional settings. Once a coding scheme for an affective dimension has been developed and tested, it could supplement the framework for the analysis of online conversations that emerged from this study.

Virtual classrooms as learning-community nodes: Pallof and Pratt (1999) have found that "in distance education, attention needs to be paid to the development of a sense of community within the group of participants in order for the teaching/learning process to be successful, since the learning community is the vehicle through which learning occurs online" (p. 29). The participants' discourse in this study provided evidence that the communication channels supporting their

interactions were not limited to the ones provided by WebCT – several chat rooms, a bulletin board, and an internal e-mail system – but also included interactions supported by external e-mail systems – such as hotmail.com, yahoo.com, and aol.com – and by phone. Since the researcher had no access to any data from outside the course itself, the analysis of those interactions was not addressed in the study. Further research is suggested to explore the nature of offline interactions among participants and the extent to which those interactions represent instances of interactions among members of *a learning community beyond the boundaries of the virtual classroom* (Carroll, 2001; Preece & Maloney-Krichmar, 2003).

Additional research is also needed to analyze the roles that other computer-mediated communication technologies play when supporting interactions between instructors, students, and content in virtual classrooms. In the study, chat rooms and electronic bulletin boards represented the main types of technologies supporting diverse types of interactions with social and learning purposes; however, further research should be conducted to determine the extent to which other computer-mediated communication technologies in synchronous format – such as videoconferencing systems, videophone systems, and messaging systems (Preece, Rogers & Sharp, 2002) – support and enhance interactions among participants in virtual learning communities. In particular, interactions among instructors and the whole class, which were not supported in the synchronous conversations in the study, should be further analyzed.

Other research paradigms: A qualitative research paradigm guided the design and the procedures for data collection, data display, and data analysis in the

study. Different research paradigms and procedures – such as the developmental approach introduced by Reeves, Herrington and Oliver (2004) and the formative approach introduced by Reigeluth and Frick (1999) –could extend the scope of this research and provide additional opportunities to address different research questions.

Appendix A
Comparative analysis of communication models

	Shannon & Weaver (1964)	Schramm (1971)
Research approach	Mathematical theory of communication	The nature of communication between humans
View of information	Information as a physical object	Information as an individual and subjective construct
View of communication	Communication as: • Single acts, not processes • Procedures by which one mind may affect another	Communication as: • a relationship and interaction, instead of "single acts" • an interdisciplinary and complex process • affected by culture, context, and psychological factors
Theoretical constructs	Mathematical models to measure information	Communication contracts Communication patterns Audience behavior Frames of reference
Goal of communication	Persuasion	Instruction Persuasion Entertainment
Unit of analysis	Individual communication components as independent entities	Relations as interactions
Role of audience	Passive; receivers are manipulated by messages	Highly active, selective
Type of model	Linear Unidirectional Mathematical	Relational Bidirectional Psychological
General applications	Mass-communication	Interpersonal communication
Potential applications in education	• Instructional communication within a mimetic view of instruction • Distance education programs with a traditional/behaviorist view of learning	• Teacher-centered instruction with a traditional/behaviorist view of learning • Computer-Assisted Instruction (CAI) applications

Appendix A (continued)
Comparative analysis of communication models

	Rogers (1980)	Vickery & Vickery (2004)
Research approach	Convergence models and network analysis	Social approach to information
View of information	Information as a subjective and uncertain entity	Information as a result of social interactions
View of communication	Communication as: • a dynamic, rich process of development over time	Communication as: • a social transaction • acts taking place in a social context
Theoretical constructs	• Communication networks • Communication structures • Convergence of meanings • Network analysis	Communicators could be individuals, groups, institutions, organizations, etc.
Goal of communication	• Information sharing • Mutual understanding • Collective actions	• Informative communication • Instructional communication
Unit of analysis	• Relationships • Interactions • Networks	Social context of each communication element
Role of audience	Perceiving, interpreting, understanding, creating and sharing information over time	Social transfer of information
Type of model	• Iterative • Convergence	• Relational • Socio-cultural
General applications	• Organizational communication • Team work	• Organizational communication • Cross-cultural studies
Potential applications in education	• Collaborative problem-solving environments with instructional strategies for ill-structured problems • Computer-supported cooperative learning (CSCL) & argumentation (CSCA) environments	• Learner-centered instruction with a situated/ socio-cultural perspective • Learning environments that are sensitive to cultural differences • CSCL & CSCA environments

Appendix B
Comparative analysis of learning paradigms

	Behaviorist/Objectivist	**Information-Processing/Cognitivist**
View of learning	Meaning exists separate from personal experience: learning is based in knowing the entities, attributes, and relationships existing in the objective reality	Knowledge is stored in mental structures: learning occurs in developmental stages when those knowledge structures are modified by the perception, acquisition, and processing of information from the environment
Learning outcomes	Learning objectives are framed in terms of specific, observable behaviors.	Learning objectives are framed around the development of high-order cognitive skills, such as: • problem solving • decision making • critical thinking
Assessment tools	Assessment of factual/conceptual knowledge	Assessment of performance and cognitive processes
Learning activities	• Programmed instruction • Emphasis on predetermined aims, systematic activities, practice, and feedback	• Problem-based learning • Project-based learning • Case-based learning
Role of Instructor	• Plan and deliver instruction • Lead students to a desired level of performance	• Provide course content • Link information from content to existing knowledge • Encourage students' development of *cognitive strategies*
Role of learners	• Apparently passive • React to stimuli	• Develop higher-order thinking skills by actively selecting, acquiring, and processing information • Reflect on personal learning strategies • Assess personal progress

Appendix B (continued)
Comparative analysis of learning paradigms

	Constructivist/ Cognitivist	Situative/Sociocultural
View of learning	Learning is the result of the learners' active engagement in meaningful learning experiences. New knowledge is constructed in terms of the learners' prior knowledge and life experiences.	Learning is the result of social interactions among learners, since social practices support the development of shared cognition. All learning experiences depend on the context in which they take place.
Learning outcomes	Learning objectives are framed around a deep understanding of concepts and principles	Learning objectives are framed around social practices of knowledge construction and inquiry
Assessment tools	Authentic assessments related to meaningful contexts	Assessment of participation in inquiry and social practices
Learning activities	• Construction of knowledge based on prior knowledge or experience • Individual work or collaboration with others	• Formulation and evaluation of questions, problems, and hypotheses • Collaborative argumentation • Collaborative decision-making
Role of Instructor	• Provide opportunities for students to assemble knowledge • Model and guide the knowledge-construction process • Encourage students' development of *self-regulation strategies*	• Provide opportunities for students to collaborate and exchange ideas • Moderate or guide collaborative processes such as argumentation and knowledge sharing • Encourage students' development of *self-regulation strategies*
Role of learners	• Create personal interpretations of the world • Self-regulation • Self-reflection • Self-evaluation	• Actively select and interpret information in the context of personal social and cultural backgrounds • Actively participate in assessments

Appendix B (continued)
Comparative analysis of learning paradigms

	Behaviorist/Objectivist	**Information-Processing/Cognitivist**
Role of media	A *communication space* for: • Information dissemination	An *information space* for: • Information acquisition • Information processing • Knowledge representation • Knowledge integration (in well-structured domains)
Implications for instructional communication	• Persuasion as main communication goal • Apparently passive audience • Communication process described by *Shannon & Weaver (1964)*	• Active, goal-directed audience • Cognitive and cultural factors influencing the selection and interpretation of information • Communication process described by *Schramm (1971)*
Implications for instructional interactions	• *Teacher-centered* • Individual work • Teacher-Student • Teacher-Content • Student-Content	• *Student-centered* • Individual work • Teacher-Student • Teacher-Content • Student-Content
Implications for CSCL environments	• Linear presentation of content • Restricted navigation choices • *CAI applications,* such as tutorials, drill-and-practice, factual information and basic concept learning	*Intelligent tutors* to: • Scaffold *problem-solving strategies* in well-structured domains • Enhance *metacognitive strategies* in high-order cognitive processes such as problem-solving and decision-making

Appendix B (continued)
Comparative analysis of learning paradigms

	Constructivist/ Cognitivist	**Situative/Sociocultural**
Role of media	An *information space* for: • Information discovery • Information exploration • Knowledge construction • Knowledge integration • Self-regulation (in ill-structured domains)	A *collaboration space* enhancing: • Collaborative problem-solving and decision-making • Collaborative argumentation • Knowledge sharing • Knowledge integration
Implications for instructional communication	• Active, self-directed audience • *Relations and networks* as communication structures • Instructional goals, instructional activities, and assessment instruments as frames of reference • Collaborative actions as learning products • Mutual understanding as communication outcome • Communication process described by *Rogers (1980)*	• Active, self-directed audience • *Individuals, groups, organizations or institutions* as communication structures • *Social and cultural contexts* of senders, receivers, and channels affect instructional communication process • Communication process described by *Vickery & Vickery (2004)*
Implications for instructional interactions	• *Student-centered* • Collaborative work • Student-Student • Student-Content • Student-Teacher • Teacher-Content	• *Task-centered* • Collaborative work • Student-Student • Student-Content • Student-Teacher • Teacher-Content • Teacher-Teacher
Implications for CSCL environments	• *Computers as Mindtools* • Features for information exploration • Features for structural knowledge representation • Interactive spaces, such as multimedia, simulations or virtual worlds • Features for self-assessment and self-regulation	• Shared information spaces • Shared workspaces • Features for CSCA • Features for CSCW • Synchronous communication tools • Asynchronous communication tools • Features for self-assessment and self-regulation

Appendix C
Revised coding scheme

(1) Instructional interactions *(adapted from Anderson, 2003, and Moore, 1989)*	
(1.1) Student – Content	Selection, analysis, interpretation, transformation or evaluation of information by a student to construct meaning and develop new knowledge.
(1.2) Student – Instructor	Interactions involving a student addressing an instructor or guest speaker, with instructional or social purposes.
(1.3) Student – Student	Interactions involving a student addressing another student, with instructional or social purposes.
(1.4) Student – Class	Interactions involving a student addressing all students in the class, with instructional or social purposes.
(1.5) Student – Group	Interactions involving a student addressing a small group of students in the class, with instructional or social purposes.
(1.6) Instructor – Content	Selection, organization, representation, adaptation or presentation of course content by an instructor for instructional purposes.
(1.7) Instructor – Student	Interactions involving an instructor or guest speaker addressing a student, with instructional or social purposes.
(1.8) Instructor – Class	Interactions involving an instructor or guest speaker addressing all the students in the class, with instructional or social purposes.
(1.9) Instructor – Group	Interactions involving an instructor or guest speaker addressing a small group of students in the class, with instructional or social purposes.
(1.10) Instructor – Instructor	Interactions among two or more instructors with instructional or social purposes.

Appendix C (continued)
Revised coding scheme

(2) Cognitive processes *(adapted from Anderson and Krathwohl, 2001)*	
(2.1) Remembering	Retrieving relevant knowledge from long-term memory
(2.1.1) Recognizing	Locating knowledge in long-term memory that is consistent with presented material.
(2.1.2) Recalling	Retrieving relevant knowledge from long-term memory.
(2.2) Understanding	Constructing meaning from instructional messages.
(2.2.1) Interpreting	Clarifying, paraphrasing, representing, translating, or changing from one form of representation to another.
(2.2.2) Exemplifying	Finding specific instances or illustrations of a concept or a principle.
(2.2.3) Classifying	Determining that something belongs to a category.
(2.2.4) Summarizing	Abstracting a general theme or major point.
(2.2.5) Inferring	Concluding, predicting, extrapolating, interpolating or drawing logical conclusions from presented information.
(2.2.6) Comparing	Contrasting, mapping, matching, or detecting correspondences between ideas, objects, and the like.
(2.2.7) Explaining	Constructing cause-effect models of a system.
(2.3) Applying	Carrying out procedures in given situations.
(2.3.1) Executing	Carrying out a procedure for a familiar task.
(2.3.2) Implementing	Applying a procedure to an unfamiliar task.

Appendix C (continued)
Revised coding scheme

(2) Cognitive processes (continued)	
(2.4) Analyzing	Breaking materials into constituent parts and determining how those parts relate to one another and to an overall structure or purpose.
(2.4.1) Differentiating	Discriminating, distinguishing, and selecting relevant from irrelevant parts or important from unimportant parts of presented material.
(2.4.2) Organizing	Integrating, structuring, and determining how elements fit or function within a structure.
(2.4.3) Attributing	Determining a point of view, bias, values, or intent underlying presented materials.
(2.5) Evaluating	Making judgments based on criteria and standards.
(2.5.1) Checking	Coordinating, monitoring, and detecting inconsistencies within a process or product. Determining whether a process or product has internal consistency. Detecting the effectiveness of a procedure as it is being implemented.
(2.5.2) Critiquing	Detecting inconsistencies between a product and external criteria. Determining whether a product has external consistency. Detecting the appropriateness of a procedure for a given problem.

Appendix C (continued)
Revised coding scheme

(2) Cognitive processes (continued)	
(2.6) Creating	Putting elements together to form a coherent or functional whole. Reorganizing elements into a new pattern or structure.
(2.6.1) Generating	Developing alternative hypotheses based on criteria.
(2.6.2) Planning	Designing and devising a procedure for accomplishing some task.
(2.6.3) Producing	Inventing and constructing a product.
(3) Knowledge Type *(adapted from Anderson and Krathwohl, 2001)*	
(3.1) Factual knowledge	Knowledge of the basic terminology or isolated bits of information representing the main elements within a discipline or domain.
(3.2) Conceptual knowledge	Knowledge of the categories and the classifications of the main elements together with their relationships, within a discipline or domain.
(3.3) Procedural knowledge	Knowledge of the steps, skills, algorithms, techniques or methods within a discipline or domain, together with the criteria to determine when to use them.
(3.4) Metacognitive knowledge	Knowledge about cognition in general, as well as awareness of and knowledge of one's own cognition.

Appendix D
Human subjects review board application forms

Research Consent Form
Name: F1
Start Time: April 20, 2:32 pm
Number of questions: 1

Finish Help

Question 1 (0 points)

Informed Consent Form

Please read the following and indicate whether or not you agree to participate in a study by selecting yes or no below.

I state that I am over 18 years of age and wish to participate in a study being conducted at an American University by F1.

The purpose of the study is to identify indicators of success in providing remote instruction.

I understand that data gathered will be treated as confidential and that my name will not be identified at any time. The data I provide will be grouped with data others provide for reporting and presentation.

I understand that there are no risks associated with this study.

I understand that I may ask questions at any time and that I may withdraw my permission to participate should I change my mind.

Yes, I give permission to use my work during this course, including the pre-assessment, post-assessment and course evaluation as well as comments made and exercises completed.

No, I do not want any of my work during this course to be used for the research project.

Save answer Finish Help

Appendix D (continued)
Human subjects review board application forms

UNIVERSITY OF MARYLAND

INSTITUTIONAL REVIEW BOARD

2100 Lee Building
College Park, Maryland 20742-51
301.405.4212 TEL 301.314.9305

Reference: IRB HSR Identification Number 03-0179

April 25, 2003 → April 2006

MEMORANDUM

Notice of Results of Final Review by IRB on HSR Application

TO: Dr. Eileen Abels
College of Information Studies

FROM: Dr. Phylis Moser-Veillon, Co-Chairperson
Dr. Joan A. Lieber, Co-Chairperson
Institutional Review Board

PROJECT ENTITLED:
"Indicators of Perceived Success in Teaching E-reference via Distance Education"

The Institutional Review Board (IRB) concurs with the departmental Human Subjects Review Committee's (HSRC's) preliminary review of the application concerning the above referenced project. The IRB has approved the application and the research involving human subjects described therein. We ask that any future communications with our office regarding this research reference the IRB HSR identification number indicated above.

We ask that you not make any changes to the approved protocol without first notifying and obtaining the approval of the IRB. Also, please report any deviations from the approved protocol to the Chairperson of your departmental HSRC. If you have any questions or concerns, please do not hesitate to contact either of us at irb@deans.umd.edu. Thank you.

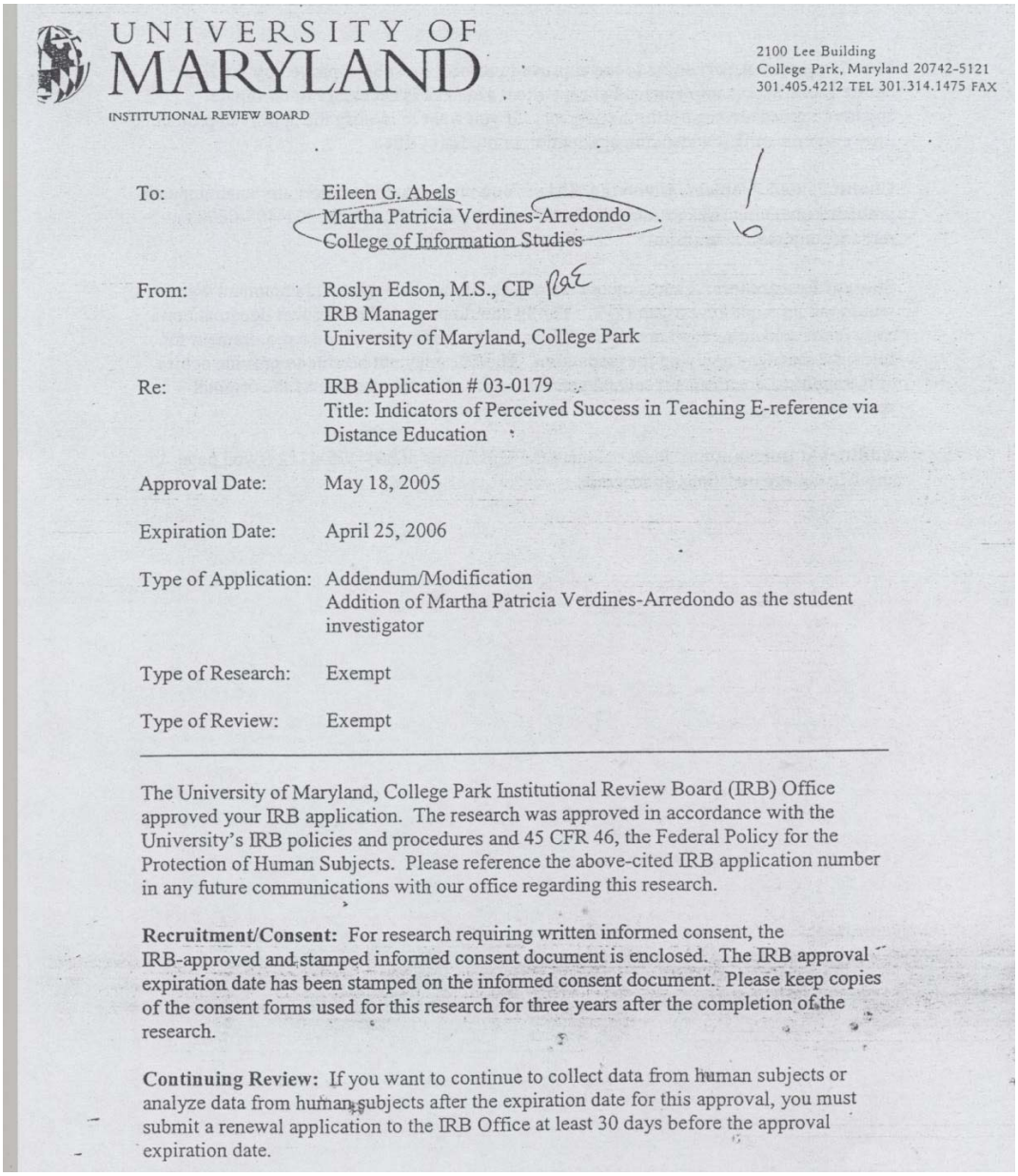
ADDITIONAL INFORMATION REGARDING IRB/HSRC APPROVALS

EXPIRATION OF IRB APPROVAL—Approval of non-exempt projects expires one year after the official date of IRB approval; approval of exempt projects expires three years after that date. If you expect to be collecting or analyzing data after the expiration of IRB approval, please contact the HSRC Chairperson in your department about submitting a renewal application. **(PLEASE NOTE: If you are not collecting data from human subjects and any on-going data analysis does not increase the risk to subjects, a renewal application would not be necessary.)**

STUDENT RESEARCHERS—Unless otherwise requested, the IRB will send copies of approval paperwork to the supervising faculty researcher (or advisor) of a project. We ask that such persons pass on that paperwork or a copy to any student researchers working on that project. That paperwork may be needed by students in order to apply for graduation. **PLEASE BE ADVISED THAT THE IRB MAY NOT BE ABLE TO PROVIDE COPIES OF THAT PAPERWORK, particularly if several years have passed since the date of the original approval.**

Enclosures (where appropriate), will include stamped copy of informed consent forms included in application and any copies of the application not needed by the IRB; copies of this memorandum and any consent forms to be sent to the Chairperson of the Human Subjects Review Committee

Appendix D (continued)
Human subjects review board application forms



UNIVERSITY OF MARYLAND
INSTITUTIONAL REVIEW BOARD

2100 Lee Building
College Park, Maryland 20742-5121
301.405.4212 TEL 301.314.1475 FAX

To: Eileen G. Abels
Martha Patricia Verdines-Arredondo
College of Information Studies

From: Roslyn Edson, M.S., CIP
IRB Manager
University of Maryland, College Park

Re: IRB Application # 03-0179
Title: Indicators of Perceived Success in Teaching E-reference via Distance Education

Approval Date: May 18, 2005

Expiration Date: April 25, 2006

Type of Application: Addendum/Modification
Addition of Martha Patricia Verdines-Arredondo as the student investigator

Type of Research: Exempt

Type of Review: Exempt

The University of Maryland, College Park Institutional Review Board (IRB) Office approved your IRB application. The research was approved in accordance with the University's IRB policies and procedures and 45 CFR 46, the Federal Policy for the Protection of Human Subjects. Please reference the above-cited IRB application number in any future communications with our office regarding this research.

Recruitment/Consent: For research requiring written informed consent, the IRB-approved and stamped informed consent document is enclosed. The IRB approval expiration date has been stamped on the informed consent document. Please keep copies of the consent forms used for this research for three years after the completion of the research.

Continuing Review: If you want to continue to collect data from human subjects or analyze data from human subjects after the expiration date for this approval, you must submit a renewal application to the IRB Office at least 30 days before the approval expiration date.

Appendix D (continued)
Human subjects review board application forms

Modifications: Any changes to the approved protocol must be approved by the IRB before the change is implemented except when a change is necessary to eliminate apparent immediate hazards to the subjects. If you want to modify the approved protocol, please submit an IRB addendum application to the IRB Office.

Unanticipated Problems Involving Risks: You must promptly report any unanticipated problems involving risks to subjects or others to the IRB Manager at 301-405-0678 or redson@umresearch.umd.edu.

Student Researchers: Unless otherwise requested, this IRB approval document was sent to the Principal Investigator (PI). The PI should pass on the approval document or a copy to the student researchers. This IRB approval document may be a requirement for student researchers applying for graduation. The IRB may not be able to provide copies of the approval documents if several years have passed since the date of the original approval.

Additional Information: Please contact the IRB Office at 301-405-4212 if you have any IRB-related questions or concerns.

Appendix D (continued)
Human subjects review board application forms

UMCP IRB Renewal Application Rev. 11/11/05
Page 1 of 2

UNIVERSITY OF MARYLAND, COLLEGE PARK
Institutional Review Board

Renewal Application for Research Involving Human Subjects

Name, Department and E-mail Address of Principal Investigator or Faculty Advisor:
DR. EILEEN ABELS, COLLEGE OF INFORMATION STUDIES, eabels@umd.edu

Name, Department and E-mail Address of Co-Investigator(s) (if applicable):

Name and E-mail Address of Student Investigator(s) (if applicable):
MARTHA PATRICIA VERDINES-ARREDONDO, pverdines@yahoo.com

Project Title:
INDICATORS OF PERCEIVED SUCCESS IN TEACHING E-REFERENCE VIA DISTANCE EDUCATION.

IRB Application Number: 03-0179

Date IRB Approval Expires: April 25, 2006.

Where should the IRB send the approval letter?

SIGNATURE SECTION

The Principal Investigator, Co-Investigator, and Student Investigator, in signing this renewal application, certify that they have conducted research in accordance with the IRB-approved protocol and that any consent forms used in connection with the project have been retained by the Principal Investigator unless otherwise indicated in this renewal application.

Eileen A Abels	03/28/2006
Principal Investigator or Faculty Advisor	**Date**
Co-Investigator (if applicable)	**Date**
M. Patricia Verdines A.	03/28/2006.
Student Investigator (if applicable)	**Date**

Appendix D (continued)
Human subjects review board application forms

Who Must Renew?

Please indicate YES or NO for each of the following questions. This will determine whether you need to submit a renewal application.

1. Will future research activities involve obtaining data through intervention or interaction with human subjects? YES☐ NO☒

2. Will future research activities involve obtaining identifiable private information about living individuals? (Information is identifiable if subjects can be identified directly or through identifiers linked to the subjects.) YES☐ NO☒

3. Will future research activities include analyzing **identifiable** private information about living individuals?

   YES☐ NO☒

** If you answered yes to any of these 3 questions, please submit 1 original, signed application and 1 copy of the signed application along with the information requested in the attached instructions.

** If you checked **"NO"** for **all** of the above renewal questions, please also check here ☒ and submit only one signed copy of this 2 page form. Your project will be removed from our active files upon receipt of this document.

PLEASE SEND COMPLETE APPLICATIONS TO:
Campus Mailing Address- IRB Office, Room 2100, Blair Lee Building, Zip 5125

Appendix E
Synchronous Conversation Transcript
Conversation ID: Dialogue with an Expert – Chat # 1
Participants: F1, E1, S3, S6, S8, S23, S1, S21, S27, S25, S14 and S17

Expert Chat with E1

F1>>Welcome every one. We are ready to get started.

F1>>A few more students may be joining us.

F1>>E1, thank you for joining us today. Would you like to make some opening remarks?

*+**** S27 entered Chat Room2. Wednesday, June 9, 12:00pm

E1>>Hi! I'm chatting from the "Left Coast" where I work at a State Library...

E1>>I did NOT put question marks in that cut and paste

*+**** S1 entered Chat Room2. Wednesday, June 9, 12:00pm

*+**** S21 entered Chat Room2. Wednesday, June 9, 12:00pm

F1>>bold converts to question marks

E1>>actually, they were quotation marks

E1>>i'm looking forward to your questions. end

F1>>OK. S1, do you have a question?

S1>>I am having some trouble with my JavaScript. Can you come back to me in 5 minutes?

F1>>OK, S3?

S3>>Your website says that your research project involves collaboration of "all kinds" of libraries. I'm assuming this means that sometimes you have academic librarians helping public-library users, & public librarians helping academic users, and so forth. Am I right?

E1>>correct

F1>>S3, do you want to follow-up?

Appendix E (continued)
Synchronous Conversation Transcript

S3>>But in face-to-face settings, reference librarians and public librarians typically address questions rather differently, don't they? I was wondering if this distinction tended to get blurred in the virtual setting or, if not, whether it posed any problems.

E1>>of course it does....

E1>>they typically have different missions...

E1>>that is, the public libs provide answers while the academics want to teach folks how to find info for themselves

E1>>The biggest challenge in collaborative service is trust that partner libraries provide the same quality of service.

E1>>Our training program is designed to increase trust and participants agree that it does. When staff from different libraries participate in the same training, they share ideas and learning.

E1>>that's one way to help minimize the problem. end

F1>>Thanks, the idea of trust is very interesting and true. S6, a question?

S6>>follow-up In Collaborative Reference Services, what is your reaction to having librarians in the East Coast answering questions for patrons in the West Coast, especially when it involves local issues? End

E1>>these are complicated problems--but the best way to solve them is working together...

E1>>that is, review transcripts, identify problem areas, and post information/urls and other materials that will help minimize these things...

E1>>for example, two universities share a service...

E1>>and over time, they have learned how to deal with the questions about directions to the third floor across the continent! end

F1>>That is a difficult question to answer! S8, do you have a question?

S8>>I do, thank you for your time E1

E1>>you bet--my pleasure

Appendix E (continued)
Synchronous Conversation Transcript

S8>>I was wondering about your research project...

E1>>I do a lot of wondering, too!

S8>>Is the software you are using something the project developed?

E1>>we don't use a single software application...

E1>>our project has funded grants for cooperative services across the state, and several different apps are used. do you want me to elaborate?

S8>>Sure!

E1>>we have provided grants to about 6 different multi-type library collaboratives...

*-**** S23 left Chat Room2. Wednesday, June 9, 12:09pm

E1>>one includes a public library, a county law library, two special libraries...
*+****

*-**** S23 entered Chat Room2. Wednesday, June 9, 12:10pm

E1>>and they use special software. A horticulture library and a health sciences library only do email. The public library, the county library and the law library use chat as well....

E1>>While we have an eastern consortium of 7 libraries--two community colleges and several rural public libraries use 24/7Reference.

S8>>ah..so the project uses existing items, but varies according to need

E1>>Others have still different configurations, like two libraries that are working with 5 K-12 libraries, using a different software.

E1>>One other thing....

E1>>We do not have any state-level funding for public libraries, unlike all but about 3 other states....

E1>>and this means that there has been very little cooperation between libraries here. But VR is changing that! end

F1>>A clarification - how was it decided which libraries would work together?

Appendix E (continued)
Synchronous Conversation Transcript

E1>>They submitted grant proposals. WE held an introductory video conference and several partnerships were formed by folks watching from the same location. end

F1>>Thanks. S23, do you have a question? (Welcome back)

S23>>yes sorry about that comcast issue...

S23>>What are some of the unexpected problems you have faced to date setting up a VRS statewide? End

E1>>again, understand that we don't have a single state-wide VRS....

E1>>the most unexpected things were opportunities...

E1>>for example, we participated in the software tool beta testing from the beginning...

E1>>and we entered into a partnership to form a regional version...

E1>>these kind of opportunities create a lot of unanticipated work for the project coordinator...

E1>>and I haven't figured out how to clone! end

F1>>Cloning would help!

S1>>I actually have a question about your partnership.

F1>>S1, have you resolved your technical problem? If so, your question please.

E1>>Love to talk about it!

S1>>Yes, resolved! I apologize for that...

S1>>Can you comment on some of the challenges in setting up your partnership...

S1>>and in the process of Internet collection-building? end.

E1>>Sure. Recruiting folks who will both take the training courses and commit to contributing 25 records over a year...

E1>>a percentage of folks inevitably drop out...but we've been lucky to have a solid core of contributors...

Appendix E (continued)
Synchronous Conversation Transcript

E1>>It includes very stringent collection development procedures, which the training does a wonderful preparation job. end

S1>>What do you look for in contributors?

F1>>S3, do you have another question?

F1>>S3, hold until the follow-up is answered please!
E1>>Take a look at the "about" page on the project Web site. It gives you a very complete picture of requirements. A bit long for this meeting! end

S3>>A broader question: What changes do you foresee for e-reference over the next few years?

E1>>more libraries participating, changes in vendors, software that improves handling, telecommunications that speeds sessions. Want detail?

F1>>Sure!

S3>>that wd be nice...especially about the software

E1>>Okay. As libraries finally figure out the connection between marketing, increased hours of service, web page design and VR links, usage will increase and libraries (even those that dropped out) will offer service--especially collaboratively....

E1>>The software is evolving so quickly that we can't keep up with changing features. They will be stabilized and simplified over the next few years--my own vision for theperfect VR is an oral session (voip) that also provides a print transcript of the session....

E1>>broadband at the patron end will expand, and that will help a lot! especially for the rural libraries. end

F1>>VoIP doesn't seem ready yet..

F1>>voice seems to be the next big step.

F1>>Hadn't thought about voice and a print transcript. Great idea!

E1>> Bill Gates recently said that in 5-10 years, everything on the computer will be voice-driven. end

F1>>S6, do you have another question?

Appendix E (continued)
Synchronous Conversation Transcript

S6>>I do

S6>>Quoting from your article…At times it seems that librarians have boarded a train without knowing where its going with more and more travelers climbing on every day? Is the situation any better today? End

E1>>a bit. But a recent article I wrote outlines some of the biggest problems

E1>>we don't do a good job of choosing a vendor. end

F1>>Follow -up S6?

S6>>no

F1>>S8, your next question please.

S8>>Do you ever see a time when librarians will be the vendor?

E1>>Well, they are in some places. Rakim, for example. But it's expensive!

E1>>that is, there is so much involved that we can't necessarily do in-house

S8>>What librarians coming together to form a vendor...

S8>>rather than a company with no library experience?

E1>>The best bet is for the big boys like OCLC & LC, which are librarian-oriented...

E1>>but also have the resources.

F1>>And there is word of a merger between OCLC and a vendor.

E1>>I don't mean that to be a direct endorsement of OCLC! Yes, I

E1>>excuse me!

E1>>

E1>>I am privy to the OCLC merger, but it's not official yet.

F1>>Right.

F1 >>S23, do you have another question?

Appendix E (continued)
Synchronous Conversation Transcript

F1>>S23, are you there?

F1>>S1, would you like to ask a question until we hear from S23?

S1>>Yes...

S1>>I am wondering about which of your digital reference services...

S1>>e-mail or chat, is more utilized by patrons...

S1>>and any thoughts on future trends in usage. end.

E1>>This is the state library--which is not the same as other specific projects....

*-**** S6 left Chat Room2. Wednesday, June 9, 12:33pm

E1>>This just began chat in February, while we've offered email for years, so can't compare yet.

E1>>As for the various cooperatives across the state...

E1>>email still is gets the most usage. But we've discovered some connections with marketing and hours of service that have a dramatic effect on chat use. end

F1>>S23 are you there or having technical difficulties?

F1>>S3, do you have another question?

S3>>yes

S3>>You've mentioned several obstacles to the success of e-reference. What is the single biggest of these obstacles? In other words, if you were allowed to have one wish granted about a change in e-reference, what would your wish be?

E1>>24/7 service. When patrons have to think about whether the service is available or not, they don't use it. end

F1>>S6?

F1>>On to S8.

S8>>In your article...

Appendix E (continued)
Synchronous Conversation Transcript

*-**** S23 left Chat Room2. Wednesday, June 9, 12:37pm

S8>>as a new librarian, are there other specific things to look for in a vendor other than history, training and tech support?

E1>>the most important thing is to ask other libraries that use the product about their experience...

E1>>because vendors lie. (I used to work for one, so I know!) end

F1>>We won't ask for more details on that!

F1>>S1 -- another question?

E1>>it's okay--they don't exist any more, which is why history is important
S1>>Yes, I have a follow-up question...

S1>>I am wondering if you could elaborate on the marketing activities you mentioned earlier. end.

E1>>sure. First, if you have time, read the marketing guidelines that were prepared by a grant project....

E1>>I'll give you the URL at the end of the session, but you can link to it from the software site

E1>>the most important thing about marketing...

E1>>is to target it. Decide on one or two primary audiences and then focus on them. The old idea of "we help everyone" doesn't work...

E1>>and please note that marketing is just as important to academic libs as public ones! end

E1>>Actually

F1>>We seem to have lost a few students. Any quick questions from the "passive" students? [One at a time please.]

F1>> S21

E1>>one example is a county law library targeting paralegals. end

Appendix E (continued)
Synchronous Conversation Transcript

F1>>Ok S21

S21>>You mentioned earlier about one of the cooperatives...

S21>>being working with k-12 libraries...

E1>>yes! we love it!

E1>>suck the kids into the service in their teens, then they understand and use it in college

S21>>how has that project done? I am interested because I have not had experience with e reference in a k-12 environment...

S21>>what made it successful?

E1>>the high school librarians all participated in our training program, as did the librarians
E1>>lots of enthusiasm on all sides--that goes a long way.

S21>>Did they have specific hours?

E1>>Yes, they've worked out a schedule--which I don't have!

F1>>Other questions? (quick ones as time is running out)

S27>>Yes ... Do you think that the network of VR service will expand to an international level in the next 5 years?

E1>>Well, it already is international in terms of email--and there is a cooperative between a UK lib, an American lib, and Australian lib that offer chat. We just had Canadian students in our last VRS class.

E1>>Global is inevitable end

S27>>What about Europe?

E1>>The software is very widely used in the Netherlands. One of our libraries has a branch in Yugoslavia.

S27>>Glad to "hear" that!

F1>>E1, do you have any closing remarks?

Appendix E (continued)
Synchronous Conversation Transcript

E1>>Actually, the software now serves 26 languages in 6000 libs or something like that--mostly email, but also chat

E1>>We offer two workshops to introduce VR to library staff members and administrators?

E1>>take a look at the project Web site.

E1>>Thanks for the hour of ideas. I hope I meet some of you at the national conference in Orlando. Stop me afterwards and introduce yourself!

F1>>Thanks E1. I learned a lot!

S3>>Thank you for your time.

S8>>Thank you!

S1>>Thanks!

S25>>Thank you !
S21>>thanks!

F1>>We'll send you a copy of the transcript E1.

S14>>Thank you

E1>>It was fun! I look forward to the transcripts.

*-**** S3 left Chat Room2. Wednesday, June 9, 12:50pm

F1>>And to the class members - we'll be posting the transcript this evening.

E1>>you can send questions to my e-mail address

F1>>Thank you all for some great questions.

S17>>this was a great resource for ideas.

F1>>E1, was the URL you sent, the one you mentioned earlier?

E1>>hold on...it's long, so I'll copy it....

Appendix E (continued)
Synchronous Conversation Transcript

S21>>Stupid question: will we get a transcript as well and where will it be?

F1>>On the resources page -- under Expert Chats.

S21>>Thanks!

*-**** S17 left Chat Room2. Wednesday, June 9, 12:52pm

F1>>Thanks for the URL and thanks for a very informative session!

*-**** S21 left Chat Room2. Wednesday, June 9, 12:53pm

E1>>My pleasure, absolutely!

F1>>You all can feel free to sign off.

*-**** S8 left Chat Room2. Wednesday, June 9, 12:53pm

*-**** S14 left Chat Room2. Wednesday, June 9, 12:53pm

E1>>Thanks--ciao.

S27>>Thank you for the wonderful session. Bye.

Appendix F
Asynchronous conversation transcript
Conversation ID: Communication tools – ListServ Discussion
Participants: F1, F2, S1, S3, S5, S6, S7, S8, S9, S10, S11, S12, S13, S14, S16, S18, S19, S21, S22, S23, S25, S26, S27, S28 and S29
Created on: Wednesday, June 2, 9:38am – Friday, July 9, 2:35pm

F1>> During the course, students must subscribe to at least one reference listserv that focuses on digital reference. A discussion topic has been created specifically for comments on listserv discussions. [If you already subscribe to one of these listservs, you do not have to subscribe to another. But you might find it useful to do so.] *(Posted within the Course orientation module)*

Choose one of these two listservs:

A joint project of the United States Department of Education, with support from the White House Office of Science and Technology Policy. It includes both librarians and Ask-an-Expert services and all forms of electronic reference.

A mailing list is for librarians, information scientists and other information professionals to share information about the many issues and technologies pertaining to the creation of "digital libraries."

Message no. 1676
Author: S22
Date: Wednesday, June 2, 9:38am
Subject: Virtual Reference Desk listserv
Hello all. I have subscribed to one of the listserv: "A listserv to explore the growing area of digital reference services."

Message no. 1869
Author: S13
Date: Sunday, June 6, 8:24pm
Subject: Shutting Down Chat Ref
Hi all. An interesting recent discussion on the listserv discussed the "shutting down" or discontinuation of chat software for reference. The majority of the comments were from academic libraries who cited that it was either too expensive to maintain or that there was not enough use of the system. I though this was an interesting bit of information that could supplement the two points of view readings. Interesting note is that MIT stopped using chat for reference a year and a half ago. If you want to read all the treads of the discussion you can go to the archives operated through Yahoo Groups.

Appendix F (continued)
Asynchronous conversation transcript

Message no. 1895[Branch from no. 1869]
Author: S27
Date: Monday, June 7, 4:02pm
Subject: Re: Shutting Down Chat Ref
S13, could you, please sent more detailed citation for the article you suggested? This link brings me to the information page of a listserv for new subscribers and I couldn't find the article. Thank you.

Message no. 1933[Branch from no. 1869]
Author: S19
Date: Tuesday, June 8, 7:18am
Subject: Re: Shutting Down Chat Ref
As is the case with so many services a library offers, it is very difficult to perform a cost benefit analysis to justify funding. It would be interesting look at some of the details of the services that are being discontinued. Did they market the service effectively? How well supported was it by staff and the administration? What was the initial funding? We looked at our university's participation in AskUsNow last semester. Discontinuing the University's participation was a very reasonable option based upon our evaluation.

Message no. 2065[Branch from no. 1933]
Author: S9
Date: Wednesday, June 9, 10:00pm
Subject: Re: Shutting Down Chat Ref
Hi S19, I understand that a library is not expected to make a profit, however, not having taken your class what exactly is it that determines if a service is eliminated, other than not enough patron use.

Message no. 2078
Author: S26
Date: Thursday, June 10, 9:09am
Subject: What do we call it discussion
An interesting discussion has begun about naming our new reference tools. The originator of the discussion indicated that she does not like the word "virtual". However, her objection was based on the American Heritage Dictionary of the English Language definition. I agree with other participant that we should use the technical definition. He references: "An adjective that expresses a condition without boundaries or constraints." Since we are using technology to provide our reference services we should use the technological definition.

Appendix F (continued)
Asynchronous conversation transcript

Message no. 2081[Branch from no. 2078]
Author: S12
Date: June 10, 9:35am
Subject: Re: What do we call it discussion
But will the technological definition be implied to everyone who hears the term? Personally, I think most people, even those who aren't necessarily tech-savvy, have come to recognize the newer, technological meaning of the word "virtual." Especially since it's one of those words that has been used (or overused) in the media to indicate anything vaguely related to computer technology (like cyber or the prefix "e"). But the semantic issue of the double meaning of something like "virtual" should not be glossed over. It is hard to completely divorce the term from ideas like "not real" or "simulated" in the minds of all. However, I'd like to add (just to be completely middle-of-the-road about this), what is the alternative? Not having read the discussion I don't know if that issue was brought up, but I think that should be a big part of the question. Other terms may be just as much of a semantic double-edged sword and if "virtual" has caught on, it will be hard to dislodge it.

Message no. 2089[Branch from no. 2081]
Author: S21
Date: June 10, 12:51pm
Subject: Re: What do we call it discussion
I have been watching this discussion evolve as well. I like one response best so far. Let's specify the media we use to describe it: e-mail reference chat reference instant message reference "Whatever comes along next" reference! - VoIP etc... These terms are easily recognizable by the majority of users and this allows for a distinction among the different services without lumping them all together.

Message no. 2110[Branch from no. 2089]
Author: S26
Date June 10, 7:02pm
Subject: Re: What do we call it discussion
Great idea, S21. Thanks

Appendix F (continued)
Asynchronous conversation transcript

Message no. 2112[Branch from no. 2089]
Author: S27
Date: Thursday, June 10, 7:16pm
Subject: Re: What do we call it discussion
I agree with S21. If a term is widely acceptable from the majority of people, it would be very hard to change the way of user's understanding by forcing him/her to accept the "right" word. The tendencies are toward changing meaning of some words or invent new ones. For example, in Bulgaria we don't use any more the Bulgarian word "communicate" but the English word "chat". Most people from my grand-parents generation cannot even understand the youth talking to each other. If you insist the young people to use the "right" words, they don't even want to listen to you. It is like to move the mountain to the sea (if you come up with an English idiom, I would appreciate that).

Message no. 2114[Branch from no. 2078]
Author: S13
Date: Thursday, June 10, 7:59pm
Subject: Re: What do we call it discussion
I tend to agree with S12 on this issue. Language is constantly evolving and just because this version of the dictionary defines "virtual" in a manner unsatisfactory to some librarians, doesn't mean that a new definition will not be added in the next edition. What did we learn in a class about how dictionaries have gone from being prescriptive to being descriptive? I think it will just be a matter of time before the connotations we give words like "virtual" start to show up in the dictionary. It certainly has been a busy week on the listserv with interesting topics discussed.

Message no. 2120[Branch from no. 2114]
Author: F2
Date: Thursday, June 10, 9:47pm
Subject: Interesting Week
I've been on this listserv for some time and I have to say it HAS been one of the most interesting weeks ever. Practically made to order for this class! E5 and E1, two of our expert chatters, have participated, as well as a university alumnus who works on campus.

Appendix F (continued)
Asynchronous conversation transcript

Message no. 2125
Author: S22
Date: Friday, June 11, 9:10am
Subject: Teaching Librarian Blog
Listserv Discussion. Posted to listserv on Thursday, June 10. It hosts a teaching librarian blog that is full of interesting information and links that lead to other websites pertaining to virtual reference. The June 10th teaching librarian blog has an article about co-browsing, specifically how firewalls can prevent co-browsing from happening. Pop-up killers are also mentioned as a barrier for co-browsing to work effectively. Stephen's final comment is that all of these technical barriers make him want to return to simple chat. When working with my partner for the role-play exercise, we experienced some of these same difficulties. Her computer was not configured correctly to view all components of the software window. Therefore, we ended our first session quickly, she fixed the pop-up barrier, and we re-scheduled for a different session. I like the idea of reading through a blog because it includes real reactions to common situations. I am considering having my undergraduate students maintain blogs during the next semester and will continue to use this teaching librarian blog as a reference.

Message no. 2134[Branch from no. 2125]
Author: S1
Date: Friday, June 11, 11:49am
Subject: Re: Teaching Librarian Blog
Thank you for posting this blog, S22. It's very interesting, and it contains lots of great links!

Message no. 2140[Branch from no. 2125]
Author: S27
Date: Friday, June 11, 6:03pm
Subject: Re: Teaching Librarian Blog
English is not my native language and I came across the word "blog". I searched Google for some definitions and I still don't understand the difference between "blog" and "web site". Could you, please, clarify the word "blog" for me? Thank you for your participation in this post.

Appendix F (continued)
Asynchronous conversation transcript

Message no. 2142[Branch from no. 2140]
Author: F1
Date: Friday, June 11, 6:39pm
Subject: Re: Teaching Librarian Blog
"A blog is basically a journal that is available on the web. The activity of updating a blog is "blogging" and someone who keeps a blog is a "blogger." Blogs are typically updated daily using software that allows people with little or no technical background to update and maintain the blog. Postings on a blog are almost always arranged in chronological order with the most recent additions featured most prominantly."

Message no. 2151[Branch from no. 2125]
Author: S6
Date: Saturday, June 12, 12:13am
Subject: Re: Teaching Librarian Blog
Thanks S22, for bringing the article to our notice. I have had to disable my pop up stopper, I also noticed further down in the weblog that download accelerator /managers can interfere with co-browsing. As it was mentioned, what price do we have to pay to be able to co-browse or utilize some of these systems?

Message no. 2170
Author: S3
Date: Saturday, June 12, 10:14pm
Subject: "what is a digital library?"
Reading people's comments about the discussion of "virtual" I was reminded of a recent attempt at definition: a thread called "What is digital library?" People commenting on this thread were eager to define "digital" as loosely as possible, to allow for advances in technology. As a result a couple of the contributors lost sight of the importance of that second word, "library." They suggested that web sites such as "Amazon" and "iTunes," as collections that were created on certain principles, managed, to some extent preserved, and easily searched, might qualify as "digital libraries." Recalling these writers to their senses in an email of June 3, somebody reminded them that a digital library needs to be not just digital but a library—a place that serves a specific community. Amazon and iTunes "do not have a _defined_ user community, they do not discriminate on behalf of that community[...], and they certainly do not maintain the collection past the point of significant sales." Changes in the form of a phenomenon sometimes prevent people from seeing that the phenomenon itself stays the same. I enjoyed that reminder that, digital or not, libraries are places that serve.

Appendix F (continued)
Asynchronous conversation transcript

Message no. 2196[Branch from no. 2170]
Author: S1
Date: Sunday, June 13, 2:51pm
Subject: Re: "what is a digital library?"
I also followed that rather lively discussion, and I would add something else that we've discussed in other classes: that librarians serve their community not only by facilitating access but by providing patrons with educated human judgment and discernment--whether it's deciding what goes into a digital repository or deciding what recommended book to pull from the stacks.

Message no. 2198[Branch from no. 2196]
Author: S5
Date: Sunday, June 13, 3:08pm
Subject: Re: "what is a digital library?"
I'd say that ideally the digital library would be all of these things--computer (mediated) information and humans there for access help. I mean that's what we're here for, isn't it?

Message no. 2249[Branch from no. 2140]
Author: S22
Date: Tuesday, June 15, 5:03am
Subject: term: Blog
S27, I believe the term 'blog' first originated from the phrase Web Log. The two words combined and shortened are blog.

Message no. 2303[Branch from no. 2065]
Author: S19
Date: Wednesday, June 16, 7:02am
Subject: Re: Shutting Down Chat Ref
A cost benefit analysis is performed on the service. The cost of providing the service is relatively easy to perform. The benefit portion is much harder. How to you place a value on the correct answer to a question? There are some qualitative and quantitative methods, such as asking how much of a tax refund a person would want if the service was no longer offered, or determining the cost of what the patron would do if the service was not offered. If you are interested I could send you some references. The point is to be able to perform a Return on Investment. Is this program the best bang for the buck when our budget is shrinking.

Appendix F (continued)
Asynchronous conversation transcript

Message no. 2609
Author: S5
Date: Tuesday, June 22, 9:36pm
Subject: Digital Reference for Homeschooling
This evening there was an email on the listserv about homeschooling and target marketing. It got me to thinking about how libraries in general but digital reference (and other digital products) in particular can be an aid to the homeschool set. But I'm not entirely sure how large an audience exactly this would be, as most homeschoolers in my experience (and admittedly I come from a poor rural area, but all the same) tend to be on the lower income level--and therefore would have limited access to computers, so their reference needs would as well be met by in person interviews as digital....Anyone got any thoughts on this?

Message no. 2615[Branch from no. 2609]
Author: S6
Date: Wednesday, June 23, 10:37am
Subject: Re: Digital Reference for Homeschooling
I agree that that the homeschool audience would be a good one to target. I would like to add that there is a relatively large number of home school students in this area, and they do not have problems getting access to computers, I suspect that some of them even do their lessons on computers.

Message no. 2618[Branch from no. 2609]
Author: S23
Date: Wednesday, June 23, 11:15am
Subject: Re: Digital Reference for Homeschooling
I also saw the email from E1 and I can understand the excitement generated by this potential market. I think digital libraries and e-reference services should definitely explore the homeschool market. Children who are homeschooled, and parents who do the homeschooling, could really benefit from e-reference service. I did a little research and found out that there were 850,000 students being homeschooled in 1999 (a little less than 2% of all students nationwide). The household income of homeschoolers was no different than nonhomeschoolers in 1999. Some reasons parents decide to homeschool their children include: religious reasons, not being happy with public school options, and the belief they can provide a better learning environment at home. I believe e-reference could be an effective instructional tool in the homeschool environment.

Appendix F (continued)
Asynchronous conversation transcript

Message no. 2639[Branch from no. 2618]
Author: S21
Date: Wednesday, June 23, 5:29pm
Subject: Re: Digital Reference for Homeschooling
I know of a youth services librarian in a public library who worked a lot with home schoolers and their families. It is a relationship you need to cultivate but it can be done. A typical student in school would first go to their school library (hopefully, cause that's where I am!) as a class to start a research project and obtain resources. Home shcoolers don't have this resource. They go right to the public library when they need information. I think VR would appeal to, and be well used by home school families if they knew more about it.

Message no. 2644[Branch from no. 2618]
Author: S5
Date: Wednesday, June 23, 6:29pm
Subject: Re: Digital Reference for Homeschooling
Wow, thanks for finding those numbers, S23 !

Appendix F (continued)
Asynchronous conversation transcript

Message no. 2837[Branch from no. 2609]
Author: S18
Date:, June 26, 3:41pm
Subject: Re: Digital Reference for Homeschooling
I was also following the discussion about homeschooling and VR. Like S5, I come from a rural rather low-income area and realize that it might be difficult to reach this population. Research done by the National Center for Education Statistics backs up this assumption. I accessed the Digest of Education Statistics and found the following information in Chapter 7: Learning Resources and Technology: "Sizable percentages of students in 2001 used computers at home, though fewer actually used them for schoolwork. In 2001, 66 percent of elementary and secondary school students used computers at home, compared to 43 percent in 1997. During the same period of time, the proportion of students using computers at home for school work rose from 25 to 45 percent. Female students are slightly more likely to use computers at home for school work than males. There were large differences between White and Black and Hispanic students; about 53 percent of White elementary and secondary schools students used computers at home for school work compared to 29 percent of Black students and 28 percent of Hispanic students. Use of computers at home was strongly associated with income. About 64 percent of students from families with an income of $75,000 or more used a computer at home for school work compared to 28 percent of students from families with incomes of $20,000 to $24,999." I would imagine that these numbers have risen since this Digest was published, but I doubt if they have risen dramatically. Virtual reference can be a wonderful resource for the homeschooled population that has access to computers, and I think it's a GREAT idea to market VR services toward this population. However, there is still a very large population that does not reap the benefits of having Internet or even a computer at home.

Message no. 2941
Author: S7
Date: Monday, June 28, 12:44pm
Subject: Data on Homeschooling
I did not see it mentioned but, in response to S18's posting, is there data on what percentage of home schoolers are also low-income? I know that many low-income parents are opting for voucher programs springing up. Dissatisfaction with public schools drives parents to home school, as S23 mentions. Does dissatisfaction have to do with the sad fact that lower performing schools are most often in low-income neighborhoods. The implications for digital reference and homeschooling would take on another dimension, if so.

Appendix F (continued)
Asynchronous conversation transcript

Message no. 2953[Branch from no. 2837]
Author: S29
Date: Monday, June 28, 4:26pm
Subject: Re: Digital Reference for Homeschooling

I brought up this discussion to my sister because she homeschools her 3 children. She thinks this is a great tool to have as a homeschooling parent. She says that right now when she gives her oldest child an assignment to do that requires research, it often means a trip to the library with the younger siblings in tow. She said it is very difficult to help her oldest child with the assignment when the younger ones want to go to their section of the library to find books. She said she would love to have the option of just letting her daughter go online to ask for assistance. She mentioned that this is particuarly good when she wants to be able to give her daughter the independence to solve problems on her own. Using VR, her daughter would need to interact with the librarian and tell her exactly what she needs. She said it is also great because it is like someone else is teaching her for a little while and that her daughter definitly gets tired of mom always telling her how to do things. Having a librarian show her how to search for the information would be great. Also, she said from her experience, most of the homeschool families she knows are not low income. SHe is part of a large home school network. They reguarly meet at each others houses and she says she would not qualify any of them as low income. (Although obviously her group is just a small cross section of the population.) She said, as someone else mentioned, they chose to homeschool for religious reasons or because they are dissatisfied with the public school system. She did mention that most of the people she knows who homeschool have very large families. She is the rare one with only 3 kids. Most of the people in her group have at least 5. This is another reason she thinks VR is great. When you are teaching 5 or more kids at a time, it is nice to have someone else for them to go to for help without having to leave the house.

Appendix F (continued)
Asynchronous conversation transcript

Message no. 3279
Author: S28
Date: Thursday, July 1, 2:48pm
Subject: using IM programs
Instant message software generally allows users to chat only with others using the same software. AOL users can only chat with AOL users, MSN only with MSN, etc. However, a discussion today revealed that there are a few programs that will allow the users to chat with people using five different programs (AOL, ICQ, MSN, Yahoo and IRC). I had a discussion with myself in a posting on the Experts discussion board about using AOL Instant Messenger for chat reference but having a software that doesn't limit who the librarian can interact based on software with makes for an even stronger argument for giving patrons the option to chat with a librarian using software with which they are already comfortable. Does anyone know of studies regarding VR using software made specifically for VR verses standard chat software? Usage statistics, patron satisfaction, etc...

Message no. 3377[Branch from no. 2953]
Author: S19
Date: Friday, July 2, 1:50pm
Subject: Re: Digital Reference for Homeschooling
Thank you S29 for sharing a personal example. As it has been mentioned so many times before, we are doing a horrible job marketing of services. I came across this quote from 1988. It seems we have not learned a lot since.

“Librarians are marketing. This is not happenstance but necessary. The world in which libraries exist has changed dramatically: It moves faster, relies on technology, and competes more intensely. Fearful that change may threaten their existence, librarians look to marketing to help them manage better.”

Keiser, Barbie E. and Carol K. Galvin. Marketing library services : a nuts-and-bolts approach. - Hague 1988

I agree. This looks like a perfect partnership. I am surprised more has not been done.

Appendix F (continued)
Asynchronous conversation transcript

Message no. 3378[Branch from no. 3279]
Author: S19
Date: Friday, July 2, 1:54pm
Subject: Re: using IM programs
I know a professor did some investigation into this with the system the campus uses. He is a great guy and is the head of a special library on campus. That is the best advice I can give.

Message no. 3389
Author: S11
Date: Friday, July 2, 4:58pm
Subject: Security
There was a posting about the low security issues, in that to make VRS work, the librarian's computer has to accept all cookies and formats to be accepted. I wish there had been more about this (have looked, but can't find anyone responding to this in later postings) but isn't it odd in a day and age when computer viruses are running rampant that we, librarians, would have to have settings so low? I too would be interested to see if technology can be advanced to accept all formats, yet also detect when a virus or some other corrupt coding is attached, when accepting a co-browsing chat. Chances are the person who has the virus might not even be aware of it. Thoughts on that?

Message no. 3395[Branch from no. 3389]
Author: S19
Date: Friday, July 2, 7:33pm
Subject: Re: Security
I understand your concerns S11. That posting caught my eye as well. I think it is a question of tradeoffs. If your want really tight security, it comes with a large overhead. It slows your system down and limits what you can do. If I were a system administrator, a job I would hate to have, I would isolate the computer(s) used for that type of work on the network as much as possible. There is just so much nasty malware out there now. I am surprised we have not heard more about this topic. Especially with the threat to patrons. Imagine if every time you use a reference service your computer gets infected.

Appendix F (continued)
Asynchronous conversation transcript

Message no. 3511[Branch from no. 3389]
Author: S16
Date: Tuesday, July 6, 9:00am
Subject: Re: Security
I had always assumed that library VR systems, or any application that attempts to be available to the widest possible audience for that matter, were 'obligated' to offer their services at low security settings. The entity providing the service understands that there are hundreds of different systems in use at many different levels. In order to be accessible to all, the application must be able to interact with the most rudimentary systems. More modern and efficient applications cut off potential customers.

Message no. 3515[Branch from no. 2170]
Author: S25
Date: Tuesday, July 6, 10:10am
Subject: Re: "what is a digital library?"
It seems this discussion topic has again come up on the listserv. The most recent posting defines a digital library:

"The second response is great, and the one phrase that struck me was "defined user community". I argue that the definition of a digital library is fundamentally tied to this phrase. A digital library is "Any collection of digital resources managed with the primary goal of maximizing the collection's utility to a defined user community".

It goes on to evaluate many sites like Amazon.com, Google, PubMed, ScienceDirect, JSTOR, etc. I would have to disagree with his evaluation of ScienceDirect though. ScienceDirect should be considered a digital library, for starters, there is clearly a "defined user community" for this service - authors, libraries, scientists. And even though it is a for-profit business and fairly expensive, they do make every effort to make their services available to their user base. "Maximizing the collection's utility" to me suggests offering collections which appeal to the user as well as providing an easy/consistent interface to access the resources.

Message no. 3524[Branch from no. 3389]
Author: S7
Date: July 6, 11:15am
Subject: Re: Security
S11- I couldn't agree more. My impression was that security would be of utmost importance yet, as the posting stated, we are being overly lackadaisical with the cookies. I would hope that there would be a greater emphasis on scanning viruses. The consequences for not are too great in terms of security, system crashing, etc.

Appendix F (continued)
Asynchronous conversation transcript

Message no. 3571
Author: S8
Date: Wednesday, July 7, 12:01am
Subject: Humm... college students going to the library, my commentary

Is it just me? I took a slight offence to the listserv discussion about college students not getting off the couch to go to the library when they are within distance to do so. It was pointed out the article was about fitness- not libraries, and the reference was used because of the assumption that college students walk or bike everywhere. The study found that even for short trips across campus, most students are driving. Ok, first of all, it couldn't have been our university- because there is no way you could drive across campus and get a parking spot faster than you could walk. Second, the person who posted the article on the listserv only referenced the AP- and thought it was from this weekend. I did some searching on the AP- and couldn't find anything, but then again, they were not sure of the source. What I would like to know is the age group of those college students that were polled, (i.e. freshman vs. a grad student who most likely lives off campus). As a grad student, you can bet I am going to start with computer reference 100 times faster than getting in my car, driving the 45 minutes to town, spending the 15 minutes to find a parking spot (unless it is a weekend- then 5), then another 10 walking to the library- 15 if the main library- and THEN the next 10 finding a terminal (15-20 if is a Sunday night), only to search the online database- WHEN I can walk to my computer from any given point in my small apartment in 1 minute 30 seconds flat (less if I'm wired on sugar) and find the same info in about 10 minutes. AND the comment to this posting- was a suggestion of "hooking up a treadmill to operate the power on the computer". !!! I will be the first one to say I need to exercise (and the rest of the country could use some too), BUT I also have a life outside of school- as many of us do- a full time job, family, 3 psycho cats and just plain taking care of my sanity. I do realize the humor, but at the same time, the undergrad college population is from a different culture- one in which everything is electronic. I didn't get a computer until I turned 30- (only 6 years ago) (ok, so I was a little behind the times), however, there are kids learning on computers before they start kindergarten. Of course I am unable to read the study- so this may be all for not- but it just struck a wrong chord with me as I am sitting here at 11:57 p.m. - knowing the sacrifices I have had to make to get here in this midnight chair, in front of my home computer. Thanks for reading/listening to my rant!

Appendix F (continued)
Asynchronous conversation transcript

Message no. 3579[Branch from no. 3571]
Author: S7
Date: Wednesday, July 7, 9:21am
Subject: Re: Humm... college students going to the library, my commentary
S8- I appreciate your perspective. With digital reference and electronic databases at our fingertips, why not utilize them first. Given that many of us grad students have full-time jobs, our time to drag ourselves to our university if limited. Although not my situation, add kids, pets, etc. to that, and you are even more tied down. I have read that e-reference is questionable and that students are lazy, also, in other articles. I couldn't disagree more. The more options we have, the more people we can reach and who can benefit.

Message no. 3583[Branch from no. 3579]
Author: S23
Date: Wednesday, July 7, 9:46am
Subject: Re: Humm... college students going to the library, my commentary
Good thoughts S8 and S7. I would agree that using all the resources available to you (in this case chat reference) is far from being lazy, it is a thoughtful, resourceful approach to getting assistance. The hard way is not always the best way (though sometimes I think my Eastern European heritage tries to convince me otherwise).

Message no. 3590[Branch from no. 3389]
Author: S14
Date: Wednesday, July 7, 12:17pm
Subject: Re: Security
I found this issue of security to be a little ironic. Working with ASKUSNOW I ran into numerous problems. I cannot pinpoint one specific aspect, but I wonder if the rigous setting changes was to blame for any malfunction. With viruses, popups, and other systems that piggy back personal computers, security should be set at an all time high. But with ASKUSNOW anything medium or low was required. Shouldn't we want our systems to entirely secure? Shouldn't we want ALL systems to be compatible to the VR service? After all, wouldn't that benefit the institution and the patron's sanity.

Appendix F (continued)
Asynchronous conversation transcript

Message no. 3595[Branch from no. 3279]
Author: S26
Date: Wednesday, July 7, 4:43pm
Subject: Re: using IM programs
I too was interested in this discussion. If we abandon the software that we are currently using we will not be able to co-browse with the user. Although it took some practice to learn how to effectively use this feature, I do think that it is valuable. Both librarian and patron can view that same webpage easily plus I think that it would be invaluable for teaching patrons. What does everybody else think. Sorry, S28, I don't know of any research.

Message no. 3596[Branch from no. 3590]
Author: S26
Date: Wednesday, July 7, 4:51pm
Subject: Re: Security
Let's be "tool builders" (E5's Expert chat) and demand that the vendors build the software so that are systems can be secure; we don't have to set to medium or low security but can have high security.

Message no. 3599[Branch from no. 3595]
Author: S8
Date: Wednesday, July 7, 5:18pm
Subject: Re: using IM programs
I agree with you S26. It is attractive to turn to IM, since it is free. Which I think would be ok to use, but IN ADDITION to software that allows for co-browsing. Using IM as the only method of e-reference assistance, limits the ability of the librarian to help the patron. What about fee databases? How will the patron be able to access those, or even see what is available, just using IM. There is also the issue of recording the chat for a transcript. I do not believe this can be done with IM. What if the patron wants a transcript to refer back to a source later, on the flip side, what if the library wants a transcript to see how where they can assist the patron better? This would be lost in just using IM.

Appendix F (continued)
Asynchronous conversation transcript

Message no. 3600[Branch from no. 3599]
Author: F1
Date: Wednesday, July 7, 5:36pm
Subject: Re: using IM programs
I believe that some universities are looking at I.M. as an add on service - since students use I.M. and most would already have it running on their system. I.M. already has a voice feature (which I have not tried). But it would not provide the advanced features we have seen in other software tools.

Message no. 3603[Branch from no. 3599]
Author: S21
Date: Wednesday, July 7, 6:30pm
Subject: Re: using IM programs
I have seen on the listserv that some IM is being used to contact specific librarians. The patron sees the person is online at that time and can solicit advice from someone that they know and have a relationship with. I think this is an interesting added benefit, especially in an academic library. Although it shouldn't replaced better software that allows for co-browsing, it does something towards personalizing the online reference experience.

Message no. 3610[Branch from no. 3603]
Author: S1
Date: Wednesday, July 7, 11:00pm
Subject: Re: using IM programs
Interesting point, S21. I agree--in an academic setting, if one is looking for a subject specialist, for example, and sees that he or she is online, it would be advantageous to be able to connect with that specialist directly I am strongly in favor of co-browsing. I think it probably helps VR librarians tremendously in the user education aspect of their jobs; 'tis easier to show than to explain...

Appendix F (continued)
Asynchronous conversation transcript

Message no. 3620[Branch from no. 3571]
Author: S25
Date: Thursday, July 8, 11:40am
Subject: Re: Humm... college students going to the library, my commentary
S8, I definitely agree with you! It is very inconvenient to go on campus and use resources there (and I only live 20 mins away from campus - 20 mins not during rush hour). If a service is available through a distance learning-type scenario, why not take advantage of that? Oh yea, and the "hooking up a treadmill to operate the power on the computer" joke...not funny.

Message no. 3631[Branch from no. 3599]
Author: S28
Date: Thursday, July 8, 3:19pm
Subject: Re: using IM programs
Regarding transcript availability in IM programs...I only have experience with AOL's IM software and the user has the ability to save the conversation to a chosen location. AOL saves conversations in HTML so the files are opened into a browser window, which means all links are usable. This does mean that the patron and librarian are each responsible for saving the transcript to their respective computers. This can, however, be automated by downloading a program called DeadAIM that that embeds itself into AIM. One of this program's functions is that it can be told to automatically save a transcript of every AIM conversation. I never quite understood why anyone would need this but it would be extremely useful for VR! Just another of my two cents about using IM for VR!

Message no. 3638[Branch from no. 3631]
Author: S8
Date: Thursday, July 8, 4:47pm
Subject: Re: using IM programs
Aaaahhh! Thank you! I did not know this. I am only familiar with Yahoo instant messaging- and I do not believe Yahoo has this feature. Thanks for the update!

Appendix F (continued)
Asynchronous conversation transcript

Message no. 3639[Branch from no. 3571]
Author: S12
Date: Thursday, July 8, 4:53pm
Subject: Re: Humm... college students going to the library, my commentary
Just curious...Did anyone post a comment to the listserv? I'm signed up for the other one so I missed the actual discussion, but it seems like this is a legitimate response to something that would really help to enlighten others on the list who may have forgotten what it's really like to be a student. Or that not all students are 19 year-olds living on campus. Or that some students may have decreased mobility. Or that the library might not be open at night or on a safe part of campus...etc., etc., etc. Great topic to bring up S8 (Especially since it's the end of the semester and I think we're all a bit taxed and it's fun to let it out.)

Message no. 3661[Branch from no. 3638]
Author: S19
Date: Friday, July 9, 7:06am
Subject: Re: using IM programs
I LOVE IM as a reference delivery service. Several professors I know use it regularly to interact with students during office hours. I believe we have an absolute obligation to open up as many communication channels as possible with our patrons. IM seems like a very reasonably price addition.

Message no. 3662[Branch from no. 3515]
Author: S19
Date: Friday, July 9, 7:15am
Subject: Re: "what is a digital library?"
The issue I have with that definition is once you go on line, how do you define your community? I would be very cautious about narrowing my services because of a perceived user community on a global resource.

Appendix F (continued)
Asynchronous conversation transcript

Message no. 3669[Branch from no. 3662]
Author: S10
Date: Friday, July 9, 2:35pm
Subject: Re: "what is a digital library?"
I'm beginning to have "bad" thoughts about the entire naming business. Why do we have to put a label on what is going on here? Call it Reference Services and move on. If we follow this path too far we may get Paper Reference, Photographic Reference, Microfilm Reference, Audio Reference, and an enormous slew of other "Reference" services all competing with one another. Advertise the fact that you provide Information Reference Services and sort out everything else in the fine print!

Appendix G
Synchronous Conversation # 1: "Chat with E1"
Conversation chart

The conversation chart in this appendix illustrates the discourse sequences, interaction types, cognitive processes, and knowledge types identified for *a synchronous conversation* in the data set. Each row in the chart represents *a discourse sequence* within the conversation, and each line within a row represents *a turn* taken by a participant – a member of the instructional team *(F1),* a guest speaker (*E1),* or a student *(S1, S3, S6, S8, S14, S17, S21, S23, S25, and S27).*

The first column in the chart illustrates the *conversational actions* identified within each discourse sequence and the relationships with other actions in the sequence. A single conversational action represented one or more interaction types, cognitive processes, and knowledge types. The set of basic conversational actions identified in the study are:

O: opening/starting a conversation

C: closing/terminating a conversation

I: initiating a sequence/eliciting participation

R: responding to a request for participation/elicitation

E: evaluating the quality of a response

F: providing feedback

A: acknowledging other participants' responses

G: greeting/introducing participants

P: probing participants for clarification or to confirm their responses

S: stating facts relevant to a topic

Discourse sequences	Interaction types	Cognitive processes	Knowledge type
F1 >> (O)	Instructor – Group	NONE	NONE
F1 >> (G)	Instructor – Group	NONE	NONE
F1 >> (A)	Instructor –Instructor	NONE	NONE
System>>(S)	*System –Participants*	NONE	NONE
F1 >> (I) E1>> (I – R)	Instructor –Instructor Instructor – Group	NONE NONE	NONE NONE
System>>(S)	*System –Participants*	NONE	NONE
System>>(S)	*System –Participants*	NONE	NONE
F1 >> (I) S1>> (I – R)	Instructor – Student Student – Instructor	NONE NONE	NONE NONE
F1 >> (I) S3>> (I – R) E1>> (I – R – R) F1>> (I – R – R – P) S3>> (I – R – R – P – R) E1>> (I – R – R – P – R – R) F1>> (I – R – R – P – R – R – A)	Instructor – Student Student – Instructor Instructor – Student Instructor – Student Student – Instructor Instructor – Group Instructor –Instructor	NONE Interpreting Inferring NONE NONE Attributing Comparing Comparing Inferring Exemplifying NONE	NONE Conceptual NONE NONE Conceptual Procedural Conceptual Procedural NONE
F1 >> (I) S6>> (I – R) E1>> (I – R – R) F1>> (I – R – R – P)	Instructor – Student Student – Instructor Instructor – Group Instructor –Instructor	NONE Organizing Attributing Exemplifying Critiquing	NONE Procedural Procedural NONE

F1 >> (I)	Instructor – Student	NONE	NONE
S8>> (I – A)	Student – Instructor	NONE	NONE
E1>> (I – A – R)	Instructor – Student	NONE	NONE
S8>> (I – A – R – R)	Student – Instructor	NONE	NONE
E1>> (I – A – R – R – R)	Instructor – Student	NONE	NONE
S8>> (I – A – R – R – R – R)	Student – Instructor	NONE	Factual
E1>> (I – A – R – R – R – R – R)	Instructor – Group	Exemplifying	Factual
E1>> (I – A – R – R – R – R – R – P)	Instructor – Student	NONE	NONE
S8>> (I – A – R – R – R – R – R – P – R)	Student – Instructor	NONE	NONE
E1>> (I – A – R – R – R – R – R – P – R – R)	Instructor – Group	Exemplifying	Factual
S8>> (I – A – R – R – R – R – R – P – R – R – R)	Student – Instructor	Inferring	NONE
E1>> (I – A – R – R – R – R – R – P – R – R – R – R)	Instructor – Group	Exemplifying Comparing	Factual
F1>> (I – A – R – R – R – R – R – P – R – R – R – R – R)	Instructor –Instructor	NONE	Factual
E1>> (I – A – R – R – R – R – R – P – R – R – R – R – R – R)	Instructor – Group	Exemplifying	Factual
F1>> (I – A – R – R – R – R – R – P – R – R – R – R – R – R – A)	Instructor –Instructor	NONE	NONE
System>>(S)	*System –Participants*	NONE	NONE
System>>(S)	*System –Participants*	NONE	NONE

F1 >> (I)	Instructor – Student	NONE	NONE
S23>> (I – R)	Student – Instructor	Differentiating	Conceptual
E1>> (I – R – R)	Instructor – Group	Attributing Exemplifying	Conceptual
F1>> (I – R – R – R)	Instructor –Instructor	NONE	NONE
S1>> (I)	Student – Instructor	NONE	NONE
F1>> (I) *with overlap	Instructor – Student	NONE	NONE
E1>> (I – R)	Instructor – Student	NONE	NONE
S1>> (I – R)	Student – Instructor	Differentiating	Conceptual
E1>> (I – R – R)	Instructor – Group	Exemplifying Attributing Critiquing	Conceptual
S1>> (I – R – R – R)	Student – Instructor	NONE	Factual
E1>> (I – R – R – R – R) *with overlap	Instructor – Student	NONE	Factual
F1 >> (I)	Instructor – Student	NONE	NONE
S3>> (I – R)	Student – Instructor	Interpreting	Conceptual
E1>> (I – R – R)	Instructor – Group	Exemplifying	Conceptual
E1>> (I – R – R – P)	Instructor – Student	NONE	NONE
F1>> (I – R – R – P – R)	Instructor –Instructor	NONE	NONE
S3>> (I – R – R – P – R – R)	Instructor – Student	NONE	NONE
E1>> (I – R – R – P – R – R – R)	Instructor – Group	Inferring Explaining Exemplifying	Conceptual
F1>> (I – R – R – P – R – R – R – R)	Instructor –Instructor	Attributing	Conceptual
F1>> (I – R – R – P – R – R – R – R – F)	Instructor –Instructor	Critiquing	NONE
E1>> (I – R – R – P – R – R – R – R – F – R)	Instructor – Group	Inferring	Factual

F1 >> (I) S6>> (I – R) E1>> (I – R – R) F1>> (I – R – R – P) S6>> (I – R – R – P – R)	Instructor – Student Student – Instructor Student – Content Instructor – Group Instructor – Student Student – Instructor	NONE Interpreting Attributing Attributing Exemplifying NONE NONE	NONE Conceptual Conceptual Procedural NONE NONE
F1 >> (I) S8>> (I – R) E1>> (I – R – R) S8>> (I – R – R – R) E1>> (I – R – R – R – R) F1>> (I – R – R – R – R – R) E1>> (I – R – R – R – R – R – R) F1>> (I – R – R – R – R – R – R – R)	Instructor – Student Student – Instructor Instructor – Group Student – Instructor Instructor – Group Instructor –Instructor Instructor –Instructor Instructor –Instructor	NONE Inferring Attributing Exemplifying Inferring Comparing Exemplifying NONE Attributing NONE	NONE Conceptual Conceptual Conceptual Conceptual Factual Factual NONE
F1 >> (I) * No answer from S23	Instructor – Student	NONE	NONE
F1 >> (I) S1>> (I – R) E1>> (I – R – R)	Instructor – Student Student – Instructor Instructor – Group	NONE Inferring Comparing Comparing Attributing Explaining	NONE Conceptual Factual Procedural
System>>(S)	*System –Participants*	NONE	NONE

F1 >> (I) * No answer from S23	Instructor – Student	NONE	NONE
F1 >> (I) S3>> (I – R) E1>> (I – R – R)	Instructor – Student Student – Instructor Instructor – Group	NONE Differentiating Explaining	NONE Conceptual Conceptual
F1 >> (I) * No answer from S6	Instructor – Student	NONE	NONE
F1 >> (I) S8>> (I – R) E1>> (I – R – R) F1>> (I – R – R – R) E1>> (I – R – R – R – R) * with delay	Instructor – Student Student – Instructor Instructor – Group Instructor – Group Instructor – Group	NONE Exemplifying Exemplifying NONE Attributing	NONE Factual Factual NONE NONE
System>>(S)	*System –Participants*	NONE	NONE
F1 >> (I) S1>> (I – R) E1>> (I – R – R) E1>> (I – R – R – R) * with delay	Instructor – Student Student – Instructor Instructor – Group Instructor – Group	NONE Interpreting Attributing Exemplifying Exemplifying Comparing	NONE Conceptual Conceptual Procedural Factual
F1 >> (S)	Instructor – Group	NONE	NONE
F1 >> (I) S21>> (I – R) E1 >> (I – R – R) S21>> (I – R – R – R) E1 >> (I – R – R – R – R) S21>> (I – R – R – R – R – R) E1>> (I – R – R – R – R – R – R)	Instructor – Student Student – Instructor Instructor – Group Student – Instructor Instructor – Group Student – Instructor Instructor – Group	NONE Interpreting Critiquing Checking Attributing Attributing NONE NONE	NONE Factual Factual Factual Factual Factual Factual

F1 >> (I) S27>> (I – R) E1 >> (I – R – R) S27>> (I – R – R – R) E1 >> (I – R – R – R – R) S27>> (I – R – R – R – R – R)	Instructor – Student Student – Instructor Instructor – Group Student – Instructor Instructor – Group Student – Instructor	NONE Inferring Attributing Exemplifying Exemplifying Exemplifying Critiquing	NONE Factual Factual Factual Factual NONE
F1 >> (I) E1 >> (I – R) E1 >> (I – R –A) F1 >> (I – R –A – A) F1 >> (I – R –A – A – R)	Instructor –Instructor Instructor – Group Instructor – Group Instructor –Instructor Instructor –Instructor	NONE Exemplifying NONE NONE Attributing	NONE Factual NONE NONE Metacognitive
E1 >> (S)	Instructor – Group	NONE	NONE
S3 >> (A)	Student – Instructor	NONE	NONE
S8 >> (A)	Student – Instructor	NONE	NONE
S1 >> (A)	Student – Instructor	NONE	NONE
S25>> (A)	Student – Instructor	NONE	NONE
S21>> (A)	Student – Instructor	NONE	NONE
S14 >> (A)	Student – Instructor	NONE	NONE
F1 >> (S)	Instructor –Instructor	NONE	NONE
E1 >> (S)	Instructor –Instructor	NONE	NONE
F1 >> (S)	Instructor – Group	NONE	NONE
E1 >> (S)	Instructor – Group	NONE	NONE
F1 >> (S)	Instructor – Group	NONE	NONE
S17 >> (S)	Student – Group	Critiquing	NONE

F1 >> (I) E1 >> (I – R) E1 >> (I – R – R) F1 >> (I – R – R – A) E1 >> (I – R – R – A – R)	Instructor –Instructor Instructor –Instructor Instructor – Group Instructor –Instructor Instructor –Instructor	NONE NONE NONE NONE NONE	NONE NONE NONE NONE NONE
S21>> (I) F1 >> (I – R) S21 >> (I – R – A)	Student – Instructor Instructor – Student Student – Instructor	NONE NONE NONE	NONE NONE NONE
F1 >> (C)	Instructor – Group	NONE	NONE
System>>(S)	*System –Participants*	NONE	NONE
System>>(S)	*System –Participants*	NONE	NONE
E1 >> (S)	Instructor –Instructor	NONE	NONE
S27 >> (S)	Student – Group	Critiquing	NONE

Appendix H
Asynchronous Conversation # 2: "Listserv"
Conversation chart

The conversation chart in this appendix illustrates the discourse sequences, interaction types, cognitive processes, and knowledge types identified for *an asynchronous conversation* in the data set. Each row in the chart represents *a discourse sequence* within the conversation, and each line within a row represents *a turn* taken by a participant – a member of the instructional team *(F1 and F2)* or a student *(S1 to S29).*

The first column in the chart illustrates the *conversational actions* identified within each discourse sequence and the relationships with other actions in the sequence. A single conversational action represented one or more interaction types, cognitive processes, and knowledge types. The set of basic conversational actions identified in the study are:

O: opening/starting a conversation

C: closing/terminating a conversation

I: initiating a sequence/eliciting participation

R: responding to a request for participation/elicitation

E: evaluating the quality of a response

F: providing feedback

A: acknowledging other participants' responses

G: greeting/introducing participants

P: probing participants for clarification or to confirm their responses

S: stating facts relevant to a topic

Discourse sequences	Interaction types	Cognitive processes	Knowledge type
F1 >> (O)	Instructor – Class	NONE	NONE
S22>> (I)	Student – Class	Executing	NONE
S13>> (I)	Student – Class Student – Content	Critiquing Attributing Explaining	Conceptual
S27>> (I – R)	Student – Student	Executing	NONE
S27>> (I – R – A)	Student – Student	NONE	NONE
S13>> (I)	Student – Class Student – Content	Critiquing Attributing Explaining	Conceptual
S19>> (I – R)	Student – Class	Attributing Exemplifying Inferring Critiquing	Conceptual
S9 >> (I – R – R)	Student – Student	Attributing Exemplifying	Conceptual
S19>> (I – R – R – R)	Student – Student	Attributing Exemplifying Critiquing	Conceptual

S26>> (I)	Student – Class	Summarizing Explaining Critiquing	Conceptual
S12>> (I – R)	Student – Class	Attributing Classifying Exemplifying Organizing Checking	Conceptual
S13>> (I – R)	Student – Class	Attributing Inferring Critiquing	Conceptual
S21>> (I – R – R)	Student – Class	Attributing Exemplifying Critiquing	Conceptual
S26>> (I – R – R – R)	Student – Student	Critiquing	NONE
S27>> (I – R – R – R)	Student – Class	Exemplifying Inferring Critiquing	Conceptual
F2>> (S)	Instructor – Class	Critiquing	Metacognitive
S22>> (I)	Student – Class	Attributing Executing Critiquing	Procedural
S1>> (I – A)	Student – Student	NONE	NONE
S1>> (I – A – R)	Student – Student	Attributing Critiquing	NONE
S22>> (I)	Student – Class	Attributing Executing Critiquing	Procedural
S6>> (I – A)	Student – Student	NONE	NONE
S6>> (I – A – R)	Student – Student	Executing	Procedural

S22>> (I)	Student – Class	Attributing Executing Critiquing	Procedural
S27>> (I – R)	Student – Class	Interpreting	Conceptual
S27>> (I – R – A)	Student – Class	NONE	NONE
F1 >> (I – R – A – R)	Instructor – Student	Classifying Exemplifying	Conceptual
S22>> (I – R – A – R)	Student – Student	Explaining Exemplifying	Conceptual
S3>> (I)	Student – Class	Attributing Explaining Exemplifying Classifying	Conceptual
S1>> (I – R)	Student – Class	Attributing Exemplifying	Conceptual
S5>> (I – R – R)	Student – Class	Attributing	Conceptual
S3>> (I)	Student – Class	Attributing Explaining Exemplifying Classifying	Conceptual
S25>> (I – R)	Student – Class	Interpreting Attributing Explaining Critiquing Classifying	Conceptual
S19>> (I – R – R)	Student – Class	Organizing Attributing Critiquing	Conceptual
S10>> (I – R – R – R)	Student – Class	Exemplifying Classifying	Conceptual Procedural

S5>> (I)	Student – Class	Inferring Attributing Explaining	Conceptual
S6 >> (I – R)	Student – Class	Critiquing Exemplifying	Factual
S23>> (I – R)	Student – Class	Critiquing Inferring Explaining	Conceptual
S21>> (I – R –R)	Student – Class	Comparing Attributing	Conceptual
S5 >> (I – R – R – A)	Student – Student	NONE	NONE
S5>> (I)	Student – Class	Inferring Attributing Explaining	Conceptual
S18>> (I – R)	Student – Class	Inferring Attributing Explaining Critiquing	Factual Conceptual
S7 >> (I – R – R)	Student – Class	Inferring Attributing Explaining	Conceptual
S29>> (I – R –R)	Student – Class	Exemplifying Critiquing	NONE
S19>> (I – R – R – A)	Student – Student	NONE	NONE
S19>> (I – R – R – A – R)	Student – Class	Attributing Critiquing	Conceptual

S28>> (I)	Student – Class	Executing Exemplifying	Procedural
S19>> (I – R)	Student – Class	NONE	NONE
S26 >> (I – R)	Student – Class	Attributing Executing Critiquing Inferring	Procedural
S26 >> (I –R – R)	Student – Student	NONE	NONE
S8 >> (I – R – R – R)	Student – Student	Critiquing	
S8 >> (I – R – R – R – R)	Student – Class	Attributing Executing Critiquing Inferring	Procedural
F1>> (I – R – R – R – R – R)	Instructor – Class	Comparing Executing Classifying	Procedural
S21>> (I – R – R – R – R – R – R)	Student – Class	Attributing Executing Classifying	Procedural
S1>> (I – R – R – R – R – R – R – F)	Student – Student	Critiquing	NONE
S1>> (I – R – R – R – R – R – R – F – R)	Student – Class	Attributing Inferring Critiquing	Procedural
S28>> (I – R – R – R – R – R – R – F – R – R)	Student – Class	Executing Exemplifying Critiquing	Procedural
S8>> (I – R – R – R – R – R – R – F – R – R – A)	Student – Student	NONE	NONE
S8>> (I – R – R – R – R – R – R – F – R – R – A – R)	Student – Class	Executing	Procedural
S19>> (I – R – R – R – R – R – R – F – R – R – A – R – R)	Student – Class	Attributing Critiquing	Procedural

S11>> (I)	Student – Class	Interpreting Inferring Critiquing	Procedural
S19>> (I – R)	Student – Student Student – Class	Attributing Explaining Exemplifying Critiquing	Procedural
S16>> (I – R)	Student – Class	Attributing Explaining	Procedural
S7 >> (I – R)	Student – Student Student – Class	Attributing Explaining Inferring	Procedural
S14>> (I – R)	Student – Class	Attributing Exemplifying Critiquing Inferring	Procedural
S26>> (I – R – R)	Student – Class	Exemplifying	Procedural
S8 >> (I)	Student – Class	Inferring Explaining Attributing	NONE
S7 >> (I – F)	Student – Student	Critiquing	NONE
S7 >> (I – F – R)	Student – Class	Attributing	NONE
S23>> (I – F – R – F)	Student – Student	Critiquing	NONE
S23>> (I – F – R – F – R)	Student – Class	Attributing Critiquing	NONE
S25>> (I – F – R – F – R – F)	Student – Student	Critiquing	NONE
S25>> (I – F – R – F – R – F – R)	Student – Class	Attributing Critiquing	NONE
S12>> (I – F – R – F – R – R – R – R)	Student – Class	Attributing Critiquing	NONE
S12>> (I – F – R – F – R – R – R – R – F)	Student – Student	Critiquing	NONE

References

Adger, C. T. (2001). Discourse in educational settings. In D. Schiffrin, D. Tannen & H.E. Hamilton (Eds.), *The handbook of discourse analysis* (pp. 503-517). Malde, MA: Blackwell Publishers.

Ahern, T.C., Peck, K. & Laycock, M. (1992). The effects of teacher discourse in computer-mediated discussion. *Journal of Educational Computing Research.* 8(3), 291-309.

Aleven, V., & Koedinger, K. (2002). An effective metacognitive strategy: Learning by doing and explaining with a computer-based Cognitive Tutor. *Cognitive Science.* 26(2), 147-181.

Anderson, J.R., Corbett, A.T., Koedinger, K.R. & Pelletier, R. (1995). Cognitive tutors: Lessons learned. *The Journal of the Learning Sciences.* 4(2), 167-207. Anderson, L.W. & Krathwohl, D.R. (2001). *A taxonomy for learning, teaching and assessing*. New York: Addison Wesley Longman.

Anderson, T. (2003). Modes of interaction in distance education: Recent developments and research questions. In M.G. Moore & W.G. Anderson (Eds.), *Handbook of distance education* (pp. 129-144). Mahwah, NJ: Lawrence Erlbaum.

Angeli, C., Valanides, N. & Bonk, C.J. (2003). Communication in a Web-based conferencing system: The quality of computer-mediated interactions. *British Journal of Educational Technology.* 34(1), 31-43.

Arts, J.A.R., Gijselaers, W.H. & Segers, M.S.R. (2002). Cognitive effects of an

authentic computer-supported, problem-based learning environment. *Instructional Science.* 30, 465-495.

Azevedo, R. (2002). Beyond intelligent tutoring systems: Computers as MetaCognitive tools to enhance learning? *Instructional Science*. 30(1), 31-45.

Azevedo, R., Verona, M.E., & Cromley, J.G. (2001). Fostering students' collaborative problem solving with RiverWeb. In J.D. Moore, C.L. Redfield, & W.L. Johnson (Eds.), *Artificial intelligence in education: AI-ED in the wired and wireless future* (pp. 166-175). Amsterdam: IOS press.

Bales, R.F. (1950). A set of categories for the analysis of small group interaction. *American Sociological Review.* 15(2), 257-263.

Becker, H.S. (1990). Generalizing from case studies. In E.W. Eisner & A. Peshkin (Eds.), *Qualitative inquiry in education: The continuing debate* (pp. 233-242). New York: Teachers College Press.

Behrens, J.T. & Smith, M.L. (1996). Data and data analysis. In D. Jonassen (Ed.), *Handbook of research on educational psychology* (pp. 945-989). New York: Simon & Schuster Macmillan.

Belanger, P. & Tuijnman, A. (1997). The silent explosion of adult learning. In *New patterns of adult learning: A six-country comparative study* (pp. 1-18). New York: Pergamon.

Bender, T. (2003). The optimal role of the online teacher. In *Discussion-based online teaching to enhance student learning: Theory, practice and assessment.* (pp. 10-15). Sterling, VA: Stylus Publishing.

Berge, Z.L. (2000). Components of the online classroom. *New Directions for*

Teaching and Learning. 84, 23-28.

Beuschel, W., Gaiser, B. & Draheim, S. (2003). Communication needs of online students. In A. K. Aggarwal (Ed.), *Web-based education: Learning from experience* (pp. 203-221). Hershey, PA: Information Science Publishing.

Blake, V. L. P. (2003). Research methods in LIS dissertations. In M.A. Drake (Ed.), *Encyclopedia of Library and Information Science* (pp. 2513-2523). 2nd edition. New York: Marcel Dekker Inc.

Blignaut, S. & Trollip, S.R. (2003). Developing a taxonomy of faculty participation in asynchronous learning environments: An exploratory investigation. *Computers & Education.* 41, 149-172.

Bloome, D. & Theodorou, E. (1988). Analyzing teacher-student and student-student discourse. In J.L. Green & J.O. Harker (Eds.), *Multiple perspective analyses of classroom discourse* (pp. 217-248). Norwood, NJ: Ablex Publishing Co.

Bogdan, R.C. & Biklen, S.K. (1998). *Qualitative research in education: An introduction to theory and methods*. 3rd edition. Boston, MA: Allyn and Bacon.

Bonk, C.J. & Dennen, V. (2003). Frameworks for research, design, benchmarks, training, and pedagogy in Web-based distance education. In M.G. Moore & W.G. Anderson (Eds.), *Handbook of distance education* (pp. 331-348). Mahwah, NJ: Lawrence Erlbaum.

Bostock, S.J. (1997). Designing Web-based instruction for active learning. In B.H. Khan (Ed.), *Web-based instruction* (pp. 225-230). Englewood Cliffs, NJ: Educational Technology Publications.

Cahoon, B. (1998). Adult learning and the Internet: Themes and things to come. *New Directions for Adult and Continuing Education.* 78, 71-76.

Carroll, T.G. (2001). Do today's evaluations meet the need of tomorrow's networked learning communities? In W.F. Heineke & L. Blasi (Eds.), *Methods of evaluating educational technology* (pp. 3-15). Greenwich, CT: Information Age Publishing.

Cazden, C.B. (1985). Classroom discourse. In M. C. Wittrock (Ed.), *Handbook of research on teaching* (pp. 432-463). 3rd edition. New York: MacMillan Publishing Company.

Cazden, C.B. (2001). *Classroom discourse: The language of teaching and learning.* 2nd edition. Portsmouth, NH: Heinemann.

Cazden, C.B. & Beck, S.W. (2003). Classroom discourse. In A.C. Graesser, M.A. Gernsbacher & S.R. Goldman (Eds.), *Handbook of discourse processes* (pp. 165-197). Mahwah, NJ: Lawrence Erlbaum.

Chen, A, Mashhadi, A., Ang, D. & Harkrider, N. (1999). Cultural issues in the design of technology-enhanced learning systems. *British Journal of Educational Technology*. 30(3), 217-230.

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

Chong, S. (1998). Models of asynchronous computer conferencing for collaborative

learning in large college classes. In C.J. Bonk & K.S. King (Eds.), *Electronic collaborators: Learner-centered technologies for literacy, apprenticeship, and discourse* (pp. 157-182). Mahwah, NJ: Lawrence Erlbaum.

Cifuentes, L. & Murphy, K.L. (2000). Promoting multicultural understanding and positive self-concept through a distance learning community: Cultural connections. *Educational Technology Research and Development*. 48(1), 69-83.

Cobb, P. (2001). Supporting the improvement of learning and teaching in social and institutional context. In S. Carver & D. Klahr (Eds.), *Cognition and instruction: Twenty-five years of progress* (pp. 455-478). Mahwah, NJ: Erlbaum.

Collis, B. (1999). Designing for differences: Cultural issues in the design of WWW-based course-support sites. *British Journal of Educational Technology.* 30(3), 201-215.

Creswell, J. W. (1994). *Research design: Qualitative & quantitative approaches.* Thousand Oaks, CA: Sage Publications.

Creswell, J. W. (1998). *Qualitative inquiry and research design: Choosing among five traditions.* Thousand Oaks, CA: Sage Publications.

Davidson-Shivers, G., Muilenburg, L.Y. & Tanner, E.J. (2001). How students participate in synchronous and asynchronous online discussions?. *Journal of Educational Computing Research.* 25(4), 351-366.

Dede, C. (1996). The evolution of distance education: Emerging technologies and

distributed learning. *The American Journal of Distance Education.* 10(2), 4-36.

Denzin, N.K. (1997). Triangulation in educational research. In J.P.Keeves (Ed.), *Educational research, methodology, and measurement: An international handbook* (pp. 318-322). New York, NY: Pergamon.

Dewey, J. (1938). *Experience and education.* New York: McMillan.

Dillon, A. & Zhu, E. (1997). Designing Web-based instruction: A human-computer interaction perspective. In B.H. Khan (Ed.), *Web-based instruction* (pp. 221-224). Englewood Cliffs, NJ: Educational Technology Publications.

Dodson, M.M. (1999). *Dialogue and interaction in computer-mediated communication: How undergraduate students socially construct knowledge through classroom discourse.* Doctoral Dissertation. The University of Texas at Austin.

Douglas, I. (2001). Instructional design based on reusable learning objects: Applying lessons of object-oriented software engineering to learning systems design. In *Proceedings of the 31st ASEE/IEEE Frontiers in Education Conference.* Retrieved November 7, 2004 from http://fie.engrng.pitt.edu/fie2001/papers/1118.pdf

Driscoll, M. (1998). Principles of adult education. In *Web-based training: Using technology to design adult learning experiences* (pp. 13-21). San Francisco, CA: Jossey-Bass/Pfeiffer.

Duffy, T.M.. (1996). Constructivism: Implications for the design and delivery of

instruction. In D. Jonassen (Ed.), *Handbook of research for educational communications and technology* (pp. 170-198). NY: Macmillan.

Dunlap, J.C. & Grabinger, R.S. (1996). Rich environments for active learning in the higher education classroom. In B.G. Wilson (Ed.), *Constructivist learning environments: Case studies in instructional design* (pp. 65-82). Englewood Cliffs, NJ: Educational Technology Publications.

Eastmond, D. V. (1998). Adult learners and Internet-based distance education. *New Directions for Adult and Continuing Education.* 78, 33-41.

Eastmond, D. V. & Ziegahn, L. (1995). Instructional design for the online classroom. In Z. L. Berge & M.P. Collins (Eds.), *Computer-mediated communication and the online classroom. Volume 3: Distance learning* (pp. 59-79). Cresskill, NJ: Hampton Press.

Eisenhart, M. & Howe, K.R. (1992). Validity in educational research. In M. LeCompte, W.L. Millroy, & J. Preissle (Eds.), *The handbook of qualitative research in education* (pp. 643-680). San Diego, CA: Academic Press Inc.

Fidel, R. (1993). Qualitative methods in information retrieval research. *Library & Information Science Research.* 15(3), 219-247.

Flottemesch, K. (May/June 2000). Building effective interaction in distance education: A review of the literature. *Educational Technology.* 40(3), 46-51.

Flowers, D.J. (2000). *Utilization-focused needs assessment: A case study of adult learners' Web-based distance education needs.* Doctoral Dissertation. The University of South Alabama.

Francis, D. & Hester, S. (2004*). An invitation to ethnomethodology: Language,*

society and social interaction. Thousand Oaks, CA: Sage Publications.

Freudenthal, D. (2001). Age differences in the performance of information retrieval tasks. *Behaviour & Information Technology.* 20(1), 9-22.

Galotti, K.M. (1994). Cognition in cross-cultural perspective. In *Cognitive psychology in and out of the laboratory* (pp. 441-476). Pacific Grove, CA: Brooks/Cole Publications.

Garrison, D.R. & Archer, W. (2000). *A transactional perspective on teaching and learning: A framework for adult and higher education*. New York: Pergamon.

Greeno, J.G., Collins, A.M., & Resnick, L.B. (1996). Cognition and learning. In D. Berliner & R. Calfee (Eds.), *Handbook of educational psychology* (pp. 15-47). New York: Simon & Schuster Macmillan.

Guba, E.G. (1981). Criteria for assessing the trustworthiness of naturalistic inquiries. *Educational Communication and Technology Journal.* 29(2), 75-91.

Guba, E.G. & Lincoln, Y. S. (1998). Competing paradigms in qualitative research. In Denzin & Y.S. Lincoln (Eds.), *The landscape of qualitative research: Theories and issues* (pp. 195-220). Thousand Oaks, CA: Sage Publications.

Gunawardena, C.N., Lowe, C.A. & Anderson, T. (1997). Analysis of global online debate and the development of an interaction analysis model for evaluating social construction of knowledge in computer conferencing. *Journal of Educational Computing Research.* 17(4), 397-431.

Gunawardena, C.N., Wilson, P.L. & Nolla, A.C. (2003). Culture and online education. In M.G. Moore & W.G. Anderson (Eds.), *Handbook of distance education* (pp. 753-775). Mahwah, NJ: Lawrence Erlbaum.

Gunawardena, C.N. & McIsaac, M.S. (2004). Distance education. In D. Jonassen (Ed.), *Handbook of research on educational communications and technology* (pp. 355-395). 2nd edition. Mahwah, NJ: Lawrence Erlbaum Associates.

Hall, R.H., Watkins, S.E. & Eller, V.M. (2003). A model for Web-based design for learning. In M.G. Moore & W.G. Anderson (Eds.), *Handbook of distance education* (pp. 367-375). Mahwah, NJ: Lawrence Erlbaum.

Hannafin, M., Oliver, K., Hill, J.R. & Glazer, E. (2003). Cognitive and learning factors in web-based distance learning environments. In M.G. Moore & W.G. Anderson (Eds.), *Handbook of Distance Education* (pp. 245-260). Mahwah, NJ: Lawrence Erlbaum.

Hara, N. (2002). Analysis of computer-mediated communication: Using formal concept analysis as a visualizing methodology. *Journal of Educational Computing Research.* 26(1), 25-49.

Hara, N., Bonk, C.J. & Angeli, C. (2000). Content analysis of online discussion in an applied educational psychology course. *Instructional Science.* 28, 115-152.

Hartson, H.R. (2003). Cognitive, physical, sensory, and functional affordances in interaction design. *Behaviour & Information Technology.* 22(5), 315-338.

Hathorn, L.G. & Ingram, A. (2002). Cooperation and collaboration using computer-mediated communication. *Journal of Educational Computing Research.* 26(3), 325-347.

Hedberg, J.G. (2001). The online and digital experience: Reassuring higher-order

learning outcomes. In L.R. Vandervert, L.V. Shavinina & R.A. Cornell (Eds), *Cybereducation: The future of long-distance learning* (pp. 219-236). Larchmont, NY: Mary Ann Liebert Inc.

Heinich, R., Molenda, M. & Russell, J.D. (1996). *Instructional media and technologies for learning*. 5th edition. Upper Saddle River, NJ: Merrill Prentice Hall.

Heinich, R., Molenda, M. & Russell, J.D. (1999). *Instructional media and technologies for learning*. 6th edition. Upper Saddle River, NJ: Merrill Prentice Hall.

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

Herring, S. C. (2001). Computer-mediated discourse. In D. Schiffrin, D. Tannen & H.E. Hamilton (Eds.), *The handbook of discourse analysis* (pp. 612-634). Malde, MA: Blackwell Publishers.

Herring, S. C. (2002). Computer-mediated communication on the Internet. *Annual Review of Information Science and Technology.* 36, 109-168.

Herring, S. C. (2004a). Content analysis for new media: Rethinking the paradigm. In *New Research for New Media: Innovative Research Methodologies Symposium Working Papers and Readings* (pp. 47-66). Minneapolis, MN: School of Journalism and Mass Communication, University of Minnesota. Retrieved on October 31, 2004, from http://ella.slis.indiana.edu/~herring/newmedia.pdf

Herring, S.C. (2004b). Computer-mediated discourse analysis: An approach to researching online behavior. In S.A. Barab, R. Kling & J. H. Gray (Eds.), *Designing for virtual communities in the service of learning* (pp. 338-376). Cambridge: Cambridge University Press.

Hill, J.R., Wiley, D., Nelson, L.M. & Han, S. (2004). Exploring research on Internet-based learning: From infrastructure to interactions. In D. Jonassen (Ed.), *Handbook of research on educational communications and technology* (pp. 433-460). 2nd edition. Mahwah, NJ: Lawrence Erlbaum Associates.

Hillman, D.C. (1999). A new method for analyzing patterns of interaction. *The American Journal of Distance Education.* 13(2), 37-46.

Hillman, D.C.A., Willis, D.J. & Gunawardena, C.N. (1994). Learner-interface interaction in distance education: An extension of contemporary models and strategies for practitioners. *The American Journal of Distance Education.* 8(2), 30-42 .

Hine, C. (2000*). Virtual ethnography.* Thousand Oaks, CA: Sage Publications.

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

Holt, M. E., Kleiber, P. B., Swenson, J. D., Rees, E. F. & Milton, J. (1998). Facilitating group learning on the Internet. *New Directions for Adult and Continuing Education.* 78, 43-51.

Honebein, P.C. (1996). Seven goals for the design of constructivist learning

environments. In B.G. Wilson (Ed.), *Constructivist learning environments: Case studies in instructional design* (pp. 11—24). Englewood Cliffs, NJ: Educational Technology Publications.

Howell-Richardson, C. & Mellar, H. (1996). A methodology for the analysis of patterns of participation within computer mediated communication courses. *Instructional Science.* 24, 47-69.

Huang, H. (2002). Toward constructivism for adult learners in online learning environments. *British Journal of Educational Technology.* 33(1), 27-37.

Huerta, E., Ryan, T. & Igbaria, M. (2003). A comprehensive Web-based learning framework: Toward theoretical diversity. In A. K. Aggarwal (Ed.), *Web-based education: Learning from experience* (pp. 24-35). Hershey, PA: Information Science Publishing.

Ingram, A.L. & Hathron, L.G. (2004). Methods for analyzing collaboration in online communications. In T.S. Roberts (Ed.), *Online collaborative learning: Theory and practice* (pp. 215-241). Hershey, PA: Information Science Publishing.

Jeong, A.C. (2003). The sequential analysis of group interaction and critical thinking in online threaded discussions. *The American Journal of Distance Education.* 17(1), 25-43.

Johnson, D.W. & Johnson, R.T. (2004*). Assessing students in groups: Promoting group responsibility and individual accountability.* Thousand Oaks, CA: Corwin Press.

Jonassen, D. (1995). Constructivism and computer-mediated communication in distance education. *The American Journal of Distance Education.* 9(2), 7-26.

Jonassen, D. (1997). Instructional design models for well structured and ill-structured problem-solving learning outcomes. *Educational Technology Research and Development*. 45(1), 65-94.

Jonassen, D. (1999). Designing constructivist learning environments. In C.M. Reigeluth (Ed.), *Instructional-design theories and models: A new paradigm of instructional theory. Volume II* (pp. 215-239). Mahwah, NJ: Lawrence Erlbaum.

Jonassen, D. (2000). *Knowledge is complex: Accommodating human ways of knowing.* Proceedings of the 11th ASIST SIG/CR Classification Research Workshop, Chicago, IL, November 12, 2000 (pp. 1-7).

Jonassen, D.H., & Carr, C. (2000). Mindtools: Affording multiple knowledge representations in learning. In S.P. Lajoie (Ed.), *Computers as cognitive tools, Vol. 2: No more walls* (pp. 165-196). Mahwah, NJ: Lawrence Erlbaum Associates.

Jonassen, D.H., Howland, J.L., Moore, J.L. & Marra, R. M. (2003). *Learning to solve problems with technology: A constructivist perspective.* 2nd edition. Upper Saddle River, NJ: Merrill Prentice Hall.

Jonassen, D.H. & Reeves, T.C. (1996). Learning with technology: Using computers as cognitive tools. In D.H. Jonassen (Ed.), *Handbook of research for educational communications and technology* (pp. 693-719). New York: Simon & Schuster Macmillan.

Jones, M.G. & Farquhar, J.D. (1997). User interface design for Web-based

instruction. In B.H. Khan (Ed.), *Web-based instruction* (pp. 239-244). Englewood Cliffs, NJ: Educational Technology Publications.

Jung, I. (2001). Building a theoretical framework of Web-based instruction in the context of distance education. *British Journal of Educational Technology.* 32(5), 525-534.

Justice, E.M. & Dornan, T.M. (2001). Metacognitive differences between traditional-age and non-traditional age college students. *Adult Education Quarterly*. 51(3), 236-249.

Kang, I. (1998). The use of computer-mediated communication: Electronic collaboration and interactivity. In C.J. Bonk & K.S. King (Eds.), *Electronic collaborators: Learner-centered technologies for literacy, apprenticeship, and discourse* (pp. 315-337). Mahwah, NJ: Lawrence Erlbaum.

Kasworm, C. (2003). Adult meaning making in the undergraduate classroom. *Adult Education Quarterly*. 53(2), 81-98.

Kelly, G.J. & Crawford, T. (1997). An ethnographic investigation of the discourse processes of school science. *Science Education.* 81(5), 533-559.

Kim, K. & Bonk, C.J. (2002). Cross-cultural comparison of online collaboration. *Journal of Computer-Mediated Communication*. 8(1). Retrieved on May 3, 2005 from http://www.ascusc.org/jcmc/vol8/issue1/kimandbonk.html

Kirschner, P., Strijbos, J., Krejins, K. & Beers, P.J. (2004). Designing electronic collaborative learning environments. *Educational Technology Research and Development.* 52(3), 47-66.

Kliebard, H.M. (1963). *Teaching cycles: A study of the pattern and flow of classroom*

discourse. Doctoral Dissertation. Teachers College at Columbia University.

Knowles, M.S. (1970). Andragogy: An emerging technology for adult learning. In *The modern practice of adult education: Andragogy versus pedagogy* (pp. 37-55). New York: Association Press.

Kozma, R. B. (1987). The implications of cognitive psychology for computer-based learning tools. *Educational Technology.* 27(11), 20-25.

Kozma, R.B. (1991). Learning with media. *Review of Educational Research.* 61(2), 179-211.

Krauss, R.M. & Fussell, S. R. (1991). Constructing shared communicative environments. In L.B. Resnick, J.M. Levine & S.D. Teasely (Eds.), *Perspectives on socially shared cognition* (pp. 172-200). Washington, D.C: American Psychological Association.

Kumpulainen, K. & Mutanen, M. (2000). Mapping the dynamics of peer group interaction: A method of analysis of socially shared learning processes. In H. Cowie & G. van der Aalsvoort (Eds.), *Social interaction in learning and instruction: The meaning of discourse and the construction of knowledge* (pp. 144-160). New York: Pergamon.

Kumpulainen, K. & Wray, D. (2002). The nature of students' social interaction and information processing in a multimedia-based learning situation. In *Classroom interaction and social learning: From theory to practice* (pp. 104-131). New York: Routledge Falmer.

Lagier, J. (2003). Distance learning and the minority student: Special needs and opportunities. *The Internet and Higher Education*. 6(2). 179-184.

Lajoie, S.P. (1993). Cognitive environments as cognitive tools for enhancing learning. In S.P. Lajoie & S.J. Derry (Eds), *Computers as cognitive tools* (pp. 261-288). Hillsdale, NJ: Lawrence Erlbaum.

Land, S.M. & Greene, B.A. (2000). Project-based learning with the World Wide Web: A qualitative study of resource integration. *Educational Technology Research and Development.* 48(1), 45-68.

Levin, J.A., Kim, H. & Riel, M.M. (1990). Analyzing instructional interactions on electronic message networks. In L.M. Harasim (Ed.), *Online education: Perspectives on a new environment* (pp. 185-213). New York: Praeger.

Lindlof, T.R. (1995). *Qualitative communication research methods.* Thousand Oaks, CA: Sage Publications.

Long, H. B. (1990). Understanding adult learners. In M.W. Galbraith (Ed.), *Adult learning methods: A guide for effective instruction* (pp. 23-38). Malabar, FA: Krieger.

Malmkjaer, K. (2002). Discourse analysis and conversation analysis. In K. Malmkjaer (Ed.), *The linguistics encyclopedia* (pp. 114-119). 2nd edition. London: Routledge.

Marra, R.M., Moore, J.L. & Kilmczak, A. K. (2004). Content analysis of online discussion forums: A comparative analysis of protocols. *Educational Technology Research and Development.* 52(2), 23-40.

Marshall, C. & Rossman, G.B. (1995). Defending the value and logic of qualitative research. In *Designing qualitative research* (pp. 142-152). 2nd edition. Thousand Oaks, CA: Sage Publications.

Martin, B.L. & Reigeluth, C. M. (1999). Affective education and the affective domain: Implications for instructional-design theories and models. In C.M. Reigeluth (Ed.), *Instructional-design theories and models: A new paradigm of instructional theory. Volume II* (pp. 485-509). Mahwah, NJ: Lawrence Erlbaum.

Martinez, A., Dimitris, Y., Rubia, B., Gomez, E. & De la Fuente, P. (2003). Combining qualitative evaluation and social network analysis for the study of classroom social interactions. *Computers & Education.* 41. 353-368.

Mason, R. (1992). Evaluation methodologies for computer conferencing applications. In A.R. Kaye (Ed.), *Collaborative learning through computer conferencing: The Najaden Papers* (pp. 105-116). New York: Springer-Verlag.

Mason, R. (2003). From distance education to online education. *The Internet and Higher Education*. 3(1-2), 63-74.

Mayer, R.E. (1999). Designing instruction for constructivist learning. In C.M. Reigeluth (Ed.), *Instructional-design theories and models: A new paradigm of instructional theory. Volume II* (pp. 141-159). Mahwah, NJ: Lawrence Erlbaum.

Maxwell, J.A. (1996). *Qualitative research design: An interactive approach.* Thousand Oaks, CA: Sage Publications.

Mazur, J. M. (2004). Conversation analysis for educational technologists: Theoretical and methodological issues for researching the structures, processes, and meaning of on-line talk. In D. Jonassen (Ed.), *Handbook of research on*

educational communications and technology (pp. 1071-1098). 2nd edition. Mahwah, NJ: Lawrence Erlbaum.

McConnell, D. (2000). *Implementing computer-supported cooperative learning*. 2nd edition. London: Kogan Page.

McInnerney, J. & Roberts, T.S. (2004). Collaborative or cooperative learning? In T.S. Roberts (Ed.), *Online collaborative learning: Theory and practice* (pp. 203-214). Hershey, PA: Information Science Publishing.

McWhaw, K., Schnackenberg, H., Sclater, J. & Abrami, P.C. (2003). From co-operation to collaboration: Helping students become collaborative learners. In R. M. Gillies & A. F. Ashman (Eds), *Co-operative learning: The social and intellectual outcomes of learning in groups* (pp.69-86). London: RoutledgeFalmer.

Mehan, H. (1985). The structure of classroom discourse. In T. A. van Dijk (Ed.), *Handbook of discourse analysis. Volume 3: Discourse and dialogue* (pp. 119-131). London: Academic Press.

Merriam, S.B. (1998). *Qualitative research and case study applications in education*. San Francisco, CA: Jossey-Bass Publishers.

Meyer, D.K. & Turner, J.C. (2002). Using instructional discourse analysis to study scaffolding of student self-regulation. *Educational Psychologist.* 37(1), 17-25.

Miles, M.B. & Huberman, A.M. (1994). Within-case displays: Exploring and describing. In *Qualitative data analysis* (pp. 90-142). Thousand Oaks, CA: Sage.

Moore, M.G. (1989). Three types of interaction. *The American Journal of Distance*

Education. 3(2), 1-6.

Morrison, D. & Collins, A. (1996). Epistemic fluency in constructivist learning environments. In B.G. Wilson (Ed.), *Constructivist learning environments: Case studies in instructional design* (pp. 107-118). Englewood Cliffs, NJ: Educational Technology Publications.

Morrison, G.R. & Guenther, P.F. (2000). Designing instruction for learning in electronic classrooms. *New Directions for Teaching and Learning.* 84, 15-22.

Morrison, G.R., Ross, S.M. & Kemp, J.E. (2001). *Designing effective instruction.* New York, NY: John Wiley & Sons, Inc.

Mottet, T. P. & Stewart, S.L. (2002). Teacher communication in the distance education context. In J.L. Chesebro & J.C. McCroskey (Eds.), *Communication for teachers* (pp. 157-171). Boston, MA: Allyn and Bacon.

Motiwalla, L. & Tello, S. (2000). Distance learning on the Internet: An exploratory study. *Internet and Higher Education.* 2(4), 253-264.

Mowrer, D.E. (1996). A content analysis of student/instructor communication via computer conferencing. *Higher Education.* 32, 217-241.

Naidu, S. (2003). Designing instruction for e-learning environments. In M.G. Moore & W.G. Anderson (Eds.), *Handbook of distance education* (pp. 349-365). Mahwah, NJ: Lawrence Erlbaum.

National Research Council (2001). J. Pellegrino, R. Glaser, & N. Chudowsky (Eds.), *Knowing what students know: The science and design of educational assessment.* Washington, DC: National Academy Press.

Naylor, P. & Cowie, H. (2000). Learning the communication skills and social

processes of peer support: A case study of good practice. In H. Cowie & G. van der Aalsvoort (Eds.), *Social interaction in learning and instruction: The meaning of discourse and the construction of knowledge* (pp. 93-103). New York: Pergamon.

Nealand, S.C. (1992). *The interface of technology and andragogy: A case study.* Doctoral Dissertation. Peabody College for Teachers of Vanderbilt University.

Norman, M. & Thomas, P. (1990). The very idea: Informing HCI design from conversation analysis. In P. Luff, N. Gilbert & D. Frohlich (Eds.), *Computers and conversation* (pp. 51-65). London: Academic Press.

Nussbaum, J.F., Baringer, D.K. & Kundrat, A.L. (2002). Communicating with students of various ages. In J.L. Chesebro & J.C. McCroskey (Eds.), *Communication for teachers* (pp. 188-201). Boston, MA: Allyn and Bacon.

Palloff, R.M. & Pratt, K. (1999). *Building learning communities in cyberspace: Effective strategies for the online classroom.* San Francisco, CA: Jossey-Bass.

Palloff, R.M. & Pratt, K. (2005). Assessment and evaluation of collaborative work. In *Collaborating online: Learning together in community* (pp. 41-54). San Francisco, CA: Jossey-Bass.

Panitz, T. (1996). *Collaborative versus cooperative learning: A comparison of the two concepts which will help us understand the underlying nature of interactive learning*. Retrieved on October 30, 2005 from http://home.capecod.net/~tpanitz/tedarticles/coopdefinition.htm

Parker, A. (Autumn /Winter 1999). Interaction in distance education: The critical conversation. *Educational Technology Review*. 12, 13-17.

Perry, N.E, VandeKamp, K.O., Mercer, L.K. & Nordby, C.J. (2002). Investigating teacher-student interactions that foster self-regulated learning. *Educational Psychologist.* 37(1), 5-15.

Peters, O. (2003). Learning with new media in distance education. In M.G. Moore & W.G. Anderson (Eds.), *Handbook of distance education* (pp. 87-112). Mahwah, NJ: Lawrence Erlbaum.

Pfaffenberger, B. (2003). *Webster's new world computer dictionary*. 10th edition. Indianapolis, IN: Wiley Publishing.

Picciano, A.G. (2001). Instructional design for distance learning. In *Distance learning: Making connections across virtual space and time* (pp. 65-87). Upper Saddle River, NJ: Merrill Prentice Hall.

Pontecorvo, C. (1997). Classroom discourse for the making of learning. In B. Davies & D. Corson (Eds.), *Encyclopedia of language and education. Volume 3: Oral discourse and education* (pp. 169-178). The Netherlands: Kluwer Academic Publishers.

Powell, R.R. (1999). Recent trends in research: A methodological essay. *Library & Information Science Research.* 21(1), 91-119.

Preece, J. & Maloney-Krichmar, D. (2003) Online communities: Focusing on sociability and usability. In J. Jacko & A. Sears (Eds.), *Handbook of human-computer interaction* (pp. 596-620). Mahwah, NJ: Lawrence Erlbaum.

Preece, J., Rogers, Y. & Sharp, H. (2002). Designing for collaboration and communication. In *Interaction design: Beyond human-computer interaction* (pp. 105-137). NY: John Wiley.

Psathas, G. (1994). Conversation analysis: The study of talk-in-interaction. Thousand Oaks, CA: Sage Publications.

QSR Web site, Retrieved May 3, 2005, from http://www.qsrinternational.com

Rabow, J., Charness, M. A., Kipperman, J., and Radcliffe-Vasile, S. (1994). William Fawcett Hill's learning through discussion. Thousand Oaks, CA: Sage Publications.

Rada, R. & Hu, K. (2002). Patterns in student-student commenting. *IEEE Transactions on Education.* 45(3), 262-267.

Reeves, T.C., Herrington, J. & Oliver, R.. (2004). A developmental research agenda for online collaborative learning. *Educational Technology Research and Development*. 52(4), 53-65.

Reigeluth, C.M. & Frick, T. W. (1999). Formative research: A methodology for creating and improving design theories. In C.M. Reigeluth (Ed.), *Instructional-design theories and models: A new paradigm of instructional theory. Volume II* (pp. 633-651). Mahwah, NJ: Lawrence Erlbaum.

Reigeluth, C.M. & Squire, K. (1998). Emerging work on the new paradigm of instructional theories. *Educational Technology.* 38(4), 41-47.

Reiser, R.A. & Dick, W. (1996). *Instructional planning: A guide for teachers.* Needham Heights, MA: Allyn and Bacon.

Reitz, J. M. (2004). *Dictionary for library and information science.* Westport, CT: Libraries Unlimited.

Riel, M. (1990). Cooperative learning across classrooms in electronic learning circles. *Instructional Science.* 19, 445-466.

Rogers, E.M. (1980). The convergence model of communication and network analysis. In E. M. Rogers & D.L. Kincaid (Eds.), *Communication networks: Toward a new paradigm* (pp. 31-78). New York, NY: The Free Press.

Romiszowski, A. (1999). The development of physical skills: Instruction in the psychomotor domain. In C.M. Reigeluth (Ed.), *Instructional-design theories and models: A new paradigm of instructional theory. Volume II* (pp. 457-481). Mahwah, NJ: Lawrence Erlbaum.

Romiszowski, A. & Mason, R. (2004). Computer-mediated communication. In D. Jonassen (Ed.), *Handbook of research on educational communications and technology* (pp. 397-431). 2nd edition. Mahwah, NJ: Lawrence Erlbaum Associates.

Ronteltap, F. & Eurelings, A. (2002). Activity and interaction of students in an electronic learning environment for problem-based learning. *Distance Education.* 23(1), 11-22.

Rovai, A. P. (2004), A constructivist approach to online college learning. *The Internet and Higher Education.* 7. 79-93.

Rudestam, K.E. & Schoenholtz-Read, J. (2002). The coming of age of adult online education: Overview. In K.E. Rudestam & J. Schoenholtz-Read (Eds), *Handbook of online learning: Innovations in higher education and corporate training* (pp. 3-28). Thousand Oaks, CA: Sage Publications.

Salmon, G. (2003). E-moderating qualities and roles. In *E-moderating: The key to teaching and learning online.* (pp. 38-54). Sterling, VA: Stylus Publishing.

Salomon, G. (1981). *Interaction of media, cognition and learning.* San Francisco:

Jossey-Bass Publishers.

Sammons, M. (2003). Exploring the new conception of teaching and learning in distance education. In M.G. Moore & W.G. Anderson (Eds.), *Handbook of distance education* (pp. 387-397). Mahwah, NJ: Lawrence Erlbaum.

Savenye, W.C. & Robinson, R.S. (2004). Qualitative research issues and methods: An introduction for educational technologists. In D. Jonassen (Ed.), *Handbook of research on educational communications and technology* (pp. 1045-1071). Mahwah, NJ: Lawrence Erlbaum Associates.

Saville-Troike, M. (1989). The analysis of communicative events. In *The ethnography of communication: An introduction* (pp. 88-143). Oxford: Blackwell.

Schramm, W. (1971). The nature of communication between humans. In W. Schramm & D.F. Roberts (Eds.), *The process and effects of mass communication* (pp. 3-53). Urbana, IL: University of Illinois Press.

Schrire, S. (2004). Interaction and cognition in asynchronous computer conferencing. *Instructional Science.* 32, 475-502.

Severin, W.J. & Tankard, J.W. (2001). Theories of cyber communication. In *Communication theories: Origins, methods, and uses in the mass media* (pp. 366-388). New York: Longman.

Shannon, C.E & Weaver, W. (1964). Introductory note on the general setting of the analytical communication studies. In *The mathematical theory of communication* (pp. 3-28). Urbana, IL: University of Illinois Press.

Shearer, R. (2003). Instructional design in distance education: An overview. In M.G.

Moore & W.G. Anderson (Eds.), *Handbook of distance education* (pp. 275-286). Mahwah, NJ: Lawrence Erlbaum.

Shulman, L.S. (1988). Disciplines of inquiry in education: An overview. In R. M. Jaeger (Ed.), *Complementary methods for research in education* (pp. 3-17). American Educational Research Association.

Shute, V. & Psotka, J. (1996). Intelligent tutoring systems: Past, present, and future. In D. Jonassen (Ed.), *Handbook of research for educational communications and technology* (pp. 570-600). NY: Macmillan.

Smith, P.L. & Ragan, T.J. (1999). Strategies for problem-solving instruction. In *Instructional design* (pp. 131-156). Upper Saddle River, NJ: Prentice Hall.

Sorg, J. J. (2000). *A case study describing student experiences of learning in an interactive computer-mediated communication context in a distance education environment*. Doctoral Dissertation. Ball State University.

Sprague, J. (1992). Expanding the research agenda for instructional communication: Raising some unasked questions. *Communication Education.* 41, 1-25.

Stahl, G. (2005). Groups, group cognition and groupware. In H. Fuks, S. Lukosch & A.C. Salgado (Eds.), *Groupware: Design, implementation and use.* Proceedings of the 11th International Workshop CRIWG 2005, Porto de Galinhas, Brazil, September 25-29 (pp. 1-16). New York: Springer.

Stake, R. E. (1995). *The art of case study research*. Thousand Oaks, CA: Sage Publications.

Staton, A.Q. (1989). The interface of communication and instruction: Conceptual

considerations and programmatic manifestations. *Communication Education.* 38, 364-371.

Stewart, R.A. & Roach, D. (1993). A model of instructional communication as a framework for analyzing and interpreting student ratings of instruction. *Communication Quarterly.* 41(4), 427-442.

Stone-McCown, K. & McCormick, A. H. (1999). Self-science: emotional intelligence for children. In C.M. Reigeluth (Ed.), *Instructional-design theories and models: A new paradigm of instructional theory. Volume II* (pp. 537-561). Mahwah, NJ: Lawrence Erlbaum.

Strauss, A.L. & Corbin, J. (1998). *Basics of qualitative research: Techniques and procedures for developing grounded theory.* Thousand Oaks, CA: Sage Publications.

Sugrue, B. (2000). Cognitive approaches to Web-based instruction. In S.P. Lajoie (Ed), *Computers as cognitive tools, Volume Two: No more walls* (pp. 133-162). Mahwah, NJ: Lawrence Erlbaum.

Ten Have, P. (1999). *Doing conversation analysis: A practical guide*. Thousand Oaks: CA. Sage Publications.

Teo, T.S.H & Lim, V.K.G. (2000). Gender differences in internet usage and task preferences. *Behaviour & Information Technology.* 19(4), 283-295.

Titscher, S., Meyer, M., Wodak, R. & Vetter, E. (2000). *Methods of text and discourse analysis.* Thousand Oaks, CA: Sage Publications.

Treleaven, L. (2004). A new taxonomy for evaluation studies of online collaborative

learning. In T.S. Roberts (Ed.), *Online collaborative learning: Theory and practice* (pp. 160-179). Hershey, PA: Information Science Publishing.

Uribe, D., Klein, J.D. & Sullivan, H. (2003). The effect of computer-mediated collaborative learning on solving ill-defined problems. *Educational Technology Research and Development*. 51(1), 5-19.

Veerman, A., Andriessen, J. & Kanselaar, G. (2002). Collaborative argumentation in academic education. *Instructional Science.* 30(3), 155-186.

Vickery, B. & Vickery, A. (2004). *Information science in theory and practice*. 3rd revised and enlarged edition. Munich, Germany: K.G. Saur.

Vygotsky, L.S. (1978). *Mind in society: The development of higher psychological processes.* Cambridge, MA: Harvard University.

Wagner, E.D. (1997). Interactivity: From agents to outcomes. In T. E. Cyrs (Ed.), *Teaching and learning at a distance: What it takes to effectively design, deliver and evaluate programs* (pp. 19-26). San Francisco, CA: Jossey-Bass Publishers.

Wang, P. (1999). Methodologies and methods for user behavioral research. *Annual Review of Information Science and Technology*, 34, 53-99.

WebCT Web site. Retrieved on May 3, 2005, from http://www.webct.com

Weber, R. P. (1990). *Basic content analysis*. Second edition. Thousand Oaks, CA: Sage Publications.

Wilson, B.G. (1996). What is a constructivist learning environment? In B.G. Wilson (Ed.), *Constructivist learning environments: Case studies in instructional design* (pp. 3-8). Englewood Cliffs, NJ: Educational Technology Publications.

Wilson, B.G. (2004). Designing e-learning environments for flexible activity and instruction. *Educational Technology Research and Development*. 52(4), 77-85.

Wilson, B. G. & Lowry, M. (2000). Constructivist learning on the Web. *New Directions for Adult and Continuing Education*. 88, 79-88.

Winiecki, D.J. (2003). Instructional discussions in online education: Practical and research-oriented perspectives. In M.G. Moore & W.G. Anderson (Eds.), *Handbook of Distance Education* (pp. 193-213). Mahwah, NJ: Lawrence Erlbaum.

Wu, A. (2003). Supporting electronic discourse: Principles of design from a social constructivist perspective. *Journal of Interactive Learning Research.* 14(2), 167-184.

Yin, R. K. (2003*). Case study research: Design and methods.* Third edition. Thousand Oaks, CA: Sage Publications.

Zemel, A., Xhafa, F. & Stahl, G. (2005). Analyzing the organization of collaborative math problem-solving in online chats using statistics and conversation analysis. In H. Fuks, S. Lukosch & A.C. Salgado (Eds.), *Groupware: Design, implementation and use.* Proceedings of the 11th International Workshop CRIWG 2005, Porto de Galinhas, Brazil, September 25-29 (pp. 271-283). New York: Springer.