

Instructional Methods for CSCL: Review of Case Studies

Hyo-Jeong So

Instructional Systems Technology
Indiana University Bloomington
hyso@indiana.edu

Bosung Kim

School of Information Science
& Learning Technologies
University of Missouri-Columbia
bkq22@mizzou.edu

Abstract. The purpose of the present study is to provide instructional methods for collaborative learning in computer-supported learning environments which would be useful information for CSCL researchers, instructional designers, and online instructors. Although several researchers have provided instructional design theories and guidelines for collaborative learning in traditional classroom environments, there are a few instructional design studies developed specifically for collaboration in online learning environments. This study critically reviewed and analyzed ten case studies to identify instructional goals, methods, effectiveness, and conditions of collaborative online learning. Twenty-three methods identified from the synthesis and comparison of cases were grouped into five categories representing commonalities: a) grouping, b) collaborative tasks, c) team-building, d) computer-mediated communication, and e) instructor. It appeared that while some methods are equally important for both face-to-face and computer-supported learning environments, instructional methods related to group composition, synchronous interaction, and communication modes are particularly critical for collaborative online learning.

Keywords: collaborative learning, instructional method, case survey

INTRODUCTION

During the past decade, there has been a significant movement toward distance education. Recent statistics show that more than 80 percent of public institutions in the United States offer either online or blended courses (Allen & Seaman, 2003). Conventional lecture-based courses are restructured with web-based components to solve problems related to overworked faculty, over-capacity, and lack of interaction (Tiangha, 2003). With more courses being offered via online learning formats, it is becoming important to improve the quality of learning experience in distance learning environments. Educators have tried to incorporate collaborative learning methods in their distance education courses with the belief that increased interaction among students could enhance learning outcomes and student satisfaction. Specifically, the use of two-way computer-mediated communication (CMC) has made collaborative learning possible among students in geographically different areas.

Despite the popular support for collaborative learning strategies, previous research has suggested that students are often dissatisfied and frustrated with their collaborative learning experiences in distance learning environments (Hara & Kling, 1998). It is clear that assigning students to groups does not necessarily mean that they will work collaboratively. Collaborative learning should be structured under the full understanding and consideration of grouping strategies, team-building activities, collaborative tasks, online discussions and evaluation methods.

PURPOSE OF THE STUDY

The purpose of the present study is to provide instructional design methods for the improvement of the quality of learning processes and outcomes in collaborative online learning. Although several researchers have provided instructional design theories and guidelines for collaborative learning in traditional classroom environments, there are a few instructional design studies which discuss theory- and conditional-based methods for collaboration in computer-supported learning environments. This study thoroughly reviewed and analyzed ten case studies to identify instructional goals, methods, effectiveness, and conditions of collaborative online learning. The instructional methods provided in this paper could be a valuable resource for computer-supported

collaboration learning researchers, instructional designers, and online instructors who want to create successful collaborative learning environments, where students gain critical thinking, problem-solving, and interpersonal communication skills through learning processes.

LITERATURE REVIEW

Collaborative Learning

The social-constructivist view of learning argues that people construct their knowledge through negotiating meanings with others. According to Vygotsky (1978), a person's cognitive development is highly dependent on their relationship with others. His idea of the *Zone of Proximal Development* (ZPD) – “the distance between actual or independent problem solving and performance when provided with learning assistance from adults or more capable peers” (Bonk & Cunningham, 1999, p. 36) – proposes that people construct their knowledge through social interaction and collaboration with others. As an example, students with low ability levels may be able to reach their ZPD with a help of advanced and high-achieving peers.

Collaborative learning is one instructional strategy used for the social construction of knowledge and skills. The advantages of collaborative learning are abundant from social to cognitive and affective ones. First, collaborative learning environments provide opportunities for students to experience multiple perspectives from others who have different backgrounds. Students can develop critical thinking skills through the process of judging, valuing, supporting or opposing different viewpoints (Fung, 2004). Second, individual students can develop social and inter-personal skills which are critical to be successful in modern society. Third, collaborative learning approaches can provide students with an affective support and a sense of belonging, which promote student participation and community-building (Stacey, 1999).

Some researchers use collaborative learning and cooperative learning interchangeably, but it is important to understand differences between the two terms. While collaborative learning places an emphasis on mutual engagement to reach a common group goal, cooperative learning uses a task specialization approach where students take divided tasks and then their results are combined into a final product. (Abrami & Bures, 1996; Bernard, et. al., 2000; Kitchen & McDougall, 1998). Unlike collaborative learning, cooperative learning provides fewer opportunities to develop mutual engagement, knowledge and skill exchange, and interpersonal communication skills.

Quality of Collaborative Learning in Distance Courses

While a number of research studies examined students' affective learning experiences such as satisfaction, dissatisfaction, anxiety and frustration with distance education courses (Conrad, 2002; DeBourgh, 1999; Hara & Kling, 2000), there is a dearth of literature which specifically focuses on student satisfaction with collaborative online learning. Possible reasons for this phenomenon may be found from the study by Hara and Kling (2000). First, students may not have opportunities to express their negative feelings about distance learning. Hara and Kling suggested that although students experienced several problems in distance learning processes, they might not be able to express their true feelings due to the relief from the course, concern about their instructor's feeling, and limited time for the course evaluation. Another reason is that researchers may have extremely positive views of collaborative learning and distance education, and assume that students are satisfied with the quality of collaborative online learning. In fact, collaborative learning has been regarded as an effective instructional method in traditional classroom learning. Nevertheless, it is questionable whether the collaborative learning approach can yield equally effective learning outcomes in distance learning situations.

Although some researchers have examined student perceptions of and experiences with collaborative online learning, they yielded inconsistent results in terms of the level of students' satisfaction. A research study by Kitchen and McDougall (1999) examined how graduate students perceived the educational value of collaborative learning delivered on the Internet. The results indicate that although students expressed some negative responses, the majority of students rated their collaborative experiences as good or excellent. Similarly, Jung, Choi, Lim and Leem (2002) reported that students who participated in collaborative online tasks expressed higher levels of satisfaction with their learning process compared to those who engaged in task-oriented interaction with their instructor.

In addition to the level of satisfaction, researchers have investigated important factors affecting the perceptions of student satisfaction with collaborative online learning. No significant correlations were found between students' satisfaction and their background characteristics such as age, gender, grade level, and computer literacy (Kitchen & McDougall, 1998; Yaverbaum & Ocker, 1998). Prior studies suggest that students are likely to be dissatisfied and frustrated with the following factors: (a) unclear expectations from instructors, (b) tight timeline, (c) workload, (d) poor software interface, (e) slow access, and (f) no synchronous communication (Gaddis, Napierkowski, Guzman, & Muth, 2000; Kitchen & McDougall, 1998).

RESEARCH METHODOLOGY

Case Survey

Instructional guidelines are often developed from a synthesis of relevant research literature on certain topics, and also from instructional designers' practical experiences. In this study, a case survey method was employed to aggregate, compare and synthesize instructional strategies regarding student collaboration in online learning environments. The case survey is a useful research method to aggregate findings across a large number of case studies (Lucas, 1974). The method is parallel to a questionnaire survey in which several cases are analyzed and categorized according to common factors (Cunningham, 1997). Beatty (2002) used the case study method to develop a situational framework for selecting instructional methods that engage learners in social interaction. In the present study, case studies which examined collaborative learning in computer-mediated learning environments were analyzed and compared in terms of instructional goals, methods, conditions, and effectiveness.

Case Collection

Ten case studies were selected from several academic search engines (See Appendix A for the list of references). Three criteria were used to locate relevant articles. First, key words 'collaborative online learning', 'collaborative learning', 'cooperative learning', 'online collaboration' and 'group interaction' were used to identify articles. Case studies that describe solely student-student social interaction without engagement in collaborative learning tasks were excluded in the process of case selections since the focus of the present study is placed on instructional interaction among students. Second, articles published in peer-reviewed journals were selected to ensure the validity and reliability of research methods. Third, only case studies with publication dates of 1998 or later were selected as shown in Table 1. Since distance education has undergone changes with advances in modern communication technologies, recent articles are likely to use sophisticated and accessible technologies to reduce technical problems.

Table 1 Publication Dates

Year	1998	1999	2000	2001	2004
Number of case study	1	2	4	1	2

Case Analysis

Information gathered from each case study was critically reviewed and recorded for comparison and synthesis across cases independently by the two authors (See Appendix B). Any disagreements on case analysis were resolved through discussions until an acceptable rate of agreement was reached. Specifically, each case study was analyzed by answering the following questions used to develop instructional design theories (Reigeluth, 1999):

1. Instructional Situations
 - Learning: What is the type of learning content?
 - Learner: What are the student characteristics?
 - Learning environment: What are the collaborative learning environments (e.g. group composition, group size, collaborative tasks, etc.)?
 - Development constraints: What are the constraints (e.g. CMC tools, time, expenses, etc.) for the development of collaborative learning methods?
2. Instructional Methods
 - Effectiveness: What instructional methods are effective or not effective?
 - Conditions: What are the instructional conditions necessary for the effectiveness of a certain instructional method?

Although this study did not aim to develop a comprehensive instructional design theory, using the framework suggested by Reigeluth (1999) provided an initial point to identify effective instructional strategies and particular situationalities.

RESULTS

All the ten cases were cross-analyzed to identify common patterns of learning goals, situations, and instructional methods for collaborative learning in computer-supported learning environments. Classification schemes were created to categorize multiple cases based on the presence of commonalities. What follows is a synthesized description of a) the learning goals, b) instructional conditions, and c) instructional methods for collaborative online learning.

Learning Goals

The goals reported in the case studies were classified into the following five major categories:

- Creating learner-centered and collaborative learning environments
- Encouraging students to learn critical-thinking, problem-solving, and interpersonal communication skills
- Acknowledging the importance of respecting, accepting, and negotiating multiple perspectives in learning processes
- Cultivating a learning community where students share and learn new knowledge and skills from each other
- Developing authentic, active, and relevant learning experiences for student motivation and engagement

Table 2 presents the goal categories and the numbers of cases in each category.

Table 2 Goals and Cases

Learning goal	Cases
Learner-centered learning environment	C2 C3 C4 C7 C8
Critical thinking	C1 C6 C7 C10
Multiple perspectives	C5 C6 C7 C10
Learning community	C2 C8
Authentic learning experience	C1 C7

Instructional Conditions

Learning

The collaborative learning approach is the best appropriate for complex problems and authentic tasks providing students with meaningful and relevant experience that they would encounter in their work environments (McAlpine, 2000). The complexity of collaborative tasks can encourage students to exchange their ideas, to negotiate different understandings, and to develop agreed solutions. Through this process, student can learn how to apply basic knowledge and skills to real situations. Thus collaborative learning is not appropriate for tasks that require a single answer and can be effectively taught by direct instruction (Nelson, 1999).

Learner

Collaborative learning may not be appropriate for all students. When students do not have previous experience with complex problem-solving and authentic tasks, they are not likely to actively participate in a group learning process, and their learning can be very superficial. In addition, since students in online courses are typically more diverse than traditional courses in terms of age, language and culture, students should have abilities to accept and negotiate multiple viewpoints of group members. Participants in all the ten cases in this study were adult learners studying in higher education institutions. Adult learners are reluctant to be dominated by a group leader or a instructor, and want some self-control and self-direction in their learning process (Kitchen & McDougall, 1998). For instance, students in Case 6 expressed negative reactions to their instructor's intervention and felt that they were constantly watched for evaluations.

Learning Environment

The inquiry-based learning environment, where students explore and exchange several ideas to find a solution, is the most conducive to collaborative learning (Duffy, Dueber & Hawley, 1999). Clearly, in this environment, students take responsibility for their learning and instructors provide necessary guidance. The nature of online courses should be considered to design a truly collaborative learning environment. It is important to consider students' diverse characteristics and backgrounds for the size and composition of groups.

Development Constraint

In most cases, the use of collaborative online learning necessitates student access to computer, the Internet, and CMC technologies. It appears that the technologies should support students to effectively plan, coordinate, and implement collaborative learning. Several commercial technologies are available for collaborative learning, but they allow little flexibility for customization. And the design and development of sophisticated collaborative technologies require considerable investment on time and money.

Instructional Methods

This section presents instructional guidelines and strategies to facilitate collaborative learning in computer-mediated learning environments. A total of 28 methods were initially identified in the ten case studies, and then were grouped into the five general themes that emerged from the comparison of the cases: (a) grouping, (b) collaborative task, (c) team-building, (d) computer-mediated communication, and (e) instructor's role. As shown in Table 3, the final guidelines include 11 instructional methods necessary for collaborative online learning.

Table 3 Instructional Guidelines for Collaborative Online Learning

I. Grouping Form small groups. Form homogenous and/or self-selected groups.
II. Collaborative Task Embed authenticity, relevance and meaningfulness. Require individual accountability.
III. Team-Building Promote opportunities for face-to-face interaction. Engage in online 'get to know you' activities.
IV. Computer-Mediated Communication Provide multiple channels of CMC for effective group communication. Create shared group spaces. Motivate students to participate in online discussions. Minimize technical problems.
V. Instructor Act as a facilitator, guider and coordinator.

Grouping

Form small groups. The first important step in collaborative online learning is to decide the size of groups, which plays a significant role in group dynamics. The size of the group should be small enough to prevent students from free riding, and at the same time, each group should have a sufficient number of members for active discussions and participation (Graham, Scarborough & Goodwin, 1999). Small group sizes are effective in that students can feel comfortable expressing their ideas and receiving social support (Stacey, 1999). Particularly, when students are novices in content areas taught, small groups may provide students with high comfort levels in the process of constructing new knowledge.

Form homogenous and/or self-selected groups. Several cases examined in this study show that collaborative learning is effective when students are grouped under the consideration of gender, age, language, educational and cultural backgrounds, and technical experiences. Specifically, when online courses are offered to students from different geographical areas and cultural backgrounds, it may be effective to form homogeneous groups rather than heterogeneous ones (Ragoondaden & Bordeleau, 2000). While students can have valuable opportunities to learn multiple perspectives from others with different backgrounds, homogeneous grouping can alleviate frustrations and problems due to delayed feedback, different languages, and ineffective communication. In Case 1, students around the world, Canada, France, Belgium, Switzerland, Mauritius and Reunion, worked collaboratively on assignments, but the diversity of written languages hampered collaboration among students.

Instructors can administer a simple survey to gather information regarding student preferences, interests, living areas, primary languages, and so forth, before online classes begin. If possible, students should have options to select their own groups and topics. Two studies (Case 2 and Case 4) suggest that students in self-selected groups were effective in their collaborative work because members shared similar interests and purposes, and actively participated to achieve common goals.

Collaborative Task

Embed authenticity, relevance and meaningfulness. As mentioned earlier, collaborative learning is the most appropriate with authentic problems (Carr-Chellmana, Dyer & Breman, 2000; McAlpine, 2000). Cases 1 and 7 present useful examples regarding how authentic tasks were used for collaborative learning. In Case 1, students worked with subject matter experts to solve complex instructional design problems identified in real learning

situations. Students in Case 7 worked collaboratively on real-world scenarios in business settings. McAlpine (2000) suggests that an important advantage of real-world projects is that students have opportunities to learn how to share and accommodate multiple viewpoints. Furthermore, the authenticity of collaborative tasks may become more important for students studying in academic areas where the primary goal is to acquire and apply skills and knowledge required in real work environments.

In addition to authenticity, the collaborative tasks should provide students with relevant and meaningful learning experiences (Fung, 2004; Stacey, 1999). Students in Case 3 did not actively participate in collaborative online discussions although instructors and moderators encourage their participation. Fung (2004) suggests that a main reason for the lack of student interest in online group work was broad and unstructured questions. Student participations in collaborative learning may become more active when they can see the connection between group tasks and personal interests (e.g. career goals and academic interests).

Carr-Chellmana, Dyer and Breman (2000) argue that authentic tasks require complex problem-solving skills, which cannot be learned in a short duration of time. Thus students without prior experiences in authentic and collaborative tasks may experience difficulties in the group problem-solving processes. To provide students with opportunities to develop problem solving skills, it is effective to start with a simple problem and then to gradually build complexity into subsequent collaborative tasks (Fung, 2004; Nelson, 1999).

Require individual accountability. Individual accountability should be ensured and assessed for active participation and group cohesion (Murphy, Mahoney & Havell, 2000; Stacey, 1999). Case 8 presents an example of group contracts or group management plans which were used to specify the communication methods, primary roles, emergency plans, project timelines, and so forth. In this example, the instructor provided a template of group contracts to reduce the amount of time that groups have to spend planning, and the group contracts were modifiable with the approval of members.

In addition to the use of group contracts, instructors may encourage groups to regularly reflect on and report group progress and dynamics. The reflection or report, however, should not be used such that students are concerned about group cohesiveness and privacy (Kitchen & McDougall, 1998). Students in Case 6 expressed that a reflection paper commenting on their group processes and other members' participation caused some concern regarding group cohesiveness.

Grading is an important issue related to individual accountability. When students engage in both individual coursework and collaborative work, students may focus more on individual assignments than on group projects that demand extensive time and effort. As an example, Case 9 shows that student participation in collaborative learning decreased as the course progressed, simply because individual assignments were worth most of the final grade. Thus it is important for instructors to find an effective balance of grading between group work and individual tasks.

Team-Building

Promote opportunities for face-to-face interaction. The online learning environment has been criticized for its lack of human interaction. Due to this reason, there is an increasing movement toward blended learning approaches where students can have opportunities for both online and face-to-face interaction with their instructors and classmates (Allen & Seaman, 2003). It appears that the blended method is also effective in facilitating the process of collaborative online learning (Carr-Chellmana, Dyer & Breman, 2000; Gabriel, 2004; Graham, Scarborough & Goodwin, 1999). In Cases 1, 4 and 5, face-to-face meetings provided students with opportunities to know other members and to build group cohesiveness for subsequent collaborative work. This method, however, may not be efficient and effective in online courses where a significant number of students have full-time jobs or live in geographically diverse areas. Carr-Chellmana, Dyer and Breman (2000) suggest that some students disliked the expense and time of traveling to attend on-campus instruction.

Engage in online 'get to know you' activities. When it is not feasible or efficient to have face-to-face meetings, instructors should design online 'get to know you' activities where students post their brief introductions and also respond to others (Curtis & Lawson, 2001). Providing one or two early synchronous CMC sessions may be useful for students to have opportunities to introduce themselves and receive immediate feedback. In addition, ice-breakers, collaborative-game types of activities can be posted online to help students gain an initial experience with the process of group collaboration.

Computer-Mediated Communication

Provide multiple channels of CMC for effective group communication. Online collaboration is not possible without the use of CMC tools, which affect the success and effectiveness of group communication. While asynchronous CMC tools, including email and online discussion boards, have been the most popular methods, students may feel the need for synchronous communication. Case 1 shows that, as group projects progressed, some students started to talk via phone because asynchronous CMC tools were not sufficient and effective for group communication. Providing multiple channels can be particularly effective when there is a need for accommodating student preferences for different communication styles. While some students may choose to use

public methods of communication, some may prefer to use private modes of communication such as email, phone or face-to-face meeting.

Create shared group spaces. The use of complex and collaborative tasks often requires groups to find additional information to reach solutions (Curtis & Lawson, 2001; McAlpine, 2000). It is essential to provide groups with online spaces where group members can actively present information and share necessary resources. The design of group spaces is important because it should give both flexibility and privacy. For instance, Duffy, Dueber and Hawley (1998) suggest that online group spaces need to be designed that only group members can access or the rest of class can have limited read-only access.

Motivate students to participate in online discussions. An online discussion board is often used as a space where students can exchange, share and debate their ideas. Case 3, however, presents an example that students did not actively participate in online discussions due to a lack of structure provided by instructors. For a truly interactive and collaborative learning environment, Cases 3 and 8 suggest that it is important for instructors to require specific expectations with respect to the frequency and length of postings.

Fung (2004) argues that scaffolding strategies can be used to encourage students' participation in collaborative online discussions. For instance, instructors or group moderators can initiate a discussion of a simple topic stimulating students' interests, and then proceed to increasingly complex questions. The characteristic of discussion topics is also an important factor affecting the success of online discussions. To encourage students' intrinsic motivation for participating in discussions, Case 3 shows that it is important to select appealing and focused questions rather than being vague and broad.

Minimize technical problems. Students often face technical difficulties due to the nature of online learning environments, which highly rely on technology for communication. Technical problems (e.g., access, software interface and conferencing tools) are negatively related to student satisfaction levels with collaborative learning. To make students feel comfortable using CMC tools, instructors can offer training sessions or written guidelines at the beginning of the course. Additionally, appropriate and immediate technical support should be provided to students who experience technical difficulties impeding their learning processes.

Instructor

Act as a facilitator, guider and coordinator. Instructors in collaborative online learning environments should play roles as facilitators who provide guidance, feedback and support (Curtis & Lawson, 2001; Fung, 2004; Kitchen & MCDougall, 1998). Often, collaborative online learning requires instructors to prepare several instructional materials necessary to facilitate group works. When instructors plan to assign students to groups, project topics and roles should be clearly prepared in advance for effective planning. Additionally, instructors can develop templates for group contracts and management plans as guidelines that students use to decide individual accountability and role (Murphy, Mahoney & Havell, 2000).

CONCLUSION

While several researchers have developed instructional design theories to promote and facilitate student collaborations in face-to-face learning situations, there is a lack of instructional guidelines specifically developed for collaborative learning in computer-mediated environments. The present study critically reviewed and analyzed ten case studies to identify effective instructional methods that facilitate the learning process of online collaboration. Methods were grouped into five categories that consistently emerged from the synthesis and comparison of cases. It appears that some collaborative learning methods successfully implemented in face-to-face classrooms are equally effective in online learning environments. Small group sizes, authentic tasks, individual accountability, and team building are critical methods that have to be considered for both traditional and online collaborative learning.

However, there are some collaborative learning methods particularly critical in online learning environments. First, instructors should accommodate students' different characteristics and backgrounds in deciding the composition of groups since students in online course are diverse in terms of their work, academic and cultural backgrounds. Second, it is clear that the role of a technology medium becomes more important in online courses than in face-to-face ones. Synchronous and asynchronous CMC tools play a critical role in facilitating the process of group communication and dynamics. Thus instructors should support students to feel comfortable using different communication tools, and, if necessary, provide appropriate support related to technical problems. Finally, it appears that the use of face-to-face or online synchronous interaction is effective in building group identity and cohesiveness among members. This method, however, should be carefully planned for students who have full-time jobs and live in different time zones.

In conclusion, the use of collaborative learning in online learning environments should be planned and implemented based on the pedagogical consideration of grouping strategies, collaborative tasks, team-building activities, CMC tools, and instructor's roles. Although the intent was not to provide a comprehensive instructional design theory or guidelines, online instructors, instructional designers and CSCL researchers

should consider the eleven instructional methods presented in this study to facilitate or study students' collaborative learning processes in online environments.

REFERENCES

- Allen, E., & Seaman, J. (2003). *Sizing the opportunity: The quality and extent of online education in the United States, 2002 and 2003*. Retrieved on February 2, 2004, from http://www.sloanc.org/resources/sizing_opportunity.pdf
- Beatty, B. J. (2002). *Social interaction in online learning: A situationalities framework for choosing instructional methods*. Unpublished doctoral dissertation, Indiana University, Bloomington.
- Bonk, C. J., & Cunningham, D. J. (1999). Searching for learner-centered, constructivist, and sociocultural components of collaborative educational learning tools. In C. J. Bonk and King, K.S. (Eds.), *Electronic collaborators* (pp.25-50). Mahwah, New Jersey: Lawrence Erlbaum Associates.
- Carr-Chellman, A., Dyer, D., & Breman, J. (2000). Burrowing through the network wires: Does distance detract from collaborative authentic learning? *Journal of Distance Education*, 15(1). Retrieved October 31, 2004, from <http://cade.icaap.org/vol15.1/carr.html>
- Cunningham, J. B. (1997) Case study principles for different types of cases. *Quality and quantity*, 31, 401-423.
- Curtis, D. D. & Lawson, M. J. (2001). Exploring collaborative online learning. *Journal of Asynchronous Learning Network*, 5(1), 21-34.
- DeBourgh, G. A. (1999). *Technology is the tool, Teaching is the task: student satisfaction in distance learning*. Paper presented at the Society for Information Technology & Teacher Education International Conference, San Antonio, TX, February 28-March4, 1999. (ERIC Document Reproduction Service No. ED 432 226)
- Duffy, T. M., Dueber, B., & Hawley, C. L. (1998). Critical thinking in a distributed environment: A pedagogical base for the design of conferencing systems. In C. J. Bonk and King, K.S. (Eds.), *Electronic collaborators* (pp.51-78). Mahwah, New Jersey: Lawrence Erlbaum Associates.
- Fung, Y. H. (2004). Collaborative online learning: interaction patterns and limiting factors. *Open Learning*, 19(2), 135-149.
- Gabriel, M. A. (2004). Learning together: Exploring group interactions online. *Journal of Distance Education*, 19(1), 54-72.
- Gaddis, B., Napierkowski, H., Guzman, N., & Muth, R. (2000, October). *A comparison of collaborative learning and audience awareness in two computers -mediated writing environments*. Paper presented at the Association for Educational Communications and Technology, Denver, CO.
- Graham, M., Scarborough, H., & Goodwin, C. (1999). Implementing computer mediated communication in an undergraduate course- A practical experience. *Journal of Asynchronous Learning Network*, 3(1), 32-45.
- Hara, N., & Kling, R. (2000). Students' distress with a web-based distance education course. *Information, Communication, & Society*, 3(4), 557-579.
- Harasim, L. M. (1990). Online education: An environment for collaboration and intellectual amplification. In L.M. Harasim (Ed), *Online education: Perspectives on a new environment* (pp.39-67). New York: Praeger.
- Jung, I., Choi, S., Lim, C., & Leem, J. (2002). Effects of different types of interaction on learning achievement, satisfaction and participation in web-based instruction. *Innovations in Education and Teaching International*, 39(2), 153-162.
- Kitchen, D., & McDougall, D. (1998). Collaborative learning on the Internet. *Journal of Educational Technology Systems*, 27(3), 245-258.
- Lucas, W. (1974). *The case survey method of aggregating case experience*. Santa Monica, Calif.: Rand.
- McAlpine, I. (2000). Collaborative learning online. *Distance Education*, 21(1), 66-80.
- Murphy, K. L., Mahoney, S. E., & Havell, T. J. (2000). Role of contracts in enhancing community building in Web courses. *Educational Technology & Society*, 3(3). Retrieved October 31, 2004, from http://ifets.ieee.org/periodical/vol_3_2000/e03.html
- Nelson, L. M. (1999). Collaborative problem solving. In C. M. Reigeluth (Ed.) *Instructional design theories and models: A new paradigm of instructional theory*, Mahwah, NJ: Lawrence Erlbaum Associates.
- Ragoonaden, K. & Bordeleau, P. (2000). Collaborative learning via the Internet. *Educational Technology & Society*, 3(3). Retrieved October 31, 2004, from http://ifets.ieee.org/periodical/vol_3_2000/d11.html
- Reigeluth, C. M. (1999). What is instructional-design theory and how is it changing? In C. M. Reigeluth (Ed.), *Instructional-design theories and models: A new paradigm of instructional theory* (Vol. 2). Mahwah, NJ: Lawrence Erlbaum Associates.
- Stacey, E. (1999). Collaborative learning in an online environment. *Journal of Distance Education*, 14(2). Retrieved October 31, 2004, from <http://cade.icaap.org/vol14.2/stacey.html>

- Tiangha, T. (2003). *Gauntlet News-Blended Learning: Wave of the future?* Retrieved on February 2, 2004, from <http://gauntlet.ucalgary.ca/a/story/6848>
- Vygotsky, L.S. (1978). *Mind and society: The development of higher mental processes*. Cambridge, MA: Harvard University Press.
- Yaverbaum, G. J., & Ocker, R. J. (1998). *Problem solving in the virtual classroom: A study of student perceptions related to collaborative learning techniques*. WebNet 98 World Conference of the WWW, Internet and Intranet proceedings, Orlando, FL, November 7-12, 1998. (ERIC Document Reproduction Service No. ED 427 750)

APPENDIX A: TEN CASES EXAMINED IN THIS STUDY

Case 1

- Carr-Chellman, A., Dyer, D., & Breman, J. (2000). Burrowing through the network wires: Does distance detract from collaborative authentic learning? *Journal of Distance Education*, 15(1). Retrieved October 31, 2004, from <http://cade.icaap.org/vol15.1/carr.html>

Case 2

- Curtis, D. D. & Lawson, M. J. (2001). Exploring collaborative online learning. *Journal of Asynchronous Learning Network*, 5(1), 21-34.

Case 3

- Fung, Y. H. (2004). Collaborative online learning: interaction patterns and limiting factors. *Open Learning*, 19(2), 135-149.

Case 4

- Gabriel, M. A. (2004). Learning together: Exploring group interactions online. *Journal of Distance Education*, 19(1), 54-72.

Case 5

- Graham, M., Scarborough, H., & Goodwin, C. (1999). Implementing computer mediated communication in an undergraduate course- A practical experience. *Journal of Asynchronous Learning Network*, 3(1), 32-45.

Case 6

- Kitchen, D., & McDougall, D. (1998). Collaborative learning on the Internet. *Journal of Educational Technology Systems*, 27(3), 245-258.

Case 7

- McAlpine, I. (2000). Collaborative learning online. *Distance Education*, 21(1), 66-80.

Case 8

- Murphy, K. L., Mahoney, S. E., & Havell, T. J. (2000). Role of contracts in enhancing community building in Web courses. *Educational Technology & Society*, 3(3). Retrieved October 31, 2004, from http://ifets.ieee.org/periodical/vol_3_2000/e03.html

Case 9

- Ragoonaden, K. & Bordeleau, P. (2000). Collaborative learning via the Internet. *Educational Technology & Society*, 3(3). Retrieved October 31, 2004, from http://ifets.ieee.org/periodical/vol_3_2000/d11.html

Case 10

- Stacey, E. (1999). Collaborative learning in an online environment. *Journal of Distance Education*, 14(2). Retrieved October 31, 2004, from <http://cade.icaap.org/vol14.2/stacey.html>

APPENDIX B: AN EXAMPLE OF CASE ANALYSES

Case 1

Carr-Chellman, A., Dyer, D., & Breman, J. (2000). Burrowing through the network wires: Does distance detract from collaborative authentic learning? *Journal of Distance Education*, 15(1). Retrieved October 31, 2004, from <http://cade.icaap.org/vol15.1/carr.html>

1. Instructional Conditions

- *Learning*: Introduction to instructional design, using real-world projects to conduct instructional design activities
- *Learner*: 23 students enrolled in a distance Instructional Technology program
- *Learning environment*: The course was delivered via both traditional and online formats.
- *Development constraints*: Traditional residential courses were converted to online courses.

2. Instructional Methods

2.1. Student attended an on-campus workshop for three days.

- *Effectiveness*: Face-to-face interactions helped students know each other, and built close relationships for subsequent group work.
- *Condition*: Students must manage their time to attend the fact-to-face workshop.

2.2. Students used both online (e.g., email, Web, chat) and audio (e.g. phone) communication tools.

- *Effectiveness*: Students found that email or Web was not sufficient for effective communication among group members.
- *Condition*: Students must manage their schedules for phone conversations.

2.3. Authentic problems were used as group projects.

- *Effectiveness*: Compared to students in a traditional course, distance students expressed high satisfaction with the authenticity of group projects.
- *Condition*: Students must have prior experiences with collaborative learning and problem solving in authentic situations. It is useful to starting with a simple problem rather than giving a complex problem since students learn problem solving and collaboration skills in stages.