

USING THE JIGSAW MODEL TO FACILITATE COOPERATIVE LEARNING IN AN ONLINE COURSE

Rob Weidman and M. J. Bishop

Lehigh University

This study examined whether the jigsaw model might be used in an online higher education course to produce the key characteristics of successful cooperative learning: interdependence, individual accountability, development of social skills, and promotive interaction. The authors employed a qualitative case study design to examine a 6-week online literature course that incorporated three jigsaw activities. Analysis of online questionnaires, transcripts from in-depth interviews, and course documents revealed that the jigsaw activities yielded mixed results with regard to the key characteristics of successful cooperative learning. The authors discuss the implications of these findings for the design of online cooperative learning activities.

Collaborative learning offers many advantages over more competitive, relative ability-based pedagogy—including higher-order thinking, increased motivation, and greater student satisfaction (Barkley, Cross, & Major, 2005). Millis and Cottell (1998) suggested that, by emphasizing shared goals, learning environments that promote collaboration can increase group cohesion and encourage interdependence among students. Johnson, Johnson, Holubec, and Roy (1984) highlighted the importance of encouraging interdependence, especially in learning environments that contain obstacles for successful group bonding

and community development—like those that depend largely on the computer as a means of communication among class participants.

As computers and the Internet have taken on a larger and more prominent role in our society, computer-mediated communication (CMC) has risen as a common form of social interaction, often serving as an integral component of daily life. Although CMC offers many advantages for learning, including the opportunities for distance education on a global scale, it also presents many obstacles that may prevent successful group transactions. Brignall and Valey (2005) pointed out

• **Rob Weidman**, Lehigh University, 30 Library Drive, 046 Linderman Library, Bethlehem, PA 18015. Telephone: (610) 758-3043. E-mail: row3@lehigh.edu

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that CMC often takes the form of text-only communication, which can drastically reduce the quantity and quality of social cues embedded in an interaction (tone, facial expressions, hand gestures, and other nonverbal messages).

Several substantive qualitative studies have made significant steps toward understanding the role of CMC in collaborative learning and how specific contexts can successfully support collaboration (see Brown, 2001; Fisher, Thompson, & Silverberg, 2004; Ingram, Conley, McDonald, Parker, & Rivers, 2003). Jeong (2004) also showed that the unique nature of CMC-based collaborations might result in outcomes quite different than those expected in face-to-face interactions, such as a more conversational tone actually reducing the likelihood of eliciting a response. Other researchers have focused specifically on the level of structure in the underlying pedagogy in CMC-based collaborative learning environments, contrasting more structured and interdependent *cooperative* learning groups with general, less structured *collaborative* learning groups (Aviv, Erlich, & Ravid, 2004; Joung & Keller, 2004; Rose, 2004).

Much discussion has centered on the meanings of the terms *cooperative* and *collaborative* learning. Barkley et al. (2005) used educational level as the dividing line, referring to group learning in K-12 as cooperative and that in higher education as collaborative. Bruffee (1999), argued that the two terms fundamentally differ, while others described cooperative learning as a specific, highly structured form of collaborative learning (Mills & Cottell, 1998; Smith & MacGregor, 1992). Those who have viewed cooperative learning as distinct from other forms of group learning have identified several key elements (Cooper, Robinson, & McKinney, 1994; Johnson et al., 1984; Johnson, Johnson, & Smith, 1998; Slavin, 1991). Four common elements are:

1. Positive interdependence—students feel responsible for and dependent upon their group mates.

2. Individual accountability—students undergo individual assessment.
3. Promotive and preferably face-to-face interaction—students work together and promote each other's learning (do not simply work independently and later compile the results).
4. Development of social skills—students learn not just the subject matter, but also skills for communicating and working together.

Cooper et al. (1994) especially emphasized the importance of interdependence and individual accountability, arguing that a strong sense of shared responsibility encourages achievement gains, while individual assessment reduces perceptions of disproportionate workload that commonly accompany group efforts. Johnson et al. (1998) stressed the need for groups to rely on well-developed social skills to communicate, make decisions, and resolve conflicts, allowing them to achieve their goals. Cooper et al. also incorporated with these skills group processing, or self-evaluation, while Johnson et al. highlighted group processing as a separate element of successful cooperative learning. Johnson et al. also suggested that interaction in which students explicitly aid and promote each other's learning provides unique opportunities for thought and reflection.

To facilitate the design of successful cooperative learning environments, theorists created the method known as "Jigsaw," which encourages interdependence as well as individual accountability and conforms to even the strictest definitions of cooperative learning (Aronson & Patnoe, 1997; Aronson, Stephan, Sikes, & Snapp, 1978). The Jigsaw technique consists of the following basic steps:

1. Each student in a "home" group receives a subtopic.
2. Subtopic experts from each group meet in an "expert" group to work together on their subtopic.

3. Experts return to their home group to teach their subtopic to the other members.
4. Each student undergoes individual assessment on all subtopics.

For example, a class studying alternative energy and consisting of nine students could divide into three groups of three. Within each of these “home” groups, one student would focus on wind energy, one on solar energy, and one on geothermal energy. The three students assigned to solar energy would work together in an “expert” group, comprised of one student from each home group, to research their subtopic and prepare to present their findings to the other members of their home group. The other students would meet in similar expert groups and then the home groups would reconvene for each student to present his or her subtopic to the other members of the group. Finally, each student would complete a test or other individual assignment, covering all three alternative energy sources.

Millis and Cottell (1998) maintained that, although originally developed for the K-12 level, Jigsaw could also meet the needs of higher education, especially in courses requiring students to “confront complex, challenging topics involving multiple pieces of information” (p. 126). Schaeffer and Cates (1996) suggested Jigsaw as one technique appropriate for computer-mediated cooperative learning, in which the computer could allow for effective student communication and teacher guidance without the need for the synchronous, face-to-face interaction traditional to this and other cooperative learning methods. Although researchers have explored structured cooperative learning in online environments to some degree, the need remains for understanding how educators can best apply specific cooperative learning models, like Jigsaw, to online learning environments in ways that capitalize on and overcome the unique characteristics of this medium.

PURPOSE AND RESEARCH QUESTIONS

The purpose of this study, therefore, was to examine how effectively the Jigsaw cooperative learning model can function in an online higher education course to achieve the cooperative learning characteristics of interdependence, individual accountability, development of social skills, and promotive interaction. The research questions that guided this examination included:

1. How can technology support the implementation of cooperative learning?
2. In what ways does the online context impede the implementation of cooperative learning?
3. Can cooperative learning succeed without face-to-face interaction?

METHODOLOGY

In order to achieve this purpose, the authors employed a qualitative case study design. Merriam (1998) described case studies as focusing on a singular case of a phenomenon to understand better the context in which it is situated and how that context shapes the phenomenon and the behavior of its participants. Such focus leads to a better understanding of the underlying processes, allowing for rich description and explanation. We will not generalize the findings beyond the specific context of this course and its participants. However, understanding of this specific context will suggest possible implications for practices and theory without applying the characteristics of this context directly to others.

Setting and Participants

During a 6-week summer-semester session, the English department of a medium-sized private university offered a course titled Literature and the World Wide Web to both undergraduate and graduate students, examining both digitally created literature and online archives of earlier literature. The course occurred entirely online and asynchronously

using the Blackboard course management system and included four types of assignments: class discussion of assigned readings (daily posts, 25% of grade), discovery and review of new online texts (exploration, 5% for each of 3 submissions for 15% total), essay proposing a print-to-electronic adaptation (adaptation, 15% for each of 2 submissions for 30% total), and group preparation for an individual composition (Jigsaw, 10% for each of 3 submissions for 30% total). Each of the three Jigsaw activities covered a different larger subject; the first Jigsaw dealt with the online novel titled 253; the second explored the Whitman Archive; the third examined the Blake Archive and the Rossetti Archive.

Three of the original 12 students enrolled in the course did not complete the course or participate in any of the Jigsaw activities, eliminating them as potential subjects for purposes of this study. The remaining nine students completed the course and participated in the Jigsaw activities. One of these nine students declined to participate in this study. Therefore, the analyses presented here do not include observations on this student's posts or other behaviors. Blackboard provided separate discussion boards for each home and expert group in these activities. For each Jigsaw activity, there were three home groups and three expert groups, each consisting of three students. Table 1 presents the exact makeup of each

TABLE 1
Makeup of Jigsaw Groups

<i>Group</i>	<i>Members</i>
Jigsaw 1: 253	
Home 1	Emma , <u>Tom</u> , (9th student)
Home 2	<u>Bill</u> , <u>Sean</u> , Jane
Home 3	Mary , Cindy , <u>Henry</u>
Expert 1: Passengers 2-85	Cindy , <u>Sean</u> , <u>Tom</u>
Expert 2: Passengers 86-169	<u>Bill</u> , Emma , <u>Henry</u>
Expert 3: Passengers 170-253	Mary , Jane, (9th student)
Jigsaw 2: Whitman	
Home 1	Mary , <u>Henry</u> , <u>Tom</u>
Home 2	Emma , Jane, <u>Sean</u>
Home 3	<u>Bill</u> , Cindy , (9th student)
Expert 1: Poems I-IV	<u>Bill</u> , Emma , <u>Tom</u>
Expert 2: Poems V-VIII	Cindy , <u>Henry</u> , Jane
Expert 3: Poems IX-XII	Mary , <u>Sean</u> , (9th student)
Jigsaw 3: Blake and Rossetti	
Home 1	Emma , <u>Tom</u> , (9th student)
Home 2	<u>Bill</u> , <u>Sean</u> , Jane
Home 3	Mary , Cindy , <u>Henry</u>
Expert 1: Natural/Spiritual	Cindy , <u>Sean</u> , <u>Tom</u>
Expert 2: Art/Poetry	<u>Bill</u> , Emma , <u>Henry</u>
Expert 3: Name/Suggest	Mary , Jane, (9th student)

Note: Graduate students in bold, males underlined.

group and some demographics of the participants.

Data Collection and Analyses

The study was designed to employ multiple methods of data collection to allow for triangulation. As Maxwell (1996) suggested, this provides many sources for the same conclusion to establish a level of validity within the study findings. Analysis of the discussion board posts, group e-mails, and course documents provided the most in-depth picture of the online Jigsaw process, serving as the primary means of data collection. The first author analyzed the data in an iterative, synchronous process, continually refining and cross-analyzing data sources to allow for his understanding of the phenomena to evolve (Auerbach & Silverstein, 2003; Maxwell, 1996; Merriam, 1998).

Online Questionnaire

The document analysis suggested areas of particular interest and, from that, we constructed an online questionnaire to further explore these topics. Before sending the questionnaire to the students, two instructional designers familiar with collaborative learning concepts validated the items and checked the questionnaire for any confusing or misleading items or directions. Some items were added and modified based on this feedback. Following the suggestion of Mann and Stewart (2000), we administered the questionnaire online, standardizing data collection and facilitating data manipulation and analysis. An e-mail directed the students to the questionnaire and reminded them of the study's purpose, making clear that participation was entirely voluntary. Before final submission, the online questionnaire displayed all student responses for final verification. Of the eight participating students, six responded to the questionnaire. Table 2 presents the questionnaire items, the individual responses, and the mean scores.

In-Depth Interviews

Although the questionnaire shed further light on key themes from the document analysis, it did not provide a truly deep understanding of the phenomena of interest. The nonparticipatory and unobtrusive nature of the primary observations of the phenomena through the document analysis process ensured the authenticity of the experience, but made it difficult to fully grasp the phenomena as experienced by the participants. Therefore, semi-structured interviews allowed participants to offer insights into the phenomena, as suggested by Merriam (1998), promoting new directions for the analysis of the Jigsaw activities. Based on the first author's previous analysis of the existing data, we created interview guides for both the instructor and the students to ensure that the interview questions focused on areas of interest (Patton, 2002).

To generate a fuller understanding of the phenomena, the interviews targeted both the student and professor's perspectives. Bill was selected as a student of interest, both because he had several successful interactions and because he also had difficulty with one Jigsaw assignment in which the delay of his group members hindered his interaction and prompted him to e-mail the professor. Furthermore, his questionnaire responses, for the most part, reflected the sentiments of the majority of the respondents. Unfortunately, limited access to the students prevented us from securing additional student interviews.

The first author digitally recorded these face-to-face interviews using a laptop computer and Audacity software. He transcribed the interviews and sent the transcriptions to the two interviewees, offering them the chance to make any additional statements or correct any inaccuracies. Continuing the data-analysis cycle presented above, the first author analyzed the interview transcriptions and reexamined the analysis of the other data sources.

TABLE 2
Individual and Mean Rankings of Questionnaire Items

Item	Jane	Emma	Henry	Mary	Bill	Sean	M
1. I had sufficient time to complete all required work for this course (1 = <i>strongly disagree</i> , 2 = <i>disagree</i> , 3 = <i>neither agree nor disagree</i> , 4 = <i>agree</i> , 5 = <i>strongly agree</i>).	4	4	4	1	4	4	3.50
2. I had sufficient time to complete all required work for the Jigsaw assignments (1 = <i>strongly disagree</i> , 2 = <i>disagree</i> , 3 = <i>neither agree nor disagree</i> , 4 = <i>agree</i> , 5 = <i>strongly agree</i>).	2	4	4	1	4	4	3.17
3. The discussion board posts of my group members helped me with the Jigsaw assignments (1 = <i>strongly disagree</i> , 2 = <i>disagree</i> , 3 = <i>neither agree nor disagree</i> , 4 = <i>agree</i> , 5 = <i>strongly agree</i>).	2	2	2	2	3	3	2.33
4. My discussion board posts helped my group members with the Jigsaw assignments (1 = <i>strongly disagree</i> , 2 = <i>disagree</i> , 3 = <i>neither agree nor disagree</i> , 4 = <i>agree</i> , 5 = <i>strongly agree</i>).	4	4	4	3	4	3	3.67
5. The amount of <i>effort</i> I put into this course (1 = <i>was greatly underestimated by my grade</i> , 2 = <i>was underestimated by my grade</i> , 3 = <i>was accurately reflected by my grade</i> , 4 = <i>was overestimated by my grade</i> , 5 = <i>was greatly overestimated by my grade</i>).	3	3	2	2	3	3	2.67
6. The amount of <i>time</i> I put into this course (1 = <i>was greatly underestimated by my grade</i> , 2 = <i>was underestimated by my grade</i> , 3 = <i>was accurately reflected by my grade</i> , 4 = <i>was overestimated by my grade</i> , 5 = <i>was greatly overestimated by my grade</i>).	3	3	2	2	3	3	2.67
7. My grade for this course (1 = <i>greatly underrated my performance</i> , 2 = <i>underrated my performance</i> , 3 = <i>accurately reflected my performance</i> , 4 = <i>overrated my performance</i> , 5 = <i>greatly overrated my performance</i>).	3	3	3	2	3	3	2.83
8. My grades for the Jigsaw assignments (1 = <i>greatly underrated my individual performance</i> , 2 = <i>underrated my individual performance</i> , 3 = <i>accurately reflected my individual performance</i> , 4 = <i>overrated my individual performance</i> , 5 = <i>greatly overrated my individual performance</i>).	3	3	2	3	3	3	2.83
9. The performance of my Jigsaw group members (1 = <i>greatly decreased my grades on the Jigsaw assignments</i> , 2 = <i>decreased my grades on the Jigsaw assignments</i> , 3 = <i>did not affect my grades on the Jigsaw assignments</i> , 4 = <i>increased my grades on the Jigsaw assignments</i> , 5 = <i>greatly increased my grades on the Jigsaw assignments</i>).	3	3	2	3	3	4	3.00

RESULTS

Analysis of the data gathered from the case study focused on evidence for interdependence, individual accountability, development

of social skills, and promotive interaction, which were identified in the review of the literature as key components of cooperative learning. In this section, we will discuss each of these elements and how they appeared to inter-

relate within this specific context. We will also present the implications of this case study and the limitations that constrain them.

Development of Social Skills

Of the four focal characteristics of cooperative learning, development of social skills expressed itself the least in the Jigsaw activities and the course as a whole. The professor's course documents, e-mails, and discussion board posts included very little in the way of explicit social skill coaching or development. Although displays of direct animosity did not occur, there were several occasions in which the lack of social tools for resolving conflicts resulted in silence and the breakdown of true promotive interaction.

In the first Jigsaw assignment, the students focused on thematic elements connecting the 253 characters in a hypertext novel. Each expert group discussed one-third of the characters and then reported their findings to their home groups. In Expert Group 1, Tom began the discussion by posting an extensive, but incomplete list of their characters, with a brief synopsis of each one. Cindy's response to Tom's post actually displayed some fairly developed social skills:

Hey Tom thanks for getting us started. I shoulda checked the DB before I started reading 253 b/c I would of went to the second car right away ... oh well. I have taken notes for 1-20 so far but I will jump ahead to the higher numbers. Hopefully we can somehow finish this in the morning. I'll post as soon as I can.

Cindy not only thanked Tom, but also set some group goals and a plan of action. Her post also pointed out that she had wasted some time with redundant work, which they might have mitigated by establishing processes to distribute the group's tasks better. Unfortunately, Cindy never followed through with her promised actions and, in fact, did not complete the Jigsaw assignment. She never posted her own analysis of the characters to the expert

group and made no posts at all to her home group.

Sean, on the other hand, did fulfill his obligations to the group, but was less effective in his response to Tom's initial post, stating:

there are *so many* things to look at that it's pretty much impossible (and rather unnecessary for the assignment) to do a list of every single passenger. i decided to just pick out a few connections that i found especially interesting. just find a character that stems to atleast three others, and you'll easily have your twelve for the assignment.

Although Sean did build off Tom's contribution, by suggesting a new approach, the manner in which he did this appears to have shut down further communication. Tom reacted defensively to Sean's post and effectively removed himself from the conversation, saying:

I did not think that it was necessary to list each character rather I chose to, in order to spark conversation. It would be a long and tedious process that is completely unnecessary but I was sure it would be helpful. I will not post the rest of my notes if anyone would like them they could just email me.

Interestingly, when reporting back to his home group, Sean described Tom's contribution positively, commenting that, "Tom also posted a good summary of the first fifteen passengers."

Interdependence and Individual Accountability

Interdependence and individual accountability were the two of the four focal characteristics of cooperative learning that appeared to be the most interconnected. Several indicators suggested that strong individual accountability may have hindered and overshadowed interdependence within the Jigsaw assignments. The course documents explicitly listed the five requirements of the assignments, which the

TABLE 3
Jigsaw Requirements Met by Individual Students

<i>Jigsaw Requirement</i>	<i>Mary</i>	<i>Bill</i>	<i>Cindy</i>	<i>Emma</i>	<i>Henry</i>	<i>Jane</i>	<i>Sean</i>	<i>Tom</i>
Jigsaw 1								
Home post	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Home response	No	Yes	No	Yes	Yes	Yes	Yes	No
Expert post	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Expert response	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
Final assignment	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Total	4	5	1	5	4	5	5	4
Jigsaw 2								
Home post	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Home response	Yes	No	No	Yes	Yes	Yes	Yes	No
Expert post	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Expert response	No	No	No	Yes	Yes	Yes	No	Yes
Final assignment	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Total	4	3	3	5	5	5	4	4
Jigsaw 3								
Home post	No	Yes	No	Yes	Yes	Yes	No	Yes
Home response	No	Yes	No	Yes	No	Yes	No	Yes
Expert post	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Expert response	No	Yes	No	Yes	Yes	Yes	No	No
Final assignment	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Total	1	5	2	5	4	5	1	4

professor had designed in a way that instilled both of these characteristics. In each Jigsaw activity, only half of the students or fewer actually met all five of the stated requirements, as indicated in Table 3.

Further examination of the missing components by type (see Table 4) reveals that the response posts were the most frequently omitted components, which arguably most encouraged interdependence among the group members. In most cases, however, the students completed the less interdependent components, namely the final assignments and initial posts. Only two students, Jane and Emma, completely met the requirements of all three

assignments and only one student, Cindy, consistently missed two or more of the key components. The other students met most, if not all, of the requirements in two of the three Jigsaw activities, but then missed two or more requirements in the other Jigsaw. Unlike the individual posts and final individual assignments, the response posts required a greater degree of interdependence; a student could not possibly fulfill this requirement without having posts from other group members to address. Table 5 tracks the posts and responses within each group.

In several instances, only a single student failed to meet the requirements, which had less

TABLE 4
Missing Jigsaw Components by Type

<i>Missing Component</i>	<i>Jigsaw 1</i>	<i>Jigsaw 2</i>	<i>Jigsaw 3</i>	<i>Combined</i>
Missing home posts	1	0	3	4
Missing home responses	3	3	4	10
Missing expert posts	1	0	1	2
Missing expert responses	1	4	4	9
Missing assignment	1	0	1	2
Total missing	7	7	13	27

TABLE 5
Jigsaw Posts and Responses by Group

Jigsaw Group	Members	Post		Response	
		Yes	No	Yes	No
Jigsaw 1					
Home 1	Emma, Tom, (9th student)	2	0	1	1
Home 2	Bill, Sean, Jane	3	0	3	0
Home 3	Mary, Cindy, Henry	2	1	1	2
Expert 1	Cindy, Sean, Tom	2	1	3	0
Expert 2	Bill, Emma, Henry	3	0	2	1
Expert 3	Mary, Jane, (9th student)	2	0	2	0
Jigsaw 2					
Home 1	Mary, Henry, Tom	3	0	2	1
Home 2	Emma, Jane, Sean	3	0	3	0
Home 3	Bill, Cindy, (9th student)	2	0	0	2
Expert 1	Bill, Emma, Tom	3	0	2	1
Expert 2	Cindy, Henry, Jane	3	0	2	1
Expert 3	Mary, Sean, (9th student)	2	0	0	2
Jigsaw 3					
Home 1	Emma, Tom, (9th student)	2	0	2	0
Home 2	Bill, Sean, Jane	2	1	2	1
Home 3	Mary, Cindy, Henry	1	2	0	3
Expert 1	Cindy, Sean, Tom	2	1	0	3
Expert 2	Bill, Emma, Henry	3	0	3	0
Expert 3	Mary, Jane, (9th student)	2	0	1	1

effect on the overall performance of the group than cases with less participation. In Home Group 3 within the third Jigsaw, for example, the inactivity of the other students made it impossible for the one active student, Henry, to fulfill all of his requirements. Students often waited until just prior to the time the assign-

ment was due before making their individual posts to their groups. This, in turn, meant that students had to wait for their group members' posts before completing the discussion portion of the Jigsaw and beginning the final individual composition. In many cases, the students directly contacted the professor through e-mail

to alert him of the situation. Henry's interactions with the professor regarding the aforementioned dilemma typified these exchanges:

Henry: I have a concern about this jigsaw 3. It's 20 of 12 and the paper is due at 10am and I have nothing from my group members to respond to for posts and also nothing for me to write about in their parts. I'll check again at around 7:30 am, if there is nothing there i'll go by other people's posts. As far as responding if there is nothing there what should i do?

Professor: This happened last time with some other students. I will print out this e-mail from you and it will count 100% for any posts that you didn't do. Thanks for being responsible.

The professor's response to this plea also underscored the strength of individual accountability within the Jigsaws, at the expense of interdependence. By taking individual responsibility for his requirements, the student negated the need to depend on his group mates. In many cases, students chose to disregard their group members, rather than try to encourage their interdependence. During Bill's interview, his sentiments underscored the conflicting nature of interdependence and individual accountability within the particular context of the course and the Jigsaw activities.

Interviewer: Did you ever have any sort of disagreements?

Bill: No. There was certainly—I certainly know there were people who didn't contribute their equal share.

Interviewer: Right. But, no one ever really brought that up?

Bill: No one ever brought it up. It was just easier to ignore almost, you know, I do remember being a little offended by somebody who jumped on late into the group project and said, "I don't even know what we are supposed to be writing in this thing, so here's what I came up with." And it was just—it had nothing to do with the topic. And it was just, you know, his or her attempt to satisfy the condition of the assignment and, you know

that's fine, I don't necessarily blame them for that, but it didn't help us. And, basically to use that kind of sarcasm of "I don't even know what we're supposed to be doing for this stupid thing." Well, you know that's saying—what, it's the professor's fault? Because, how is it that ten other people do and you don't? You know, it's just, like I said it has to be proportional to the work that you are willing to put into it. You know, it's easy to lose the discipline of being a student I think when you are not in a classroom. And I can sympathize with that.

Promotive Interaction

One of the most striking examples of successful and rich interactions arose during the first Jigsaw assignment. Jane reported on the seeming importance of a character that thought she was Anne Frank. In turn, Mary, another member of her expert group, developed this idea further in her expert group posts. Both Jane and Mary reported on the significance of the Anne Frank character to their home groups and discussed this character in their individual assignments. Mary's composition especially concentrated on the Anne Frank character, the historical Anne Frank, and the Holocaust. Sean, Jane's fellow home group member, also highlighted this character both in his response post to his home group and in his own individual submission to the professor.

However, this level of success was not consistent across the Jigsaw activities. In contrast to the Anne Frank example above, many students' initial posts had little or no references to the ideas already posted by fellow group members. This was particularly true within the home groups, where the students often simply reposted the same content they had posted to their expert groups without even synthesizing or reporting on the ideas of the other members of their expert group.

Initial analysis of the group activities suggested an imbalance between individual accountability and interdependence. Furthermore, the degree of participation seemed to wane further during the second and, especially,

third Jigsaw activities, which both occurred in the final week of a short and condensed summer semester. We designed the questionnaire to specifically address these areas.

The majority of the respondents to the questionnaire perceived themselves as individually accountable for their grades on their assignments. Interestingly, perceptions of interdependence proved more contradictory and directional, with most respondents feeling they were not dependent on others, but others were dependent on them. The students reported less difficulty with the time allotted for the course and assignments than expected.

Both interviewees indicated that the relative success of the first Jigsaw as opposed to the second and, especially, third Jigsaw partly owed to the subject matter involved. The interviews suggested that analysis of all 253 characters in the text of the first Jigsaw would have been impossible under the time constraints of the course without a cooperative effort. The second Jigsaw required the students to track changes in multiple Walt Whitman poems across multiple editions of *Leaves of Grass* in an online Whitman archive, which also seemed suited to the Jigsaw structure. The professor admitted problems with the topics of the third Jigsaw, stating:

The final assignment I don't think worked very well. I don't think it was as good a fit. Because there I was asking them to compare and contrast two writers: William Blake and Dante Gabriel Rossetti and I kind of had to create three topics for them. And the topics weren't—didn't arise as naturally from the material as the other two did. So I had to assign them three topics to ask—three questions to ask—that they would be experts on. It seemed a little more forced, where I was forcing the material to fit the assignment. Whereas the others—the assignment really fit the material.

Both interviewees also admitted that this last Jigsaw had suffered for being late in an already compressed semester with less available time and more student burnout. However, they both suggested that this, combined with

the topic's incompatibility with the Jigsaw structure, had further broken down successful interaction. In fact, one student, Sean, only submitted his individual composition in the final Jigsaw without any interaction with either of his groups. Although he lost 50 of the available points for failing to complete the interaction component of the assignment, he still achieved the full remaining 50 points for his final composition. This meant that this Jigsaw did not require any interaction in order to successfully tackle the subject.

It is important to note that successful interactions also occurred in other portions of the course. These interactions occurred most significantly in the Daily Posts, which the professor intended as simulations of face-to-face class discussions of assigned readings and in the Exploration Assignments, which required students to discover and discuss new texts not assigned in the readings.

In the Daily Posts, the professor would post a "Lecture," which would pull out some of the most pertinent posts by the students, describe how they interrelated with each other, and the past and upcoming course topics. Bill admitted in his interview that this guidance allowed him to better understand the expectations of the course and how his own posts contributed to the overall class discussions. He also indicated that similar follow-up posts from the professor might have been helpful in the Jigsaw activities.

Both interviewees felt that some of the most spirited interactions occurred in the Exploration Assignments, which they attributed to a greater sense of ownership on the part of the students. The student interviewee, Bill, explained how the task of deciding which posts to respond to in these assignments added to the quality of the interactions, stating:

So yeah, definitely there was that interaction that didn't exist before and yeah, you know, I certainly thought there was kind of energetic feedback. And, you know, to find a text you wanted to respond to or respond well to, you had to kind of fool around with a few of them. Like, I remember going into three or four

individuals' exploration assignments and either not having necessarily anything to say about it, you know, or being moved in a very similar way that I just didn't want to repeat what their summary was. So I would just go and I would find something that I found more compelling and so it took some effort and it was a little more expansive in that way I think.

LIMITATIONS AND RECOMMENDATIONS

This study focused by design on exploring one unique context, prohibiting the direct application of the findings to other learning environments, but providing valuable insight. The less than complete participation by those involved in the online Jigsaw activities may have somewhat diminished the depth of understanding achieved through this study. These deficiencies included only eight of the nine students consenting to involvement in the study, only six of those eight responding to the questionnaire, and only one student partaking in an in-depth interview. However, the richness in the variety and amount of data available allowed for a level of consistency both within and across these various sources, which served to alleviate these gaps.

The four focal characteristics of cooperative learning existed to varying degrees within each Jigsaw activity as well as within some of the other course activities. Several factors emerged as contributing to the strength or weakness of each of these four characteristics. The example from Expert Group 1 in the first Jigsaw assignment suggested that explicit social skill development could have improved the quality of the interactions between group members. Furthermore, it reinforced Brignall and Valey's (2005) assertion that an online medium without the nonverbal cues of face-to-face communication can increase misunderstandings. The asynchronous nature of this particular online environment contributed to these feelings and made it easy to ignore conflicts rather than confront them. In the afore-

mentioned example, Sean's post came a full day after Tom's and late into the progress of the assignment, making it more difficult to change one's methodology. However, in another example, the asynchronous discussion board posts allowed students time to digest and then build on others' ideas in the successful cooperative analysis of the Anne Frank character. The addition of synchronous communications, such as online chat, in the early phases of the group discussion, might have allowed students to develop better group processes that would direct and improve subsequent asynchronous cooperation via the discussion boards. Adding synchronous communication might have also reduced the impact of the time constraints and condensed nature of the summer semester. Furthermore, direct guidance from the instructor could have suggested how and when to make use of these tools most effectively.

Both the professor and the students emphasized individual accountability over interdependence in the group projects. Johnson et al. (1998) urged the instructor to reinforce group responsibilities. The professor's Lectures in the Daily Posts section of the course effectively modeled successful student contributions and could have similarly been applied to the group work. This would have allowed the professor to continue to strengthen individual accountability by highlighting the work of individuals, while still stressing the need for interdependence by recognizing and rewarding peer support.

Millis and Cottell (1998) advised that complex, multi-part topics most appropriately fit the Jigsaw structure and also provided examples of students themselves deciding on the exact topic and subtopics of the Jigsaw activities. In this course, clearly some topics were better suited than others for this type of group work. Also, the Exploration Exercises, which featured a much greater degree of student choice than the Jigsaws, initiated enthusiastic interaction. More careful selection of the topics for the Jigsaws with input from the students

might have encouraged more interdependence and promotive interaction.

These analyses revealed that the characteristic elements of cooperative learning were closely interrelated and interacted with one another. As mentioned, the overall strong sense of individual accountability throughout these assignments reduced and impeded interdependence among group members. Also, the relatively lacking development of social skills may have prevented further promotive interaction and feelings of interdependence. Instructors planning similar online cooperative activities should consider each of these elements as integral, without overemphasizing one at the expense of the others. Cooper et al. (1994) recognized that the role of the instructor in cooperative learning activities is as a facilitator, actively encouraging interaction while allowing the students to accept responsibility for both their own success and that of their group mates. In this way, an instructor should initially structure and then closely monitor the learning environment to ensure that it includes these elements and supports successful cooperation. This may include suggesting specific communication methods and group processes to ensure interdependence and promotive interaction or highlighting examples of such successes within certain groups as models for other groups to follow. At the same time, the instructor should encourage students to take on an active role in regulating their own group activities and taking ownership of the Jigsaw activities.

Our mixed findings suggest that, although cooperative learning could indeed occur in an online environment and Jigsaw may be one viable approach for making that happen, the broader context of the course's design, contents, schedule, and reliance upon CMC produce unique challenges. Although the design of this study prohibits generalizations beyond its specific context, it does suggest some possible complexities that may arise in similar contexts and how to mitigate them. Further research is required to provide insight and deeper understanding of the role of Jigsaws

and other cooperative methods within online learning environments. Subsequent studies of similar courses and activities that apply the lessons learned from the current study would help substantiate and flesh out these findings.

REFERENCES

- Aronson, E., & Patnoe, S. (1997). *The Jigsaw classroom: Building cooperation in the classroom* (2nd ed.). New York: Longman.
- Aronson, E., Stephan, C., Sikes, J., & Snapp, M. (1978). *The Jigsaw classroom*. Beverly Hills, CA: Sage.
- Auerbach, C. F., & Silverstein, L. B. (2003). *Qualitative data: An introduction to coding and analysis*. New York: New York University Press.
- Aviv, R., Elrich, Z., & Ravid, G. (2004). Design and architecture of collaborative online communities: A quantitative analysis. In M. Crawford & M. R. Simonson (Eds.), *2004 annual proceedings—Chicago of selected research and development presentations at the National Convention of the Association for Educational Communications and Technology* (Vol. 1, pp. 59-72). North Miami Beach, FL: Nova Southeastern University.
- Barkley, E. F., Cross, K. P., & Major, C. H. (2005). *Collaborative learning techniques: A handbook for college faculty*. San Francisco: Jossey-Bass.
- Brignall, T. W., III, & Valey, T. V. (2005). The impact of Internet communications on social interaction. *Sociological Spectrum*, 25, 335-348.
- Brown, R. (2001). The process of community-building in distance learning classes. *Journal of Asynchronous Learning Networks*, 5(2), 18-35.
- Bruffee, K. A. (1999). *Collaborative learning: Higher education, interdependence, and the authority of knowledge* (2nd ed.). Baltimore: John Hopkins University.
- Cooper, J. L., Robinson, P., & McKinney, M. (1994). Cooperative learning in the classroom. In D. F. Halpern & Associates (Eds.), *Changing college classrooms* (pp. 74-92). San Francisco: Jossey-Bass.
- Fisher, M., Thompson, G. S., & Silverberg, D. A. (2004). Effective group dynamics in e-learning: Case study. *Journal of Educational Technology Systems*, 33, 205-222.
- Ingram, K. W., Conley, C., McDonald, S., Parker, V., & Rivers, J. (2003). *What factors affect the*

- way teams interact in an on-line graduate course? Mobile, AL: University of South Alabama. (ERIC Document Reproduction Service No. ED482681)
- Jeong, A. C. (2004). The effects of communication style and message function in triggering responses and critical discussion in computer-supported collaborative argumentation. In M. Crawford & M. R. Simonson (Eds.), *2004 annual proceedings—Chicago of selected research and development presentations at the National Convention of the Association for Educational Communications and Technology* (Vol. 1, pp. 394-403). North Miami Beach, FL: Nova Southeastern University.
- Johnson, D. W., Johnson, R. T., Holubec, E. J., & Roy, P. (1984). *Circles of learning: Cooperation in the classroom*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Johnson, D. W., Johnson, R.T., & Smith, K. A. (1998). *Active learning: Cooperation in the college classroom*. Edina, MN: Interaction Book.
- Joung, S., & Keller, J. M. (2004). The effects of high-structure cooperative versus collaborative design of decision change, critical thinking, and interaction pattern during online debate. In M. Crawford & M. R. Simonson (Eds.), *2004 annual proceedings—Chicago of selected research and development presentations at the National Convention of the Association for Educational Communications and Technology* (Vol. 1, pp. 316-320). North Miami Beach, FL: Nova Southeastern University.
- Mann, C., & Stewart, F. (2000). *Internet communication and qualitative research: A handbook for researching online*. Thousand Oaks, CA: SAGE.
- Maxwell, J. A. (1996) *Qualitative research design: An interactive approach*. Thousand Oaks, CA: SAGE.
- Merriam, S. B. (1998) *Qualitative research and case study applications in education*. San Francisco: Jossey-Bass.
- Mills, B. J., & Cottell, P. G., Jr. (1998). *Cooperative learning for higher education faculty*. Phoenix, AZ: Oryx Press.
- Patton, M. Q. (2002). *Qualitative research and evaluation methods* (3rd ed.). Thousand Oaks, CA: SAGE.
- Rose, M.A. (2004). Comparing productive online dialogue in two group styles: Cooperative and collaborative. *The American Journal of Distance Education*, 18(2), 73-88.
- Schaeffer, R. S., & Cates, W. M. (1996). Cooperative software for the Internet. In M. R. Simonson, M. Hays, & S. Hall (Eds.), *Proceedings of selected research and development presentations at the 1996 National Convention of the Association for Educational Communications and Technology* (pp. 674-682). Ames: Iowa State University.
- Slavin, R. E. (1991) Synthesis of research on cooperative learning. *Educational Leadership*, 48(5), 71-82.
- Smith, B. L., & MacGregor, J. T. (1992). What is collaborative learning? In A. Goodsell, M. Mahler, V. Tinto, B. L. Smith, & J. MacGregor (Eds.), *Collaborative learning: A sourcebook for higher education* (pp. 9-22). University Park, PA: National Center on Postsecondary Teaching, Learning, and Assessment.