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The Effects of Cooperative and Collaborative Strategies on Student Achievement and Satisfaction in Blended and Online Learning Environments

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by

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ABSTRACT

THE EFFECTS OF COOPERATIVE AND COLLABORATIVE STRATEGIES ON STUDENT ACHIEVEMENT AND SATISFACTION IN BLENDED AND ONLINE LEARNING ENVIRONMENTS

by
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Darden School of Education
Old Dominion University, 2010
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The purpose of this study was to examine whether cooperative versus collaborative strategies used for a group project had differential effects on students' achievement, process and solution satisfaction, value and preference for collaboration, and perceptions of community of inquiry in online and blended environments. The study sample consisted of teacher education students enrolled in a technology integration course. Students' age, academic level, online experience, and teaching experience were used as covariates in an effort to identify differential effects associated with student characteristics. Cooperative and collaborative strategies were differentiated by the amount of structure imposed by the instructor as well as the design of the group-based and activity. Cooperative strategies were characterized as highly structured, with assigned roles and scaffolding of teamwork skills and group processing, Collaborative strategies were characterized as less structured, meaning that groups were be encouraged to take on specific roles or divide the task. Additionally, teamwork skills and group processing were scaffolded. Statistical procedures that were employed included a factorial ANCOVAs and factorial MANCOVAs.

The findings show that cooperative and collaborative learning strategies are equally effective in online and blended environments in regard to individual achievement, but cooperative strategies are less effective with regard to group achievement. Student satisfaction with the group process and solution did not differ according to course delivery method or learning strategy. Student perceptions of social presence and cognitive presence did not differ according to course delivery method or learning strategy, but teaching presence differed significantly by course delivery method. Of particular note was the finding that blended cooperative students had lower perceptions of the design and organization of the instruction in comparison to the other treatment groups, a result that mirrors the results found for group project grades.

Richard Overbaugh (Director)

Shana Pribesh (Member)

Terrell Perry (Member)

DEDICATION

To my wonderful husband, Rick Nickel. When I was unsure if I was capable of completing a PhD program, you never once questioned whether it was possible. Once I began writing my dissertation, only a few times did you ask, "Aren't you done with that thing yet?". Without your support I could not have accomplished my goal. I love you with all of my heart.

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Chapter I: Introduction to the Study

Introduction

Individuals are social beings. Even the most hermit-like curmudgeon still needs others on occasion. From this basic human need comes Dewey's position that education is both a psychological and a social process (1897) and that "if we eliminate the social factor...we are left only with an abstraction" (para. 7). We learn by interacting with others.

While it has been established that learning is, at least in part, a social process, the question still remains: How should group activities be designed so that students learn efficiently and effectively? And because students' attitudes and contentment with their learning can have an influence on achievement, how should group learning be designed so that students are satisfied and will want to work with others again? Should group work be more structured and cooperative or should students be given more control and work collaboratively? And what about when the learning activity is delivered partially or completely online? Such complex questions would make anyone want to join the hermit in his cave dwelling!

Cooperative and collaborative learning, based on Deweyan and social constructivist concepts, were popular in different forms throughout the 20th century and have gained new interest with the increased use of online and blended (a mixture of online and face-to-face learning) learning in higher education. While cooperative and collaborative learning have been found to enhance learner achievement and satisfaction (Cuseo, 1992; Emerson & Mosteller, 2004a; D. W. Johnson & R. T. Johnson, 1994; Johnson & Johnson, 2004; Johnson, Johnson, & Smith, 2007; Springer, Donovan, & Stanne, 1999; Susman, 1998), few empirical studies have compared these instructional strategies and even fewer have investigated

differences within blended and online environments. Research in this area is important because instructional designers and instructors must consider what instructional strategies work best in different course delivery modes. Furthermore, higher education institutions are concerned about student retention, which may be influenced by achievement and satisfaction.

Important factors for consideration in the design, development, and analysis of cooperative or collaborative blended/online activities are student achievement, student satisfaction, and student preferences and perceptions of group work. This study was designed to help inform the instructional design field by examining the differing structured approaches of cooperative and collaborative learning and the differing blended and online learning delivery modes and their resulting effects on student achievement, satisfaction, attitudes about and value of collaboration, and perceptions of community of inquiry.

Background

The advent of the information age has caused industry to call for employees who can work in a team to solve complex problems and build knowledge (Kagan, 1994; Tan, Hung, & Scardamalia, 2006). As a result, schools are beginning to require that their incoming teachers know how to design and implement group activities and projects (Cohen, Brody, & Sapon-Shevin, 2004). Institutions of higher education are also beginning to push collaboration as a way to promote critical thinking skills and become more learner-focused. Instructional designers and educators have been presented with the task of designing and developing effective group activities, yet research is mixed in regards to what types of approaches are the most successful in various contexts. For example, more structured approaches may be more appropriate for certain tasks and audiences, while less structured methods may be more

suitable for others. The increasing adoption of blended and online learning courses by universities makes design issues even more complicated (Bonk & Graham, 2006; Garrison & Kanuka, 2004).

Although there is not an agreed upon definition for either term, a distinction can be made between cooperative and collaborative learning based on the amount of structure and facilitator control designed into the group activity. Cooperative activities are more structured, in terms of assigned roles and tasks, while collaborative activities give more control to the learner (Bruffee, 1999; Emerson & Mosteller, 2004a, 2004b). While empirical research has found evidence of higher effectiveness and satisfaction in cooperative and collaborative learning in comparison to individual learning (Johnson, Johnson, & Stanne, 2000; Lou, Abrami, & d'Apollonia, 2001; Lou, Abrami, & Spence, 2000; Springer, Donovan, & Stanne, 1999), there is a paucity of research comparing the effects of cooperative and collaborative learning on achievement, student preferences, and student satisfaction. Similarly, few studies have compared learning outcomes or satisfaction between students enrolled in blended and online courses (Lim, Morris, & Kupritz, 2006).

Achievement

An important factor in determining the effectiveness of an learning strategy or delivery method is the resulting group and individual grades. Few studies have compared group or individual grades between cooperative and collaborative strategies and the little research available provides mixed results. Structured, cooperative activities where roles are assigned may promote group cohesion (Rose, 2002) and perceptions of learning and efficiency (Strijbos, Martens, Jochems, & Broers, 2004). Structured activities may positively

influence achievement (Cavalier, Klein, & Cavalier, 1995), although the impact of assigned roles on group and individual grades is debatable (Klein & Doran, 1999; Rose, 2004; Schellens, Van Keer, & Valcke, 2005). On the other hand, research shows that unstructured, collaborative activities may result in significantly more cognitive interactions and elaboration (Brewer & Klein, 2006), and ultimately influence achievement. Such contradictory results suggest that other factors, such as type of task, may also play an important part in student achievement. Low level skill acquisition may be helped by more structure whereas higher-level learning may be most effective in less structured activities (Cohen, 1994; Joung & Keller, 2004), but again, research results vary (Cavalier, et al., 1995). Moreover, the learning strategies and delivery methods may impact group project grades and individual quiz grades in different ways (Lou, et al., 2001).

Satisfaction

Another important factor in the design of cooperative and collaborative activities and blended and online learning is student satisfaction. Due to differences in group structure and the associated benefits and constraints, satisfaction may differ according to group learning strategy. Yet, research is limited in this area. Additionally, few studies have investigated differences in satisfaction between blended learning students and fully online students. Blended learners may benefit from the verbal and nonverbal cues gained from occasional face-to-face meetings with classmates and may understand subtle nuances in conversation that could be confusing online (Warkentin, Sayeed, & Hightower, 1997). Confusion between group members in the online environment can lead to higher levels of dissatisfaction (Piccoli, Ahmad, & Ives, 2001; Priluck, 2004; Rivera, McAlister, & Rice, 2002; Warkentin, et al.),

although many well-designed courses have found equivalent satisfaction between online and face-to-face counterparts (Fredericksen, Pickett, Shea, Pelz, & Swan, 2000; McFarland & Hamilton, 2005; Olaniran, 1996; Overbaugh & Nickel, 2008; Paul, 2001; Stizman, Kraiger, Stewart, & Wisher, 2006; Woo & Kimmick, 2000; Zhang, Zhao, Zhou, & Nunamaker, 2004).

Numerous studies have measured student satisfaction in traditional, distance, and online learning, yet results are somewhat ambiguous in regards to elements of the learning process that are less satisfying (Thompson & Coovert, 2003). Additionally, student demographics, online experience, teaching experience, and pre-treatment attitudes about collaboration may all influence satisfaction with the process and solution. Factors that may influence student satisfaction can be more specifically defined when satisfaction with a group process during a learning activity and satisfaction with the outcome of the activity are examined separately (Ocker & Yaverbaum, 1999; Thompson & Coovert, 2003), something that has not been widely performed in the research literature. By distinguishing process and outcome satisfaction, inconsistencies in research may be resolved (Mejias, 2007).

Preference for Collaboration

The higher demand and broader use of teamwork in education confirm the importance of investigating students' values and preferences for collaboration. While some students have positive attitudes regarding collaboration (Brewer, Klein, & Mann, 2003; Dewiyanti, Brand-Gruwel, Jochems, & Broers, 2007; Kitchen & McDougall, 1998), other students prefer to work individually and may not acknowledge the potential benefits of working with others (Hillard, 2006; Kitchen & McDougall, 1998; Klein & Doran, 1999; Uribe, Klein, & Sullivan, 2003). Still other students seem to be ambivalent about collaboration (Overbaugh & Nickel,

2008). Differing affiliation motives, time constraints, the context of the activity, and fears of lazy group mates may influence attitudes (Brewer, et al., 2003; Fortune, Shifflett, & Sibley, 2006; Graham & Misanchuk, 2004) and instructional designers and instructors need to be aware of these factors. Students' pre-treatment attitudes about collaboration may influence achievement and satisfaction (Ocker & Yaverbaum, 2001; Williams, Duray, & Reddy, 2006), while post-treatment attitudes may serve as a sign of potential successes or failures in group process. In order to better understand the factors surrounding learning and satisfaction in cooperative and collaborative activities, examination of students' value and preference for collaboration/cooperation is essential.

Perceptions of Community of Inquiry

Measures of achievement, satisfaction and attitudes may not paint the whole picture in comparing the group dynamics of cooperation and collaboration. Indeed, measures of achievement may not be sensitive enough to measure retention of knowledge or critical thinking. Supplemental measures, such as the Community of Inquiry (CoI) framework, can help identify the progress of social dynamics and higher level learning in communities of inquiry while accounting for variance in design and instructor facilitation. The framework identifies three essential elements to a successful higher education experience, cognitive presence, teaching presence, and social presence, and utilizes them as mutual support for assessing asynchronous online interaction and learning strategies (Ice, 2008; Shea, Fredericksen, Pickett, & Pelz, 2004). Student perceptions of social presence are likely to correlate to learning outcomes and satisfaction (Arbaugh, 2005; Williams, et al., 2006). The degree of discourse facilitation performed by the instructor as well as the design of the

activity can be an important factor in reaching higher levels of cognitive presence (Murphy, 2004). In some instances, instructors may have to provide more guidance and structure (Arbaugh, 2007), meaning a more cooperative and less collaborative approach. In the current study, the lack of direct instructor facilitation in the collaborative group may affect students' perceptions of cognitive presence and potentially influence achievement.

Given the complexities of the internal dynamics of each of the three presences, as well as their interdependencies (Akyol & Garrison, 2008), understanding the three presences as they relate to cooperative and collaborative learning, as well as how they relate to blended and online learning, is valuable in terms of evaluating the effectiveness of the instructional strategies in the two course delivery modes.

Summary

At the beginning of this study it was unclear whether cooperative and collaborative learning strategies would differentially affect cognitive or affective outcomes in the context of the course under study. Moreover, although technology is considered a mere vehicle and is not supposed to enhance learning (Clark, 1983), it was posited that certain learning strategies may be more effective in one course delivery method than another. This study investigated whether the different structures and levels of control associated with cooperative and collaborative learning and the differing levels and types of interaction associated with blended and online learning had a differential effect on group achievement, individual achievement, group process satisfaction, and group solution satisfaction. Examination of student attitudes toward collaboration and perceptions of community of inquiry helped to better inform the data analysis.

Definition of Terms

Collaborative Learning is defined as "the mutual engagement of participants in a coordinated effort to solve the problem together" (Roschelle & Teasley, 1995, p. 70). Collaborative activities are characterized by learners completing the group task and constructing meaning together through dialogue and negotiation (Garrison, Anderson, & Archer, 2000a; Paulus, 2005b). Compared to cooperative learning, collaborative learning is relatively unstructured, neither requiring nor encouraging a division of labor.

Cooperative Learning is defined as students working together to "attain group goals that cannot be obtained by working alone or competitively" (Johnson, Johnson, & Holubec, 1986). The defining characteristics of cooperative learning are positive role interdependence, meaning that group members take on specific roles and divide the labor accordingly, and scaffolding of teamwork skills and group processing.

Project-Based Learning is defined as "a systematic teaching method that engages students in learning knowledge and skills through an extended inquiry process structured around complex, authentic questions and carefully designed products and tasks" (Markham, Mergendoller, Larmer, & Ravitz, 2003, para. 7).

Online Learning is defined as instruction delivered on the computer by way of the Internet (Clark & Mayer, 2008). Online instruction is generally delivered asynchronously but can also be delivered synchronously.

Blended learning is the planned, pedagogical integration of the strengths of face-to-face learning experiences (verbal and nonverbal communication) with the strengths of online

learning (text-based communication and internet resources) (Garrison & Kanuka, 2004; Vaughan & Garrison, 2005; Vignare, 2007).

Purpose of the Study

The purpose of this study was to examine whether a short-term project utilizing cooperative and collaborative strategies had differential effects on students' individual and group achievement, process and solution satisfaction, value and preference for collaboration, and perceptions of community of inquiry. Students' age, gender, academic level, online experience, teaching status and teaching experience were used as covariates in an effort to identify differential effects associated with student characteristics. Cooperative and collaborative strategies were differentiated by the amount of structure imposed by the instructor and by the design of the group-based activity. Cooperative strategies were characterized as highly structured, with assigned roles and scaffolding of teamwork skills and group processing, Collaborative strategies were characterized as less structured, meaning that groups were encouraged to work together on the project as a whole and were not encouraged to take on roles or divide the task. Additionally, teamwork skills and group processing were not scaffolded in the collaborative treatment.

Research Questions

Four major research questions were examined.

Within subjects:

1. Do learning strategy (collaborative vs. cooperative) and course delivery method (online vs. blended) differentially impact students' group grades and individual assessment grades (assessed after the group project)?

2. Do learning strategy (cooperative vs. collaborative) and course delivery method (online vs. blended) differentially impact students' attitude toward collaboration?

Between Subjects:

3. Do learning strategy (collaborative vs. cooperative) and course delivery method (online vs. blended) differentially impact students' satisfaction scores?
4. Do learning strategy (collaborative vs. cooperative) and course delivery method (online vs. blended) differentially impact students' perceptions of teaching presence, social presence, and cognitive presence in the project-based learning activity?

Significance of the Study

Cooperative and collaborative learning have been identified as best practices in K-12 and higher education. Moreover, theorists and practitioners promote the potential advantages of collaborating or cooperating online or in a blended learning environment. Yet little has been written about when to use cooperative strategies and when to use collaborative strategies, particularly in web-based higher education, leaving instructional designers and educators to venture educated guesses as to what will be most effective.

Educational programs and institutions primarily measure effectiveness through grades and satisfaction surveys, although rarely at a course activity level. While cooperative strategies tend to take more effort on the part of the instructional designer and instructor than collaborative strategies, the level of structure might be more helpful to student groups working online. Furthermore, type of learning strategy may influence a student's satisfaction, which in turn may influence learning outcomes as well as future participation in group work. The costs and benefits of the level of structure and facilitation on learning and satisfaction must be carefully weighed, a task that requires examining other influential factors, such as

student characteristics and pre-treatment attitudes, as well as investigating other indications of group problem-solving differences, such as perceptions of the community of inquiry and group structure.

The primary goal of this study was to add to the instructional design research literature in regard to the impact of cooperative and collaborative learning and blended and online learning on student achievement, satisfaction, and perceptions of community of inquiry.

Overview of the Study

This study examined short-term cooperative and collaborative learning strategies in blended and online learning environments. The sample consisted of roughly 22 sections of ECI 430/530: PK-12 Instructional Technology, including 13 blended learning sections and nine online sections of the course, with approximately 389 students. The study investigated the influence of two independent variables, group learning strategy (cooperative or collaborative learning) and course delivery method (blended or online learning). Six outcome variables important to instructional design theory and practice were included: individual and group achievement, process and solution satisfaction, attitudes about collaboration, and perceptions of community of inquiry. To account for student differences, student age, ethnicity, gender, online experience, and teaching experience were used as covariates in the data analysis.

Chapter II: Review of the Literature

Introduction

Empirical and anecdotal evidence support the idea that in many contexts group work is more effective than individual study in regard to cognitive and affective factors. Two forms of group work, cooperative learning and collaborative learning, support group interdependence, a concept based on social constructivist theory. Positive group interdependence promotes working together to maximize goals or outcomes and empowers people to achieve difficult goals or solve complex problems (Johnson & Johnson, 2003). Research examining the differences between cooperation and collaboration is not only of interest in the educational realm, but is also relevant to industry, where the need for social skills and ability to work in teams is on the increase. Moreover, differences in relation to the structure of cooperative and collaborative learning, as well as their delivery in computer-mediated environments, are hot topics in the instructional design realm, where instructional designers and instructors strive to balance learning effectiveness and student satisfaction when developing and implementing a course. Research in regard to achievement outcomes, student satisfaction, student attitudes, and student perceptions will benefit the course used in this study and may potentially inform instructional design best practices.

Industry. Industry leaders have clearly expressed that they want today's students (tomorrow's employees) to be able to work collaboratively. A transition from the industrial era to an information or knowledge economy has long been predicted (Drucker, 1966) and the largest growing segment of our economy is becoming information-based (Kagan, 1994). The most successful people in tomorrow's job market are likely to be those who are not only knowledgeable about content, but are flexible and have a variety of social skills (Kagan).

Among the skills established by the National Institute of Literacy and the U.S. Department of Labor as necessary for success in work, social and family lives are: communication skills, interpersonal skills, and sociability (Stein, 2000; Whetzel, 1992). These necessary skills are exemplified in current industry practices, including Total Quality Management methods that incorporate cooperation and interdependent teams working on complex problems (Kagan, 1994; Millis & Cottell; 1998). Since collaboration seems to be a desired and often necessary skill in today's and tomorrow's workforce, schools need to teach students how to work interdependently and think critically in order to solve ill-structured problems. To successfully train primary, secondary and post-secondary students to work together, pre-service teachers need to understand and experience the value of cooperative and collaborative learning.

Preparing for future classrooms. Within the last two decades cooperative learning has been recognized as a best practice. The acknowledgement of the potential impact of cooperative learning may be due to calls for change from industry (Kagan, 1994; Millis & Cottell, 1998; Stein, 2000; Whetzel, 1992), the increasing diversity within public school populations that has necessitated more flexible teaching and learning methods (Cuseo, 1992; Millis & Cottell, 1998; Snyder, 2007) or the paradigm shift in education from an instructional focus to a more learning focus (Millis & Cottell). No matter the cause, school districts expect new teachers to be comfortable with the concepts and application of cooperative and collaborative learning in the classroom (Cohen, et al., 2004). Furthermore, teaching has changed from a more individualistic position to one where everyone is expected to work collaboratively as part of a school team. Yet, if pre-service teachers do not fully understand the principles behind cooperative and collaborative learning, they are likely to not use those principles correctly or they may give up on

the instructional strategies when they have any difficulties in their future classrooms (Brody & Nagel, 2004). Therefore preservice teachers have to be able to practice cooperative learning as part of a team, as well as be able to plan and facilitate it in their classroom.

Another benefit to investigating cooperative and collaborative learning is the gains such investigations can have on instructional design pedagogy and best practices. While use of cooperation or collaboration in higher education courses has been found to increase motivation, critical thinking skills, and achievement (Johnson & Johnson, 2004), the ways cooperation or collaboration are utilized, how strategies are delivered, and the effects of using one or both of these strategies are important issues to study, potentially resulting in new best practices.

Instructional Design. The Sloan Consortium has developed principles (or pillars) to ensure quality in online learning. The two pillars that relate to the present study are Learning Effectiveness and Student Satisfaction (Moore, 2002). These pillars are interdependent and act as goals toward improving the quality, breadth and scale of online education and making "education a part of everyday life, accessible and affordable for anyone, anywhere, at any time, in a wide variety of disciplines" (The Sloan Consortium, n.d., para. 2).

Learning effectiveness. The goal of Sloan-C's Learning effectiveness pillar is to demonstrate that online learning has at least the same level of quality as an institution's traditional face-to-face classes (Moore, 2002). One can presume that equivalent quality in blended learning and online learning would also be important. While studies show that delivery method does not enhance learning (Clark, 1983), learning strategy, in this case cooperative or collaborative learning, may be a moderating factor in learning effectiveness. Additionally, different types of assessments of learning may have different outcomes. For example, group project grades and individual grades may differ between delivery modes or instructional

strategies, leading to speculation that certain delivery modes and instructional strategies are better for promoting learning. The present study sought to examine online and blended learning, with the goal to ensure that the quality of student learning is equivalent in both delivery modes. Therefore learning effectiveness, or achievement, was assessed via group project work and individual quiz grades.

Student Satisfaction. Student perceptions of the elements of a community of inquiry – cognitive presence, social presence and teaching presence – may relate to students' perceived learning (Swan, 2002) and their level of satisfaction. The goal of Sloan-C's student satisfaction pillar is for students to be pleased with their learning experiences online, including student-to-student and student-to-instructor interaction, matching expectations with learning outcomes, and providing support services (Moore, 2002). Because preservice teachers are expected to know how to implement learning in their future careers, it makes practical sense to examine experiential instructional strategies which result in the highest levels of satisfaction as well as leave students with an understanding of the potential value of collaboration. While there are a multitude of metrics for student satisfaction in the research literature, many of the metrics investigate satisfaction from a general level, the results of which tell little about students' satisfaction with group process and satisfaction. Therefore this study investigated satisfaction as it related to the processes in which students engaged to complete group assignments. Moreover, this study examined student attitudes and preferences regarding collaboration as they related to the other dependent variables.

Rationale for the Study and Design of Instruction

The course used in this study, ECI 430/530: PK-12 Instructional Technology, included a module that covers the foundations of cooperative learning and project-based learning. The

module was re-designed to enable pre-service teachers to experience cooperative, collaborative and project-based learning as they learned by developing a cooperative, project-based lesson plan. The goal of introducing an authentic cooperative or collaborative activity was to facilitate better understanding of the principles behind the strategies as well as promote the use of cooperative strategies in pre-service teachers' future classrooms. Furthermore, investigating the effectiveness of using cooperative or collaborative strategies in this course, with regard to achievement, satisfaction, value of collaboration and perceptions of community of inquiry, may inform course designers and instructors of the effectiveness of cooperative and collaborative learning strategies in blended and online learning environments.

Theoretical Foundations

To have an understanding of collaborative and cooperative learning, one must first understand the theoretical foundations of these instructional strategies. One of the four attributes of a quality education is that it is community centered (Bransford, Brown, & Cocking, 2000), emphasizing the importance of learning "through social and peer interaction that is centered in the learning community" (Anderson, 2004, p. 240). Both cooperative and collaborative learning are based on the concept that humans create meaning within our communities (Shea, 2006) and that these relationships are significant to "welfare, achievement, and mastery" within an educational environment (Bruffee, 1999, p. 83). Proponents of these instructional strategies also claim that effective instruction goes beyond simple interaction and requires learners to share their experiences in order to negotiate and construct meaning (Garrison, et al., 2000a), an act some term "constructive conversation" (Bruffee). Research on collaborative and cooperative learning has been guided by theories of social constructivism and social interdependence (Johnson & Johnson, 1996). The Community of Inquiry model (Garrison, Anderson, & Archer)

has guided much of the current research on critical discourse and collaboration in online learning.

Social Constructivism. The social constructivist perspective is based on the work of Vygotsky (1978b), who theorized that knowledge is socially constructed through cooperative or collaborative groups working together to understand and solve problems (Johnson & Johnson, 1996; Slavin, 1995). Social constructivist theorists examine how social discourse and interaction help people construct and define their knowledge (Sharma, Xie, Hsieh, Hsieh, & Yoo, 2008). A central premise of Vygotsky's theories is the concept of the zone of proximal development (Lopez Islas, 2004), defined as the "distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined by problem solving...with more capable peers" (Vygotsky, 1978a). Bruffee (1999) simplifies the concept by defining the process as "understanding that lies beyond current knowledge and ability: what we cannot learn on our own at the moment, but can learn with a little help from our friends" (p. 37). The concept of a zone of proximal development is particularly important for instructors or instructional designers who are planning on using cooperative or collaborative instructional strategies because, to be effective, the assigned activity must be above the skill level of the individual but still accomplishable by a group of peers.

Social constructivism also focuses on the shared context and culture in which learning occurs (Bereiter, 1994; Roschelle & Teasley, 1995), since it is not possible to dissociate a learner from social influences (Palincsar, 1998; Schunk, 2008). Vygotsky theorized that language and signs mediate learning, and that dialogue and discussion, in particular, promote cognitive development (Palincsar, 1998; Sharma, et al., 2008). The essence of Vygotsky's theory is that "Human thinking develops through the mediation of others" (Moll, 2001). The current study

investigates students' achievement, satisfaction, and perceptions of community of inquiry based on contextual factors (course delivery method and learning strategy).

Social Interdependence Theory. Formulated by Morton Deutsch in the 1940s, Social Interdependence theory focuses on relational concepts between individuals and "views cooperation as a result of positive interdependence among individuals' goals"(Johnson, Johnson, & Smith, 1998b) (Johnson, et al., 1998b, p. 10). The theory's basic premise is that the way interdependence is structured influences interaction, which thereby determines the outcome of the activity (Johnson, Johnson, & Smith, 2007). Interdependence can be positive, resulting in cooperation; negative, resulting in competition; or non-existent, resulting in individualistic efforts (Johnson, et al., 1998b). Positive interdependence results in self-interest expanding to mutual interest through "an emotional investment in achieving goals...and though an openness to being influenced so that joint efforts are more effective" (Johnson, et al., 2007, p. 17). Group members are socially interdependent if they share common goals and each individual's success is dependent on the others'.

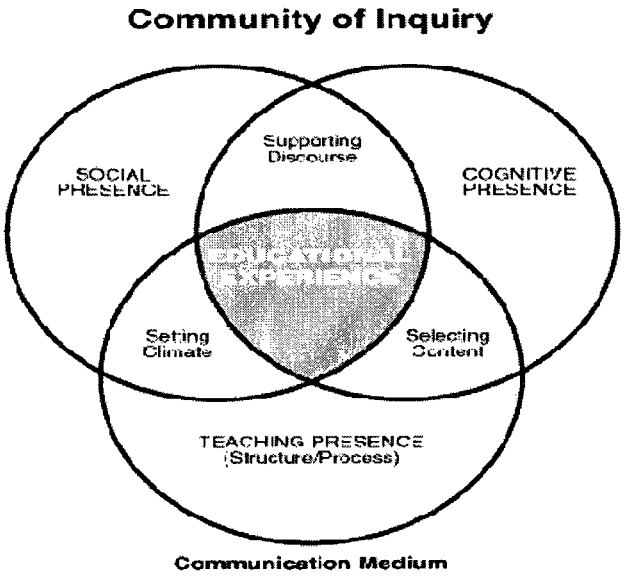
The concept of positive interdependence is central to both cooperative and collaborative learning, although it is mentioned most often in the cooperative learning literature. Social interdependence theory has been extensively examined and is thought to have a broad generalizability (Johnson & Johnson, 1996).

The Community of Inquiry Model. Taken from the practice of scientific inquiry, the term "community of inquiry" has broadened to include the classroom (physical or virtual), where students build upon each other's ideas, challenge one another's reasoning, help each other draw inferences, and work to discover each other's assumptions (Lipman, 2003). A community of

inquiry is characterized by its objective to generate a solution, judgment or product, its sense of direction (moving in line with the argument), and its structured dialogue (Lipman).

Contemporary research within instructional technology has focused on effective strategies and models for interaction and collaboration in online learning environments. Garrison, Anderson and Archer's (2000a) Community of Inquiry model (see Figure 1) identifies three essential elements to a successful higher education experience: cognitive presence, teaching presence, and social presence. This model of critical thinking and inquiry utilizes the three essential elements as mutual support for assessing asynchronous online interaction (Shea, et al., 2004) and assumes that learning occurs through the interaction of the three essential elements (Rourke, Anderson, Garrison, & Archer, 1999). The model is socio-constructivist in nature and suggests that well designed learning materials are only part of the equation to successful online learning – human interaction and instructional guidance are also needed (Ice, Kupczynski, & Mitchell, 2008). The community of inquiry model is important when studying cooperation and collaboration, because it hypothesizes that, while the process of cognition is central to collaborative work (Lopez Islas, 2004), effective collaboration also encompasses the presence of social and teaching elements.

Figure 1: Community of Inquiry Model



Cognitive presence, defined as the "extent to which participants in a community of inquiry are able to construct meaning through sustained communication" (Garrison, et al., 2000a, p. 89), reflection, and discourse (Ice, et al., 2008), embodies the process of higher-order thinking and learning (Garrison & Anderson, 2003). The "sustained communication" involves critical analysis of group members' experience and knowledge, along with the subject matter being studied, through students questioning and challenging each others' assumptions (Garrison, Anderson, & Archer, 2001). Cognitive presence is the model element that "is most basic to success in higher education"(Garrison, et al., 2000a, p. 89), because it's outcome, the construction of meaning, is measured via course assessments. The other two elements, teaching presence and social presence, act as vital support for cognitive presence, by facilitating the critical thinking process (Garrison, et al., 2000a).

Teaching presence refers to the design of a course and the facilitation of communication within the course (Garrison, 2006). The teaching presence construct consists of three

components: (1) instructional design and course organization, (2) discourse facilitation, and (3) direct instruction (Shea, Pickett, & Pelz, 2003). All three components of teaching presence have been found to correlate highly with student satisfaction, an important focus in the current research study. Furthermore, teacher feedback has been found to correlate with higher achievement (Akyol & Garrison, 2008). Without a thoughtful design and proper facilitation, higher level learning and collaboration is less likely to be successful (Garrison, et al., 2000a; Garrison & Cleveland-Innes, 2005).

Social presence is interpreted as the ability of learning community members to project their personal characteristics and to connect with others socially and emotionally (Garrison, 2006; Ice, et al., 2008). This element of the community of inquiry functions as a support for the cognitive (critical thinking) and affective (student engagement and intrinsic motivation) goals of learning (Rourke, et al., 1999). While interaction is characterized by making a comment or posting in a course or group discussion, social presence is described as feeling part of a group. The difference between interaction and social presence is that a learner can make a contribution to a discussion without feeling like part of the group (Picciano, 2002). Similarly, a student's attendance in a traditional classroom does not automatically indicate that he or she feels a sense of belonging to the classroom community. When motivation or other affective goals are important in an online course, social presence directly contributes to the success of the educational experience (Garrison, et al., 2000a). The amount of social presence perceived by students in their online class has been found to be directly related to the students' perceived learning (Richardson & Swan, 2003). Social presence supports cognitive presence just as interaction with group members supports negotiation of meaning (Garrison, et al., 2000a).

This study utilized the Community of Inquiry Student survey (Arbaugh, et al., 2007a) to investigate students' perceptions of cognitive, social and teaching presence within their cooperative or collaborative activity and thereby reveal the complex internal dynamics of each of the three presences as they occurred within the two instructional strategies. Discussion regarding the potential differences in cognitive, social and teaching presence between the two treatment groups is explored later in this paper.

Independent Variables

Collaborative and Cooperative Learning. The terms collaborative and cooperative learning have been used interchangeably in the research literature, perhaps because they both incorporate some similar assumptions, including:

- Learning should be active
- The teacher acts as a facilitator
- Students participate in small groups
- Students must take responsibility for their learning
- Students develop social skills through consensus building (Barkley, Cross, & Mayor, 2005; Kirschner, 2001).

While the strategies include some similar assumptions, they differ in important aspects. Yet interpreting the research literature is problematic because the terms have not been consistently defined conceptually or operationally (Cuseo, 1992; Dillenbourg, Baker, Blaye, & O'Malley, 1996; Underwood & Underwood, 1999). Brody and Nagel (2004) view collaborative learning as an umbrella term for cooperative learning strategies. A similar perspective regards cooperative learning as a more structured and focused form of collaborative learning (Millis & Cottell, 1998). While proponents of these positions provide valid reasoning for their conceptions of the terms, the rationale that cooperative learning is an adapted form of collaborative learning

makes investigating potential differences between the two strategies difficult to operationalize. Roschelle and Teasley (1995) make the following distinction between the terms:

> "Cooperative work is accomplished by the division of labour among participants, as an activity where each person is responsible for a portion of the problem solving" (p. 70). In contrast, collaborative work involves "the mutual engagement of participants in a coordinated effort to solve the problem together" (p. 70).

The view that cooperative and collaborative learning are similar but separate entities, also held by Bruffee (1999), Henri and Rigault (1996), and Hooper (1992) affords more options for investigation, which in turn allow practitioners to apply these principles appropriately.

Cooperative learning. Cooperative learning, defined as students working together to "attain group goals that cannot be obtained by working alone or competitively" (Johnson, Johnson, & Holubec, 1986), promotes the idea that students learn by working together and by being responsible for one another's learning as well as their own. The main purpose of cooperative learning is to actively involve students in the learning process by working toward a common goal (Slavin, 1985). In the 1970s and 1980s, cooperative learning proponents in primary schools set as their goals to help children learn to work together, to promote social integration and overcome racial biases (Bruffee, 1995). As research has persisted, the learning strategy has been recognized for its promotion of higher level thinking and pro-social behavior (Gillies & Ashman, 2003).

Structure of design. Cooperative learning methods are much more structured and systematic than collaborative strategies (Slavin, 1985). Indications of the high amount of structure involved in cooperative learning are found in what Johnson and Johnson (1991) call cooperative learning's five essential elements: (1) positive interdependence, (2) individual accountability, (3) promotive interaction, (4) teamwork skills, and (5) group processing. While

there are many forms of cooperative learning strategies available to instructors, most include these critical elements, which differentiate cooperative learning from other group learning activities.

Positive interdependence. In order for a group of students to feel connected and take ownership of their group project, the students must perceive that they are positively interdependent. A feeling of positive interdependence is the perception that members of a group are linked with each other so that they cannot succeed on the group task unless the others in the group succeed – each group member's work benefits the rest of the members (Johnson & Johnson, 1991). "Students must believe that they sink or swim together" (Johnson & Johnson, 2004, p.). Since students often do not automatically feel a connection with group mates, proponents of cooperative learning suggest that positive interdependence must be clearly structured by the instructor.

Positive interdependence structure consists of mutual dependence within the group in regard to goals and roles, and sometimes resources and rewards (Johnson, Johnson, & Smith, 1991). Positive goal interdependence is important for any type of teamwork, since to accomplish anything groups must agree upon a shared mutual goal (Johnson, et al., 1991). Role interdependence occurs when each student is assigned a role and task to complete (Curtis & Lawson, 2001; Johnson, et al., 1991). Some call this division of group work into tasks that can be completed independently and then combined near the end of the project as a "divide and conquer" strategy (Graham & Misanchuk, 2004). Yet others maintain that this approach helps students understand their part in relation to the project as a whole (Waggoner, 1992). Cooperative activities often also require group members to mutually depend on each other for resources to solve problems within a project, and may be structured to include group grades

(reward interdependence) (Bruffee, 1995; Johnson & Johnson, 1994b). The combination of goal interdependence and reward interdependence has been found to increase achievement over the use of goal interdependence alone (Johnson & Johnson, 1994b).

Individual accountability. While students in cooperative groups are meant to work together interdependently, students are also responsible for their own learning and achievements. A student must keep up with their own assigned tasks within the group so that they are an active participant in the learning process and not riding the coattails of the rest of the group. Individual accountability is important in cooperative activities because the purpose of cooperative learning is "to make each member a stronger individual in his or her own right. Students learn together so that they can subsequently perform better as individuals" (Johnson, et al., 1998b, p. 31). Individual accountability is promoted by the assessment of each individual's performance and by the group holding each member accountable for contributing their fair share (Emerson & Mosteller, 2004a; Johnson & Johnson, 1994b). By assessing each student's accomplishments in terms of quality and quantity, the instructor will ensure that students are contributing their own efforts toward group goals and also encouraging other group members to do the same (Johnson, et al., 1998b).

Promotive interaction. Positive interdependence results in promotive interaction, characterized as group members actively encouraging and assisting each other in their efforts to achieve group goals (Johnson, et al., 1991; Johnson & Johnson, 1994b). Characteristics of promotive interaction include mutual help, exchange of resources, personal support, praising others' efforts, respectfully challenging each other's reasoning, and personal commitment to members of the group (Johnson & Johnson, 1994a; Johnson, Johnson, & Smith, 1998a; Johnson & Johnson, 1994b). Group and individual accountability help ensure that students will strive to

interact effectively. Additionally, helping students to learn how to work effectively as a team will further promote positive group interaction.

Often proponents call for cooperative learning to be done face-to-face in order to facilitate high levels of promotive interaction. For example, Roger and David Johnson (1994b) maintain, "Although positive interdependence in and of itself may have some effect on outcomes, it is the face-to-face promotive interaction among individuals fostered by the positive inter-relationships, and psychological adjustment and social competence" (p. 3). When cooperative learning is set in a computer-mediated, asynchronous environment where nonverbal cues are not apparent, promotive interaction may be affected (Waggoner, 1992). Introducing scaffolding of teamwork skills within a cooperative, computer-mediated activity may reduce the impact of the lack of verbal and nonverbal cues. The current study investigated whether scaffolding structure had an impact on learning and affective outcomes.

Teamwork skills. Putting people into small groups and requiring them to cooperate does not guarantee that they have the ability to interact successfully. One of the essential concerns of cooperative learning is scaffolding of social and teamwork skills so that students will be able to cooperate productively (Curtis & Lawson, 2001). Because students have to simultaneously engage in "taskwork" and "teamwork", cooperative learning proponents believe that skills in leadership, decision-making and communication must be scaffolded (Johnson & Johnson, 1994a; Johnson, et al., 1998a). For example, instruction on how to be an "active listener" and how to criticize an idea without criticizing a person are frequently taught or modeled (Cooper & Mueck, 1990).Working in a computer-mediated environment may make learning and maintaining teamwork skills more complex (Waggoner, 1992).

Group processing. When groups are working on complex tasks, members need to communicate frequently about what is working well and what is not. Group processing takes place when members take time to discuss how well they are achieving group goals and how well they are communicating with one another (Johnson & Johnson, 1994a). By identifying helpful and unhelpful actions and deciding what actions can be taken to improve upon their group effectiveness (Johnson, et al., 1998a; Johnson, et al., 1991), group processing not only benefits a group's working relationship, but also helps members learn effective cooperative and communication skills, allows members to voice concerns, and helps students practice thinking in a metacognitive way (Johnson, et al., 1991). Furthermore, group processing can enhance future cooperative efforts (Hooper, 1992) and potentially impact post-test achievement (Yager, Johnson, Johnson, & Snider, 1986).

Group processing in a computer-mediated environment can be more complicated than in a traditional classroom because the instructor's timely intervention is crucial to its success. Instructors of computer-mediated groups may need different strategies for monitoring group processing (Waggoner, 1992) and communicate clear expectations regarding the purpose of group processing (Johnson & Johnson, 1994b), and students may have to be more diligent in completing their analysis of how the group is functioning.

Collaborative Learning. Collaborative learning is based on the concept that humans create meaning within our communities (Shea, 2006) and that formal educational activities should also be based on social learning. Collaborative learning in instruction goes beyond simple interaction and requires learners to share their experiences in order to negotiate and construct meanings (Garrison, et al., 2000a). Roschelle and Teasley (1995) define collaboration as "the mutual engagement of participants in a coordinated effort to solve the problem together" (p. 70).

Collaboration, in comparison to cooperation, is relatively unstructured, because division of labor is not required or encouraged. Instead, collaborative activities are characterized by learners completing the group task together through dialogue (Paulus, 2005b).

Like cooperative learning, collaborative learning requires positive goal interdependence and individual accountability, meaning that students see the value in working together in order to achieve a common goal and must take responsibility for their own efforts to benefit themselves and the group (Barkley, et al., 2005; Brandon & Hollingshead, 1999; Brewer & Klein, 2006). However, collaborative learning differs from cooperative learning in that role interdependence, a type of means interdependence (Brewer & Klein, 2006), is not emphasized nor encouraged. Collaborative groups require all members to participate and negotiate the solution to a problem (Kuech, 2004). Any division of labor is heterarchical, not hierarchical, meaning that tasks are equally important, are reliant on each other, and do not represent more authority than any other task regarding the final solution (Bruffee, 1999). All tasks require students to come back together to negotiate meaning (Cranton, 1996).

The differences between cooperative and collaborative learning. The main differences between cooperative and collaborative learning are characterized by how interaction and control within the activity are structured. Bruffee (1995) maintains that understanding these differences is crucial because "some of what collaborative-learning pedagogy recommends the teachers do tends in fact to undercut some of what cooperative learning might hope to accomplish, and vice versa." (p. 16). The attributes of the instructional strategies are discussed in more detail below.

Interaction. One distinction between cooperation and collaboration is based on interaction. While cooperative strategies often emphasize harmony, collaborative groups may just as often experience disagreement. This distinction can be illustrated through a comparison of

conversation and dialogue. Lipman (2003) differentiates between conversation and dialogue, both attributes of social interaction, by noting that conversation involves stability and reciprocity, while dialogue involves instability and disequilibrium. In a conversation, feelings and information are exchanged, but the conversation "does not move". Conversations are made up of shared values and experience. In contrast, a dialogue is compelled to move forward by the disequilibrium felt. Values and experiences are not necessarily shared by the whole group, and the goal is to negotiate meaning based on the different perspectives shared. According to Lipman, cooperation is typified by conversation, while collaboration is characterized by dialogue.

Collaborative and cooperative strategies also differ in that promotive interaction, teamwork skills, and group processing are not emphasized in collaborative learning. The differences stem from the emphases of the strategies. While the focus of cooperative learning is for learners to help one another to be successful in the learning activity and is structured by the instructor to ensure success (Emerson & Mosteller, 2004b), collaborative learning focuses on shifting control of learning to students and assumes that students have the teamwork skills and autonomy necessary to govern themselves and manage their group work (Millis & Cottell, 1998). "Collaborative learning teachers tend to trust college and university students to govern themselves in a context of substantive engagement, conversation, and negotiation. This emphasis on self-governance has its source in one of the important goals of collaborative learning: to help...adults acknowledge dissent and disagreement and cope with difference" (Bruffee, 1999, p. 99). Furthermore, the purpose of cooperative learning is to successfully co-investigate a topic and co-create an end product, while the goal of collaborative learning is to efficiently develop critically thinking students, even if that means that group discussions are controversial. The

assumption is that collaborative students will be able to manage their group in order to construct meaning based on differing views and ideas (Dillenbourg, et al., 1996; Matthews, 1996).

Control. Although there is less structure in collaborative learning activities than in cooperative learning, the instructor is still available for consultation. Small-group collaboration can range from moderate student control, where students are responsible for governing their interaction, to extreme student control, where students propose and negotiate their own problem, end product and assessment. Some level of student control encourages ownership of the collaboration process and the final product (Panitz, n.d.).

The nature and structuring of authority also differ between cooperative and collaborative learning strategies. University education promotes constructive resistance to authority – what the instructor "professes" should be subject to doubt (Bruffee, 1999). As such, the nature of authority, and the structuring of that authority, differs between cooperative and collaborative learning. In cooperative strategies, the teacher is still considered the authority and activities are structured to incorporate frequent facilitation from the instructor. For example, the instructor develops roles and subtasks that are assigned and completed individually before being combined for the final group product. During that process, the instructor often observes how well student groups are interacting and intervenes if necessary. In contrast, collaborative approaches give much of the authority for constructing knowledge to the members of student groups, meaning the responsibility for learning shifts from the instructor to the student (Bruffee) and the less structured design of the group activities reflect that shift. Proponents of collaborative learning believe that the short-term efficiency gained from assigning tasks based on individual skill or knowledge does not balance out the potential loss of students developing new skills (Kitchen & McDougall, 1998).

Different origins. While cooperative and collaborative approaches have similar goals, Bruffee (1995) asserts that the distinctions between the approaches originate from the different age groups for which the approaches were developed and the differing assumptions about the nature and authority of knowledge. According to Bruffee, cooperative learning was developed for primary and sometimes secondary school children, while collaborative learning is more appropriate for more mature learners. This position is based on the ideas of foundational and non-foundational knowledge. For example, in primary school students learn mostly foundational knowledge – the "socially justified beliefs" (Bruffee, 1999, p. 84) and basic practices of the knowledge community to which the student is acculturating. Therefore, a cooperative approach is most appropriate because the more structured strategy will help guide young learners and will also model social and teamwork skills. In colleges and universities, education is mostly nonfoundational in nature, because issues are more often addressed that require reasoning and have debatable solutions. Reasoning and debate require less instructor control and course structure, a characteristic of collaborative learning.

Bruffee (1995) maintains that problems may occur when cooperative and collaborative strategies are used for the wrong populations. For example, Bruffee maintains that cooperative learning is best used for populations who are learning mostly foundational, well-structured information (such as primary school students) while collaborative learning works best for populations constructing nonfoundational, or ill-structured, knowledge (such as university students). Yet this view has been criticized for its disregard for the potential efficiency more structured strategies may provide to the college classroom (Millis & Cottell, 1998). Therefore an investigation of both instructional strategies in a higher education setting is called for.

Research on cooperative and collaborative learning. Cooperative and collaborative learning are some of the most researched forms of student group work and have been established empirically as having a positive effect on numerous student outcome measures, including achievement, satisfaction, and social skill development (Cooper & Mueck, 1990; Cuseo, 1992). While cooperative learning has been well validated in numerous educational contexts, standing "as one of the strongest principles of social and organizational psychology" (Johnson & Johnson, 1994b, p. 6), research in cooperative learning is much more common for primary schools and face-to-face classrooms, and much less common in university and online contexts. Although cooperative learning research in colleges is a more recent phenomenon, current evidence indicates that college students can also experience educational gains from cooperative and collaborative learning (Emerson & Mosteller, 2004a). Collaborative learning research is more common in higher education settings and has also been found to positively impact achievement and satisfaction (Bruffee, 1999).

Cooperative and collaborative learning vs. individual learning. Literature reviews and meta-analyses have revealed the benefits cooperative and collaborative learning can have on achievement and attitudes in comparison to individual study or competitive strategies (Johnson, et al., 1998b; Springer, et al., 1999; Susman, 1998). Studies set in primary and secondary education have found that cooperative learning activities produced larger achievement gains when compared to traditional individual learning (Johnson, Maruyama, Johnson, Nelson, & Skon, 1981; Slavin, 1983).

Student attitudes can also be affected by cooperative and collaborative learning activities. Students tend to like each other more after cooperative experiences, no matter their attitude before the cooperative learning activity (Johnson & Johnson, 1989). Additionally, students

perceive the teacher as more supportive after engaging in cooperative learning (Johnson & Johnson, 1994b). Research on school children has found that cooperative learning activities produced closer friendships with students outside of their own ethnic groups and more acceptance of physically or mentally handicapped students (Slavin, 1991). Additionally, distance learners often appreciate the chance to collaborate with classmates with whom they would not otherwise get to interact (Dewiyanti, et al., 2007).

Rationale for studying cooperative and collaborative learning in higher education. Small-group learning, whether cooperative or collaborative in nature, has been shown to effectively promote higher academic achievement and more favorable attitudes about learning than content learned individually (Springer, et al., 1999). While the effectiveness of well designed group work seems to be a given, there is a paucity of research comparing cooperative and collaborative learning as they relate to achievement, student preferences, and student satisfaction. Additionally, much of the research literature that claims to study collaborative learning does not provide evidence of group structural characteristics (Joung & Keller, 2004), making differentiating between study results difficult.

Bruffee (1995, 1999) claims that cooperative learning is more appropriate for primary school students learning "basic" knowledge, while collaborative learning is more appropriate for university students engaged in reasoning. Collaborative learning "complements and supplements the cooperative learning that children may have experienced in primary school" (Bruffee, 1999, p. 86). Yet, one can argue that many college students have little to no experience in cooperative or collaborative learning and do not know how to work together (Kagan, 1994). Wouldn't it then be reasonable to question if cooperative learning might be more appropriate for inexperienced university students, with the possible intention of designing future group work as more

collaborative in nature? Additionally, Millis and Cottell (1998) contend that Bruffee's distinction does not take into account the need for more structure in adult classrooms to promote time efficiency and coverage of content. Furthermore, in the case of the sample in the current study, the students are pre-service primary and secondary school teachers who need to learn about cooperative learning methods. Modeling of effective cooperative learning strategies may be beneficial to their future use in the students' classrooms. Given these arguments, it is reasonable to investigate cooperative and collaborative strategies in blended and online delivery modes within a university setting.

Method of delivery (blended versus online). Since online learning became a real possibility in higher education, a plethora of studies have compared traditional face-to-face learning to online learning on variables ranging from achievement, perceptions of learning, student preference, to student satisfaction, faculty satisfaction, sense of community, student retention, and beyond. Research literature has shown online learning to be as effective as face-to-face methods in student achievement (Russell, 2001), while satisfaction results are mixed (Contreras-Castillo, Favela, Perez-Fragoso, & Santamaria-del-Angel, 2004; Piccoli, et al., 2001; Priluck, 2004; Rivera, et al., 2002; Wegner, Holloway, & Garton, 1999). Now that many courses that were originally face-to-face have moved to a blended, format (Garrison & Kanuka, 2004) and blended courses are expected to continue to increase in higher education (Bonk & Graham, 2006), one would presume that many studies would have compared blended and online learning. Yet, while some studies have found blended learning to be more effective than face-to-face learning environments (Althaus, 1997), few studies have specifically investigated blended courses (Lin, 2008) or compared learning outcomes or satisfaction between students enrolled in blended and online courses (Lim, et al., 2006).

Blended learning. Blended learning is the planned, pedagogical integration of the strengths of face-to-face learning experiences (verbal and nonverbal communication cues) with the strengths of online learning (text-based communication and internet resources) (Garrison & Kanuka, 2004; Vaughan & Garrison, 2005; Vignare, 2007). The ultimate goal of blended learning is not to "re-shape" face-to-face or online learning, but to go beyond the potential of either delivery mode by combining them (Garrison & Vaughan, 2008). Many practitioners believe that blended learning has the potential to be an effective way for universities to deal with impending technological developments (Garrison & Kanuka), as well as the potential to be transformative, creating new kinds of learning environments in which critical thinking and creativity are facilitated (Bransford, et al., 2000; Garrison & Kanuka).

Studies on blended learning are limited. While blended learning environments have been found to be generally effective (Dziuban, Hartman, Moskal, Sorg, & Truman, 2004), when compared to face-to-face environments, results are mixed. Some studies have found no significant difference between the delivery modes in terms of learning and collaborative solutions (Lim, Morris, & Kupritz, 2007; Ocker & Yaverbaum, 1999) while another study found blended learning to be more effective than a traditional face-to-face learning environment in perception of learning and final grades (Althaus, 1997). Moreover, Reasons, Valaderes and Slavkin (2005) found that online learners achieved higher final grades than blended and traditional learners. The authors surmised that blended learners had to adapt to learning in multiple formats each week, which could have resulted in confusion in terms of course expectations. Given the lack of general and longitudinal research and the contradictory results of the little research available, the potential for blended learning to be more effective than online learning is, as of yet, mostly anecdotal (Reasons, et al., 2005; Vaughan & Garrison, 2005).

Similarly, research is lacking with regard to student satisfaction in blended learning. While student satisfaction has been found to be generally high in blended learning environments, due to increased flexibility and interaction (Cottrell & Robison, 2003; Dziuban, Moskal, & Hartman, 2005; Willett, 2002), few studies have compared student satisfaction in blended and online learning environments.

Perhaps more important, few (if any) studies have been conducted that compare online and blended learning environments in regard to cooperative or collaborative instructional strategies. Bourne and Seaman (2005) maintain that research on blended learning is not well defined and that further research on successful pedagogical approaches and best practices are warranted. This study used blended and online learning delivery modes to investigate potential differences in achievement, value of collaboration, student satisfaction, student perceptions of community of inquiry, and student perceptions of group structure.

Task type. A better understanding of the dependent variables associated with cooperative or collaborative projects that were investigated in this study can only be achieved if the characteristics of the assigned task are examined (Straus & McGrath, 1994). Student achievement, satisfaction, and perceptions of the experience may be influenced by the task the group is trying to complete, the environment or media in which they are trying to complete it, and the structure of the group (McGrath, 1984).

Daft and Lengel (1986) theorized that group information processing tasks take place in order to reduce uncertainty, defined as "the absence of information" (p. 556), or reduce equivocality, defined as "ambiguity, the existence of multiple and conflicting interpretations" (p. 556). Reducing uncertainty entails finding the correct answer to a problem, while reducing equivocality entails choosing the most appropriate question to ask or the most appropriate

solution to an ill-defined problem (Daft & Lengel, 1986; Hollingshead & Contractor, 2002). Media richness, the capacity for a medium to provide verbal and non-verbal cues, personalization, and immediate or prompt feedback, varies in different forms of communication (Daft & Lengel). Media Richness Theory suggests that tasks in which uncertainty needs to be reduced are better suited for "lean media", such as text-based impersonal information, while rich media (e.g., face-to-face group meetings) are more appropriate for reducing equivocality (Hollingshead & Contractor).

McGrath (1984) developed a more detailed group task classification scheme (Figure 2) that classifies group tasks based on cognitive or behavioral performance requirements and the degree of interdependence among group members (Straus & McGrath, 1994). The four categories of group processes are: (1) generate, (2) choose, (3) negotiate, and (4) execute. Within each task category are two sub-categories. For example, the category "generate" can be further differentiated into the task of generating plans or generating ideas. Similarly, the "choose" category is divided by intellective tasks, which are problems to be solved that have correct answers, and decision-making or judgment tasks, which are issues or problems that do not have one correct answer. The "negotiate" category includes resolving cognitive conflicts and resolving conflicts of interest. Finally, the "execute" category is more behavioral in nature and involves resolving battles, competitions, and conflicts of power, as well as executing psycho-motor or other performance tasks (McGrath).

Figure 2: Task Circumplex (Straus & McGrath, 1994)

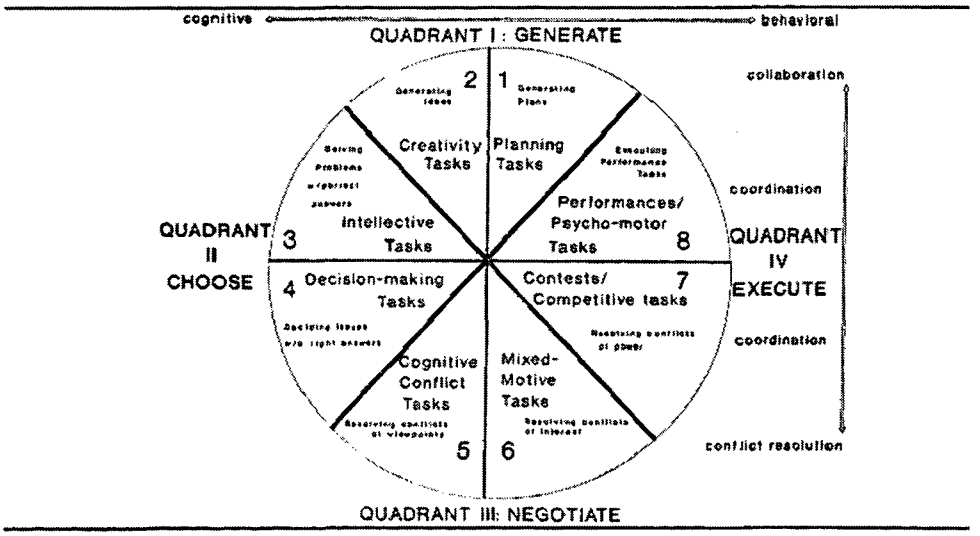


Figure 1: Task Circumplex
SOURCE: Adapted from McGrath (1984).

Studies examining media fitness in relation to task types generally find that members of computer-mediated groups have a harder time understanding each other, most likely because of the lack of social context cues (Straus & McGrath, 1994), which may result in lower group performance or lower satisfaction. However, computer-mediated groups tend to respond more favorably than face-to-face groups on idea generation tasks, which do not require much consensus or coordination by the group (DeRosa, Smith, & Hantula, 2007; Straus & McGrath, 1994). Intellective tasks and judgment tasks are perceived to be less effective by learners when accomplished via the computer (Straus & McGrath), and computer-mediated groups tend to be much less satisfied with the communication process during judgment tasks than face-to-face groups (Baltes, Dickson, Sherman, Bauer, & LaGanke, 2002; Straus & McGrath). However much of the literature examining media fitness and task types has limited generalizability because temporary groups in laboratories with little to no computer-mediated communication

experience have often been used. Additionally, group size and member attribute, which may be moderating factors, are often not controlled (Straus & McGrath).

The cooperative and collaborative activities investigated in the current study can be categorized as generating ideas, generating plans, decision-making, and resolving cognitive conflict tasks. The differing structures of the cooperative and collaborative activities may serve as moderating factors on the dependent variables in this study. Cooperative groups may have an easier time planning their activities (due to group structure) giving those groups an advantage in terms of performance. On the other hand, the less constrained nature of collaborative interaction may make negotiation and decision-making strategies easier to accomplish. Moreover, one might posit that participants in the blended learning groups were more satisfied with the communication process and their group projects and produce better performances than the online groups. Yet given the few studies comparing blended learning students' and online students' achievement and satisfaction with group tasks, it is uncertain that the face-to-face "qualities" of the blended learning environment would be significantly influential.

Dependent Variables

Achievement.

Learning strategy: Group work versus individual study. Much of the research and practical literature on cooperative and collaborative learning seems to suggest that both instructional strategies are generally more effective than individual study (Hall, et al., 1988; Johnson, et al., 2000; Lou, et al., 2001; Lou, et al., 2000; O'Donnell, et al., 1988; Springer, et al., 1999). For example, studies set in primary and secondary education have found that cooperative learning activities produced larger achievement gains when compared to traditional individual

learning (Johnson, et al., 1981; Slavin, 1983). Students who participated in cooperative learning treatments tended to outperform students who studied individually in daily and post-activity achievement tests (Yager, et al., 1986) and on factual recognition, application, and problem-solving assessments (Johnson, Johnson, & Stanne, 1985). Moreover, cooperative strategies have been found to promote higher-level reasoning, and greater transfer of learning (Johnson & Johnson, 1989). Similarly, collaborative groups have been found to outperform students working individually (Hiltz, Coppola, Rotter, Turoff, & Benbunan-Fich, 2000; Uribe, et al., 2003). Even when conducted asynchronously, collaborative groups have been found to have higher perceptions of learning and better quality solutions on projects in comparison to individual computer-based or individual paper-based work (Hiltz, et al., 2000).

Some researchers have cautioned that significant differences between cooperative or collaborative and individual groups may be due to differences in instructional quality, meaning that the cooperative or collaborative treatment content was better designed than the individual treatment content (Bossert, 1988-1989). Conversely, cooperative or collaborative treatment groups and individual student control groups that are equally well designed may result in no difference in student achievement. For example, in a study conducted by Flynn and Klein (2001), students who worked in groups performed better than individual-study students on the first of two case studies but did not perform significantly better on the second case study than the control group. Moreover, although the first case study performance score differences were statistically significant, the mean scores seem to be practically similar (cooperative mean = 23.33; individual mean = 22.39). In between case studies, both groups were provided with instructor feedback, which likely influenced their performance on the second case study. Similar results were found in other research utilizing case studies (Golbeck & Sinagra, 2000). One may argue that the

student achievement in these studies did not practically differ between the treatment and control groups because they were equally well designed and facilitated. This finding is consistent with other studies, which have suggested that when well-designed materials are utilized, small groups do not always perform significantly better than individuals (Bossert, 1988-1989; Cavalier & Klein, 1998).

The suggestion that equivalently designed group activities may result in equal levels of achievement can be seen in a comparison of cooperative and collaborative strategies. Klein and Doran (1999) conducted a study where students were randomly assigned to work on a computer simulation in one of three groups: (1) individual learning structure, (2) a small group with high interaction, or (3) a small group with occasional interaction. The small groups were similar to cooperative and collaborative learning structures in terms of interaction and structure, in that the high interaction group required students to take on specific roles and emphasized positive goal interdependence and reward interdependence. The occasional interaction group did not assign specific roles for group members and encouraged students to consult with each other regarding questions or comments on difficult concepts. Student achievement did not differ significantly between the individual, cooperative or collaborative groups; perhaps because the overall design of the content material was designed equally well for individual or group learning.

Nature of the task. Another explanation for studies that find no significant difference between scores of cooperative or collaborative participants and individual-study students may be the nature of the task used in the study. Cooperative or collaborative groups and individuals tend to perform equally well on drill-and-practice type assessments (Gokhale, 1995) and declarative knowledge assessments (Riley & Anderson, 2006). Drill-and-practice items and declarative knowledge assessments are well-structured in nature, and therefore high levels of interaction,

negotiation, and consensus are not as important (Cohen, 1994; DeRosa, et al., 2007; Straus & McGrath, 1994). Groups and individuals should succeed equally well on such a task because they don't require problem-solving skills that would be best accomplished through group discussion (Cohen). Such tasks may also fall within an individual's level of understanding, meaning that help from others is not necessary to find the solution. However, when a task is procedural or conceptual, requires higher cognitive and critical thinking skills, and does not have one correct solution, performance results tend to differ significantly with cooperative or collaborative group participants outperforming individual-study students (Gokhale, 1995; Riley & Anderson, 2006). One might conjecture that these results can also apply to studies investigating effectiveness of cooperative versus collaborative learning.

Cooperative versus collaborative learning. As has been described, cooperative learning activities are much more structured, requiring the assignment of roles, division of labor, and the scaffolding of teamwork skills and group processing. In contrast, collaborative groups tend to have more control over their projects, are not assigned formal roles, and are expected to know how to work effectively in team activities. The major differences between the strategies have to do with instructor/student control, role assignment, and interaction structure.

Control. In cooperative learning groups, the specificity of the group work, frequent monitoring by the instructor, structured group formation, and the assigning of roles and tasks to group members, point to fairly high control by the course designer and instructor (Curtis & Lawson, 2001; Millis & Cottell, 1998; Panitz, n.d.). Instructor control in cooperative activities is also exemplified by his or her active role when groups are in conflict or get off track (Cranton, 1996). Moore (2005) goes further and maintains that in cooperative learning activities, the instructor is still considered the expert – a position of power which will "ultimately control the

outcome of the experience" (p. 80). In contrast, collaboration does not require specific assigned roles, frequent intervention from the instructor, or evaluation of group process (Bruffee, 1995). Therefore collaborative learning activities tend to feature low teacher control and high student control.

The question is: how much control is important in a small-group activity? Lou, Abrami and d'Appolonia (2001) suggest that students need specific instructions and practice in cooperative learning activities to be successful. Structured cooperative activities featuring role assignments and/or interaction guidelines have been found to beneficially influence achievement (Cavalier, et al., 1995; Doymus, 2008; Hall, et al., 1988; Webb & Palincsar, 1996) and attitudes about group learning (Brewer & Klein, 2006). Cooperative learning practitioners suggest that not providing specific guidance, whether in teamwork skills or tasks to perform, may hinder peer communication (Macdonald, 2003).

On the other hand, proponents of collaborative learning strategies put forth that less structure promotes more student control and ownership of the process, which may influence satisfaction and enhance critical thinking (Moore, 2005). For example, Brewer and Klein (2006) found that although structured (cooperative) groups had significantly more group processing (management) interactions, the unstructured (collaborative) group had significantly more cognitive interactions. According to the authors, cognitive interactions were characterized by "providing examples or elaborating, asking question...disputing others' opinions" (p. 345). The potential new negotiation and decision making skills developed through collaborative learning may be more important, in some circumstances, than the efficiency gained through a more cooperative structure (Kitchen & McDougall, 1998).

Roles. Supporters of structured group work contend that role assignments result in more consistent levels of interaction, while proponents of less structured group work argue that activities that do not contain teacher assigned roles result in more elaboration and critical thinking (Schellens, et al., 2005). Yet research results have been inconsistent in regard to the effect of role assignments in group work.

Role assignments within group tasks promote group cohesion (Rose, 2002), responsibility (Mudrack & Farrell, 1995), and beneficially influence achievement (Cavalier, et al., 1995; Doymus, 2008; Hall, et al., 1988). Furthermore, in a study conducted by Rose (2004), cooperative groups utilizing assigned roles employed more deep processing within their messages as compared to collaborative (non-role) groups during the first weeks of a problem-based activity. While collaborative groups reached deep processing levels after a few weeks into the activity, role assignment may have more of an impact on a short-term group activity, such as the activity investigated in the current study.

Conversely, several studies have found no significant difference in terms of achievement or knowledge construction between the two group structures. Strijbos, Martens, Jochems and Broers (2004) found that although groups with assigned roles reported higher perceptions of group efficiency, no significant difference in group grades were found between groups with assigned roles and groups without assigned roles. The researchers suggest that the results may be due to a provision within the course that allowed students to revise and resubmit their work, thereby decreasing any variation between group grades. Yet, similar results revealed that at the end of an activity cognitive skill and level of knowledge construction did not differ between structured and unstructured groups (Klein & Doran, 1999; Rose, 2004; Schellens, et al., 2005).

Results of no significant differences may suggest that role assignment structures do not affect learning and performance in university-level group work. On the other hand, perhaps the designs of roles for cooperative work in higher education have been inadequate for complex tasks. Most roles developed for cooperative learning consist of a single duty. While useful for simpler tasks in primary education (for which cooperative learning was developed), Strijbos, Martens, Jochems and Broers (2004) maintain that these one-dimensional roles may be insufficient for the complexities of higher education group work, particularly when it is delivered via computer support. Instead roles may need to be more detailed and explicit, allowing for deeper processing and greater levels of interaction. In the current study, students in the cooperative treatment took on one of four roles. While a role might be considered a single duty, each role required students to evaluate other students' work and potentially challenge others' solutions. Such negotiation may increase interaction and critical thinking.

Interaction. A major issue in group work research is the degree to which interaction should be structured or prescribed. Strijbos, Martens and Jochems (2004) articulated the issue well when they wrote, "Too much structure may result in 'forced' artificial interaction, but no structure may result in fragmented interaction or a situation where interaction could be seen as an optional activity instead of an essential process" (p. 412).

According to Cohen (1994), instead of asking, "Is the structuring of interaction productive?" we should really be posing the question, "Under *what conditions* are structured interaction productive?". Once a group task is designed so that group interdependence and interaction are essential for success, the nature of the task is relevant to the level of interaction structure. Cohen (1994) suggests that lower level skill acquisition is enhanced by highly structured, cooperative activities where teamwork skills and group processing are guided and

scaffolded. Higher-level learning (where content is conceptual, problems may be ill-defined and solutions are often nebulous) is most effective in a less structured collaborative activity where interaction is not constrained by role assignments or specific requirements and students are more free to elaborate on content (Cohen; Joung & Keller, 2004).

While several research studies seem to support Cohen's theory, Cavalier, Klein and Cavalier (1995) found contradicting results. The researchers compared structured cooperative groups (utilizing the Jigsaw cooperative learning strategy) with less structured, collaborative groups. The less structured groups were not instructed on interacting within a team or how to evaluate their group process but were instructed on how to be an active listener. Each group utilized case study scenarios to learn the content. Cooperative group participants performed significantly higher on a10-item post-test than the less structured control group. The authors suggest that the higher performance of the cooperative group may be the result of the cooperative structure, which promoted interaction and group skills, leading to higher levels of interaction, agreement, encouragement, questioning and explanations and more solicitations for opinions and suggestions.

Course delivery method. Computer-mediated cooperation and collaboration have the potential to be effective ways to provide flexibility via the time-independent nature of asynchronous communication (McIsaac & Gunawardena, 1996) and to reduce isolation via synchronous and asynchronous communication (Hall, 1997). Collaborative learning and online learning have a reciprocal relationship – collaborative learning is enhanced by online learning because students have the ability to reflect on content and other students' opinions, elaborate and defend their own opinions, and negotiate meaning together due to the flexibility of time inherent

in asynchronous online communication. At the same time online learning depends on students willingness to participate (Cifuentes, Murphy, Segur, & Kodali, 1997).

Collaboration and cooperation have been found to be equally effective in online environments and face-to-face environments, although at least one study revealed higher rates of learning in computer-mediated groups in comparison to traditional face-to-face groups (Scifres, Gundersen, & Behara, 1998). Tutty and Klein (2008) found that online groups performed better on group projects while face-to-face groups performed better on individual tests after the learning activity. Yet few studies have compared learning outcomes between students enrolled in blended and online courses (Lim, et al., 2006), and this researcher has been unable to find any studies comparing cooperative and collaborative learning within blended and online delivery modes. The few studies published comparing individual work in blended and online courses reveal mixed results in regard to learner achievement. One study found that online learners achieved higher grades than blended and traditional learners (Reasons, et al., 2005). In contrast, no significant differences in achievement were found in a study conducted by Lim, Morris and Kupritz (2007), although online students perceived that their workload was heavier than that of blended students.

Any difference in group or individual achievement is likely to be influenced by the nature of the group task. Cohen (1994) maintains that collaborative strategies are more likely to enhance effective, higher-level learning than cooperative strategies, yet reports of students having difficulties with coordinating decision-making tasks in an asynchronous online environment (Harasim, 1993) make one question whether collaborative strategies can be as effective as cooperative strategies online. Benbunan-Fich, Hiltz, & Turoff (2002) found that online collaborative groups utilizing decision-making case studies were engaged in more

complex and challenging discussions than face-to-face group colleagues. Nonetheless, one may question whether a structured, cooperative strategy would have resulted in a more effective performance. Furthermore, a blended course delivery mode provides students the option to coordinate tasks and decision-making in a face-to-face environment, allowing students to pick up on verbal and nonverbal cues and potentially increase time efficiency.

Learning strategy: group achievement versus individual achievement. Another important issue is whether the structures of the cooperative and collaborative groups will differentially influence group project achievement and individual achievement. Uribe, Klein and Sullivan (2003) found that students who worked in collaborative dyads performed better than students who worked alone, suggesting that interaction where negotiation is required promotes thoughtful discussions, which in turns promotes deeper learning. One might propose that the same results could be found between collaborative and cooperative learning methods. Perhaps participants in groups that work collaboratively and negotiate all decision-making together, may retain more knowledge than participants in groups where parts of the project are divided among group members and edited together at the conclusion of the project. However, Lou et al (2001) found that cooperative strategies seemed to positively influence group performance and individual achievement, whereas collaborative strategies positively influenced only group performance, suggesting that not all students within collaborative group strategies are equally engaged in the content and able to retain knowledge for post-treatment tests. Recognizing that the current study utilizes a group project assessment and an individual quiz, the findings from Lou et al suggest that further investigation related to cooperative and collaborative structure is needed.

Summary

The group projects utilized in the current study require idea generation, decision-making and negotiation, skills which require a range from lower to higher-level thinking (Straus & McGrath, 1994). Given the higher level learning elements inherent in the assignment, one might posit that collaborative strategies would be more effective in this study. Yet higher-order learning has been found in both structured and unstructured learning activities (Heller, Keith, & Anderson, 1992; Lou, et al., 2001). The type of assessment (group project or individual quiz) may also differ according to learning strategy and delivery method.

Value and Preference for Collaboration

Employers want employees who can work in team-based organizations to solve complex problems (Kagan, 1994; Millis & Cottell, 1998). The learner-focused paradigm of education, which emphasizes a shift to student-directed, meaningful learning with others (Millis & Cottell, 1998; Reigeluth, 1999) seems to be a response to the demands of industry. Given that teamwork is in high demand and is becoming more widely used in primary, secondary and post-secondary education, a student's value and preference for collaboration is important to investigate. For example, do students generally prefer to work with others and do they see a potential for higher achievement by working with others?

Study results are mixed regarding student attitudes of computer-supported cooperative and collaborative learning. Several studies reveal that students were satisfied with their collaborative experience, appreciated the opportunity to collaborate (Brewer, et al., 2003; Dewiyanti, et al., 2007; Kitchen & McDougall, 1998) and even found it helpful for their learning (Kim, Liu, & Bonk, 2005). However, several other studies have revealed a student preference for working individually or a denial of the academic benefits of working cooperatively or

collaboratively (Hillard, 2006; Kitchen & McDougall, 1998; Klein & Doran, 1999; Uribe, et al., 2003). For example, Klein and Doran (1999) found that roughly half of individual-study and group-study students reported that they preferred working alone rather than with a partner. Interestingly, when asked if they would have enjoyed a particular module more if they had worked with a partner, over 60% of students in each treatment group responded that they would have enjoyed working with a partner. However, when asked whether students felt they would have learned more in the module if they had worked alone or with a partner, only 46% of individual-study respondents thought they would learn more working with a partner while only 38% of group-study respondents indicated that they would have learned more working with a partner (and 38% said they would have learned the same under either condition). Another study revealed that although a majority of students viewed group work positively and thought that it aided them in their work, half of respondents still preferred to work on their own, and nearly 25% saw no value in group work (Oliver & Omari, 2001). Overbaugh and Nickel (2008) found similar results in a study utilizing a similar population of students and the same attitude instrument as the current study. Although face-to-face students valued connectedness and preferred collaboration more than online students, responses were at the "neutral" level of a five-point Likert scale. Furthermore, both face-to-face and online students responded to the instrument item "I have the potential to achieve more academically by collaborating with others" at the neutral point of the scale. Scores at the neutral part of the scale suggest an attitude of ambivalence (Dziuban, Moskal, Brophy, Shea, & Lorenzo, 2008), meaning they do not really care about working with fellow students and do not recognize the potential benefits of working collaboratively (Overbaugh & Nickel)

One potential explanation for these results is that students range from low to high levels of affiliation motives, meaning that some students are more intrinsically motivated to relate to and be part of a group than others (Brewer, et al., 2003; Klein & Schnackenberg, 2000). Students with a higher affiliation motive are likely to have a more positive attitude toward group work (Brewer & Klein, 2006). Moreover, convenience and flexibility may be valued over interaction with the instructor and peers by online learners (Fortune, et al., 2006), indicating that students who self-select into an online section of a course are more independent than students who enrolled in a blended learning section (Diaz & Cartnal, 1999).

Another explanation for differences in student attitudes between studies, as well as differences between acknowledged value of collaboration and reported preference may have to do with the context of the studies. Many survey items in studies investigating student attitudes ask questions that are specific to the activity that students just completed. It is possible that some activities within research do not lend themselves to group work, or the design of the activity was not well planned. Furthermore reports of student attitudes may have little to do with students' general attitudes and more to do with what they see students in alternative group strategies doing. For example, while Uribe et al (2003) found that a significant majority of students reported a preference to work with a partner, the majority of the positive responses seem to come from students within the individual-study control group. Seventy percent of the individual-study participants reported preferring to work with a partner, while 40% of the participants who worked in dyads reported preferring to "work individually". The results make one wonder if students' answers to the question were more of a "grass is always greener on the other side of the fence" reaction than a true measure of their general group work preferences.

Finally, reports of a preference for individual study or a rejection of collaborative value may be due to issues with online cooperative or collaborative learning that may impact preference for or satisfaction with the medium and the process. For example Gunawardena et al (2001) found that the amount of time required to make group decisions and the lack of nonverbal cues were problematic in collaborative environments. Students also worry about the logistics of planning virtual group work and that some group members won't do their "fair share" (Graham & Misanchuk, 2004). Furthermore, students may fear feeling isolated from their team members (Graham & Misanchuk, 2004), may be overly inhibited regarding giving constructive criticism (Bonk, Wisher, & Lee, 2004), or may fear that others will be uninhibited, posting overly critical or inappropriate remarks in small group discussions. While one can speculate that these issues would be alleviated given good course design and practice in a cooperative or collaborative environment, student attitudes before and after a short-term group project may influence student process and outcome satisfaction (Ocker & Yaverbaum, 2001). Furthermore, students value of working as a team has been found to influence learning for the individual group member as well as the whole team (Williams, et al., 2006). Therefore, in order to better understand the factors surrounding cooperative and collaborative strategies, examination of students' value and preference for collaboration/cooperation is essential.

Student Satisfaction

Student satisfaction, defined at the most general level, is the "sum of an individual's negative and positive feelings to a set of variables" (Olaniran, 1996, p.25, citing Bailey & Peterson, 1983). Satisfaction is subjective in nature and may be influenced by a variety of environmental and personal factors. As such, student satisfaction is a difficult construct to

measure or predict effectively, yet is a crucial factor in evaluating successful programs, courses and activities within higher education institutions.

Value of student satisfaction measures. More than a place to transfer knowledge, higher education is often seen as a service industry where the expectations of students are of major importance (Boylston, Peters, & Lacey). As of 2005, over 17.5 million students were enrolled in undergraduate or graduate degree-granting programs in roughly 4,276 United States higher education institutions ("Digest of Education Statistics," 2007). The number of students in higher education increased 1.5% from 2002 to 2006 (Allen & Seaman, 2007) and is projected to continue to grow through the year 2015 (Hussar & Bailey, 2006). At the same time, changes in the institutional landscape including decreasing resources and higher demand (Howell, Williams, & Lindsay, 2003) and newer learning options for traditional and distance learning students ("Digest of Education Statistics,") place universities and colleges in stiff competition to attract and retain students. Therefore, student satisfaction appears to be an important variable to research because the construct has been linked to higher retention at the institutional and program level (Cheng & Tam, 1997). Changes in pedagogy and technology, exemplified by online course enrollment doubling between 2002 and 2006 (Allen & Seaman, 2007), need to be investigated in regards to student satisfaction as well. With the estimation that at least 40% of higher education courses will be taught in a blended format by the year 2016 (Bonk, Kim, & Zeng, 2006), student satisfaction measures are valuable for assessing a university's or program's responsiveness to student needs (Beltyukova & Fox, 2002) and, in the case of online and blended learning, determine the quality and "evolution of online environments" (Sener & Humbert, 2003).

At a course or learning activity level, student satisfaction measures serve as a way to determine student needs and the quality of the traditional or distance learning environment. Student satisfaction at the course level often looks at overall satisfaction with the course, perceptions of learning, and potential for taking another course within the same type of learning environment (Sener & Humbert, 2003). Comparison studies of student satisfaction in courses delivered via different media (e.g. face-to-face versus online) often function as an evaluation of a particular course, or as a contribution to the mixed results found in research literature.

Investigating student satisfaction at the learning activity level is also valuable, particularly when comparisons between media and learning strategies are made. Comparing satisfaction using differing media and differing instructional strategies does not assume that the traditional classroom approach utilizing one strategy over another is necessarily the benchmark or baseline for satisfaction. Indeed, certain strategies may be more effective in one media over another. Moreover, measures of student satisfaction at the learning activity level may provide more detailed relationships between factors that influence satisfaction. For example, student satisfaction can be even further delineated by looking at student satisfaction with the process of a learning activity and then satisfaction with the outcome of the activity (Ocker & Yaverbaum, 1999; Thompson & Coovert, 2003) , with the purpose of investigating what factors may influence student satisfaction and at what point in the learning activity (process or solution).

Student satisfaction in traditional, blended and online learning environments. It has often been assumed that face-to-face students are more satisfied with their learning environments than computer-mediated students. The rationale is that students participating in computer-mediated communication (CMC) lose the verbal and non-verbal communication cues associated with discussing a topic with a group of people in the same room. Without the verbal and

nonverbal cues, students conversing online may have difficulty understanding the subtle nuances and meanings of other students' discussion points and group discussion may become confusing (Warkentin, et al., 1997). Indeed, several studies have found that students participating in computer-mediated or online environments were less satisfied with their course experiences as compared to their traditional, face-to-face colleagues (Piccoli, et al., 2001; Priluck, 2004; Rivera, et al., 2002; Warkentin, et al.). While general inexperience with the communication medium or a lack of verbal and nonverbal cues were sometimes factors (Priluck; Warkentin, et al.), other potential reasons for the difference in satisfaction were due to lack of instructor training in online course design (Priluck), technological issues (Piccoli, et al.; Rivera, et al.), or course structure or content problems (Bernard, et al., 2004; Priluck; Tallent-Runnels, et al., 2006).

On the other end of the spectrum, some studies have found online students offer highly positive evaluations of online courses (Contreras-Castillo, et al., 2004; Wegner, et al., 1999), sometimes higher praises than those received for equivalent face-to-face courses (Kleinman & Entin, 2002; Paul, 2001; Wegner, et al., 1999). Often such studies may have included activities that were much more engaging than their face-to-face counterparts and therefore the comparisons may be skewed. Still other studies have found no significant difference in satisfaction scores between the face-to-face and online (or computer-mediated) delivery modes. Overbaugh and Nickel (2008) found that in practical terms, satisfaction did not differ between online and face-to-face students, a result that is consistent with other studies (Fredericksen, et al., 2000; McFarland & Hamilton, 2005; Olaniran, 1996; Paul, 2001; Stizman, et al., 2006; Woo & Kimmick, 2000; Zhang, et al., 2004). When the same, well designed instruction is delivered via different media and certain confounding variables are controlled (such as age, gender and computer experience), many studies find that there is little difference in the satisfaction of

students in either medium. One may posit then, that the delivery medium has little to do with student satisfaction. However another possibility is that students who are apprehensive about working online or understand their need to learn in a face-to-face environment will self-select into a traditional classroom section of a course, thereby limiting the amount of online dissatisfaction recorded in satisfaction instruments (Allen, Burrell, Timmerman, Bourhis, & Mabry, 2007). That possibility skews comparison results and makes it difficult to state that online learning is always as satisfactory to students as traditional classroom learning.

While much of the literature has focused on comparing student satisfaction in face-to-face and online environments, or face-to-face and computer-mediated environments (which could be blended in nature), few studies have investigated differences in satisfaction between blended learning students and fully online students. Albrecht (2006) defines blended learning as "bringing together face-to-face classroom instruction with Web-based activity in which classroom time is partially replaced by the Web-based work" (p. 1). An instructor or learner might choose a blended learning environment because of the increased flexibility for learning (Dziuban, Hartman, Juge, Moskal, & Sorg, 2006) and the increased access to learning resources (Graham, 2006). Blended learning is often chosen because it lends itself to more learner-centered, active learning strategies by taking advantage of the benefits associated with both face-to-face and web-based interaction (Dziuban, et al., 2006).

While not detailed, Albrecht (2006) stated that an EDUCAUSE survey found high student satisfaction with blended learning. Leh (2002) reported similar results, although no face-to-face or fully online comparison groups were used. When a blended course is developed , supported and implemented well, researchers have found that a majority of the students will be as satisfied or more satisfied with the blended course as they have with previous face-to-face

courses (Harker & Koutsantoni, 2005; Voos, 2003). Challenges to fully online learners, when compared to blended learners, can include perceptions of higher workload and less support (Lim, et al., 2007), possibly due to the lack of social context cues. High levels of interaction and collaboration may be key to highly satisfied students in online and blended courses (So & Brush, 2008).

Looking deeper into satisfaction of learning activities. While numerous studies have measured student satisfaction in traditional, distance, and online learning, the results are somewhat ambiguous in regards to elements of the learning process that are less satisfying (Thompson & Coovert, 2003). Satisfaction measures often include a variety of questions that investigate everything from satisfaction with the technology, the group members, the discussion, the learning process, and the final project outcome or solution and report them as one score (Thompson & Coovert). If one wants to better understand differences in student satisfaction, using an instrument that further delineates student satisfaction would be most appropriate. For example, a student may be satisfied with the final outcome of a collaborative project, but not the collaboration process, or vice versa (Mejias, 2007). By distinguishing process and outcome satisfaction, inconsistencies in research may be resolved (Mejias). In the case of this study, the goal is to look at student satisfaction in regards to the process of collaborating or cooperating as a group and in terms of the final group solution to the problem.

Process satisfaction. Process satisfaction "refers to the contentment with the interactions that occur while team members are deriving decisions" (Thompson & Coovert, 2003, p. 138). Studies that have specifically looked at the satisfaction of the interaction process have found that traditional, face-to-face groups tend to be more satisfied with the group interaction process than students who have interacted via the computer (Ocker & Yaverbaum, 1999; Thompson &

Coovert; Warkentin et al., 1997). One potential explanation for the difference is that students are more familiar with participating in face-to-face groups than in computer-mediated groups and therefore their evaluation of group process satisfaction in the computer-mediated environment would be much less concerned with group participation than it would be with the less familiar computer-mediated environment (Olaniran, 1996). Moreover, face-to-face groups tend to have better perceptions of their discussion quality as compared to asynchronous or partially synchronous, web-based groups (Benbunan-Fich & Hiltz, 1999; Whitman, et al., 2005), perhaps because they have an easier time conveying their messages and understanding others' contributions (Straus & McGrath, 1994). Beyond the lack of nonverbal cues associated with computer-mediated collaboration, asynchronous groups often have to deal with lags between member participation (Benbunan-Fich & Hiltz). Inefficiencies in web-based communication promote more task-oriented messages and less socio-emotional interaction, particularly at the beginning of group formation (Chidambaram, 1996). A lack of "relational intimacy" (Chidambaram, p.159) may result in decreased satisfaction in the group process. If given time, asynchronous groups may begin to share more personal information with each other (Chidambaram), thereby becoming more socio-emotionally bonded and possibly more satisfied with the group process.

While studies have investigated face-to-face groups versus web-based, asynchronous and synchronous groups, few studies have investigated process satisfaction in blended groups versus completely online groups. One might reason that blended groups are likely to be more satisfied because they have the opportunity to meet face-to-face in class. Yet that conclusion may be highly dependent on how much time members have to converse while in class. Additionally, the amount of time the group has to complete a project is important because satisfaction with the

collaboration process has been found to increase over time (Flanagin, Park, & Seibold, 2004; Olaniran, 1996)

Process satisfaction may also be influenced by student characteristics and group dynamics. For example, Ocker and Yaverbaum (2001) found that men were more satisfied with face-to-face collaboration while women preferred asynchronous collaboration, possibly reflecting gender-based communication differences (Barrett & Lally, 1999). Group dynamics may play an especially large part when the group needs to reach some sort of consensus, which requires more coordination and negotiation skills (Straus & McGrath, 1994). Moreover, process satisfaction may be related to the student's satisfaction in the solution, or "decision confidence" (Olaniran, 1996), which is discussed in the next section.

Solution satisfaction. Solution satisfaction refers to a student's "satisfaction with the solution...that resulted from the collaborative experience" (Ocker & Yaverbaum, 2001, p. 433). Studies have found mixed results when comparing solution satisfaction of face-to-face and asynchronous web-based groups. While several studies found no significant differences in solution satisfaction between face-to-face and web-based groups (Benbunan-Fich & Hiltz, 1999; Fjermestad & Hiltz, 1998; Ocker & Yaverbaum), other studies found that computer-mediated groups were less satisfied with their collaborative outcomes (Thompson & Coovert, 2003; Warkentin, et al., 1997). Contradictory findings may be due the amount of times students have been exposed to asynchronous collaboration (Thompson & Coovert), their general attitude toward collaboration (Ocker & Yaverbaum), or the type of assigned task (Straus & McGrath, 1994). Given mixed results in prior studies and the lack of comparison between blended and online groups, this study will serve to add to the empirical literature.

Factors related to student satisfaction. Student satisfaction results are difficult to generalize because satisfaction instruments differ and the validity and reliability of some instrument may be questionable (Phipps & Merisotis, 1999). Many studies do not use random assignment or systematically control for extraneous variables that may influence satisfaction (Allen, et al., 2007; Phipps & Merisotis). Furthermore, some studies report high satisfaction scores for computer-mediated courses or activities but don't use comparison groups within the study. Those studies tend to report high satisfaction and user effectiveness, an interpretation which, "may give us less information about user satisfaction with the technology at hand than about systematic biases in human respondents' use of rating scales" (McGrath & Hollingshead, 1994, p.91). Clearly student satisfaction literature can be difficult to interpret due to differences in research methodology. Satisfaction is also a complex construct to assess because it can be affected by a variety of factors, including task type, course structure, computer and online learning experience, and student characteristics (Dziuban, Moskal, Brophy, & Shea, 2007).

Task Type. Satisfaction with the group communication process and the final outcome of a group project are influenced by the task the group is trying to complete, the environment or media in which they are trying to complete it, the structure of the group (McGrath, 1984), and spatial and temporal distribution of the group members (McGrath & Hollingshead, 1994).

McGrath (1984) developed a group task classification scheme that classifies group tasks based on cognitive or behavioral performance requirements and the degree of interdependence among group members (Straus & McGrath, 1994). As described earlier in this document, the four categories of group processes are: (1) generate (plans or ideas), (2) choose (intellective or judgment tasks), (3) negotiate, and (4) execute.

Studies comparing face-to-face and computer-mediated group work have found that computer-mediated groups tend to respond more favorably than face-to-face groups on idea generation tasks, which do not require much consensus or coordination by the group (DeRosa, et al., 2007; Straus & McGrath, 1994). Intellective tasks and judgment tasks are perceived to be less effective by learners when accomplished via the computer (Straus & McGrath), and computer-mediated groups tend to be much less satisfied with the communication process during judgment tasks than face-to-face groups (Baltes, et al., 2002; Straus & McGrath).

The cumulative experience of group collaboration may also impact research on group task, media fitness and satisfaction. Hollingshead, McGrath, & O'Connor (1993) found that satisfaction in face-to-face and computer-mediated groups varied throughout a semester. Computer-mediated groups were least satisfied with their group performance at the beginning of the semester and when group membership was changed. Participants in the computer –mediated groups complained throughout the semester that their performance was inhibited by the computer. However, computer-mediated groups' satisfaction with group task outcomes increased after the first week of interaction, suggesting that given time and experience, computer-mediated groups can be as satisfied with the results of group work as their face-to-face colleagues.

Some longitudinal research has shown that face-to-face highly structured versions of a task produced better quality results than the highly structured computer-mediated version of the of same task. In turn, the computer-mediated version of the task produced higher quality group decisions than the face-to-face low structure group. McGrath and Hollingshead (1994) suggest that "it may be the task structure rather than the computer mediation that influences quality on these tasks" (p. 90). While McGrath and Hollingshead's findings refer to group decision quality,

the potential impact of course structure may also influence group member satisfaction with the communication process as well as the final group product.

Computer and online learning experience. If students are new to the online learning environment, one might expect that their lack of web-based course experience could influence their overall student satisfaction. Yet results in the research literature are mixed. While several studies found that experience with web-based learning did not significantly influence student satisfaction (DeBourgh, 1999; Thurmond, Wambach, Conners, & Frey, 2002) other studies have found computer experience and web-based learning experience to directly (Hong, 2002; Ocker & Yaverbaum, 1999; Ropp, 2000) or indirectly (Hostetter & Busch, 2006) influence students' reported satisfaction with the course.

In the case of students enrolled in the course used in this study, the course designers have attempted to decrease the impact of inexperience with online learning by directing students to the university's "Online Student Orientation" at the beginning of the course. The orientation directs students on how to manage their time, communicate and complete assignments in the learning management system. The course's first module, aptly entitled "First Thing's First", orients students on how to be a successful online student, how to use Blackboard communication features, and how to complete and submit assignments. The introduction to the learning management system environment is designed to reduce much of the anxiety felt by inexperienced students, yet further reduction of anxiety may have to occur over time. Therefore, online experience could be an important variable in this study. Moreover, students' level of computer anxiety and degree of web based learning experience may be related to student demographics, like gender, ethnicity and age.

Student characteristics. Internet-based learning has been touted as a democratizing environment, reducing the impact of stereotypes and social boundaries associated with status, gender, ethnicity and age (Postmes, Spears, & Lea, 1998). While the use of the internet in educational situations may provide the potential for more equitable contributions from the group, particularly by members who would be too shy or somehow marginalized in traditional classroom contexts, the lack of visual cues and the feelings of anonymity that can occur in an online situation may fuel remarks that would not normally be said publicly (Herring, 1996). Furthermore, the lack of visual cues to ethnicity or gender does not necessarily mean that students will take up different social roles or disregard stereotypes that they are used to in the traditional classroom. In fact, some studies have found that differences online may be exaggerated in comparison to face-to-face interaction, due to the lack of physical immediacy of the participants (Herring, 1996; Selfe & Meyer). Learner characteristics may influence participation in collaborative learning (Kagan, 1994), which in turn may affect students' ultimate satisfaction with the experience. Although research literature differs as to the strength of the influence of student characteristics on student satisfaction, controlling for variables such as gender, age, and ethnicity are vital to the integrity of this study's results.

Gender. Gender differences in student satisfaction and attitudes about online learning have been found to be impacted by prior computer experience and skills (Hong, 2002; Ropp, 2000). Studies conducted over a decade ago indicated that male students had more computer experience, exhibited more positive attitudes toward computers (Shashaani, 1994), were less anxious about computer use, and more confident of their computer abilities (Colley, Gale, & Harris, 1994). Moreover, computer aptitude has been stereotyped as a more "male" attribute (Colley, et al., 1994). Results in more recent literature are mixed. Despite similarities in

computer experience, several studies have found females to still be less confident or more anxious than males regarding their computer abilities (Jackson, Ervin, Gardner, & Schmitt, 2001; Lee, 2003; Whitley, 1996). Yet Stokes (2003) found little to no difference in computer and internet experience between males and females, possibly reflecting the increased use of computers by both genders in the classroom and at home. Whitley (1996) noted that although females were more anxious than men in his study, their mean scores were "significantly below the midpoints of both the anxiety scale...and the negative beliefs scale" (p. 281) and that the female participants should not be considered overly anxious in relation to the males. Therefore, it is reasonable to assume that most females in the current study would be relatively confident in their ability to use a computer.

Research results have also been mixed in regards to gender's impact on attitudes toward online learning and online group work. While some studies have found that student characteristics did not influence student attitudes regarding online learning (Arbaugh, 2000; Gatfield, 1999; Hong, 2002; Jiang & Ting, 1998; Ory, Bullock, & Burnaska, 1997; Thurmond, et al., 2002), others have found that gender may influence student comfort with asynchronous collaborative tasks (Ocker & Yaverbaum, 2004; Overbaugh & Nickel, 2007), due to gender differences in communication pattern and cognitive style (Rovai, Ponton, & Baker, 2008). For example, females participating in computer mediated communication tend to use qualifying statements intended to sustain dialogue (Barrett & Lally, 1999; Fahy, 2002) and are more likely to agree with fellow students, ask open-ended questions (Wolfe, 1999), and indirectly resolve conflict (Rovai et al, 2008). In contrast, male students are more likely to write longer, more frequent posts that utilize linguistic intensifiers and are less likely to agree and ask open-ended questions (Barrett & Lally; Fahy; Wolfe). Herring (1996) states that women "preferentially

evoke an ethic of politeness" (p. 117) in computer mediated communication, while men "evoke an ethic of agonistic debate and freedom from rules" (p.117). While Herring's conclusions are generalized and debatable, the differences in communication styles may point to a difference in preference for working with others.

Cognitive style, which partially deals with social orientation, is another potential influence on gender differences regarding student satisfaction. Females tend to be more field dependent, meaning that they are more socially oriented and are more likely to be affected by criticism (Ibarra, 2001). Males, on the other hand, tend to be more field-independent, indicating that they prefer more impersonal environments, are more competitive, and are less influenced by classmates (Ibarra; Rovai, et al., 2008). Females have been found to report more positive experiences in communicating with others online (Stokes, 2003) and to use online communication tools more often (Ory, Bullock & Burnaska, 1997), which one might posit results in females feeling more connected to others in their classes (Rovai & Baker, 2005). Interestingly, Ocker and Yaverbaum (2001) found that although males felt more comfortable from the outset about working in collaborative teams, females ended up being more satisfied with group collaboration. Whether the more frequent use of communication tools or an innate desire to feel more connected to others results in females feeling more positive toward communicating with others online, studies seem to indicate that females are more satisfied than males when working cooperatively (Savard, Mitchell, Abrami, & Corso, 1995) and may suggest that females are more suited for interactive web-based learning (Fredericksen, et al., 2000; Swan, et al., 2000).

Age. Age may play an important role in student satisfaction with learning asynchronously, as well as working collaboratively or cooperatively. Students older than the traditional college age have been found to rate the quality of online education higher than

traditional age students (Richardson, Long, & Woodley, 2003; Wyatt, 2005). While perceptions of quality do not always equate with overall satisfaction, older students are often more satisfied with on-line learning in comparison to students aged 25 and below (Fredericksen, et al., 2000; Swan, et al., 2000). The ability to learn around job and family responsibilities may influence the older students' higher satisfaction scores. Then again, older students may be more motivated to learn (Kearsley, 2000), and as such, more satisfied with the results.

While older students may be more satisfied with online learning, they may not be as satisfied with collaborating online. For example, Kitchen and McDougall (1998) found that older students preferred computer-mediated collaborative learning less than younger students. In previous research using the population in the current study, approximately half the students enrolled in online sections of the course were over the age of 30. Online students were less likely to prefer collaborative learning as compared to their colleagues enrolled in blended course sections, 86% of whom were under the age of 30 (Overbaugh & Nickel, 2007). It is debatable as to whether the difference in preference for collaborative learning was due to the age difference or to differences in learning characteristics associated with students who choose online learning. Moreover, preference for collaboration has been found to be a predictor of satisfaction with a group experience in face-to-face groups, but not in asynchronous groups (Ocker & Yaverbaum, 2001). Nevertheless, the possibility that age may predict preference for collaboration, and in turn affect student satisfaction necessitates that age is considered as an important variable in this study.

Ethnicity and background. Like gender, students' ethnicity has the potential to influence student satisfaction due to differences in computer experience, cognitive style and communication style. According to the U.S. Census Bureau, 62% of U.S. households own one

or more computers and 55% had internet access, yet only 45% of African-American and Hispanic households reported owning a computer in 2003 (Cheeseman Day, Janus, & Davis, 2003). Beyond computer ownership, scholars also have to consider the "second-level digital divide" (Hargittai, 2002), which includes how old the computer is, the connectivity of the computer, available computer support, and the learner's online skills (Hawkins & Oblinger, 2006). Due to the digital divide, minority students tend to exhibit less computer skills than white students (Rovai, et al., 2008). Lack of computer skills affects satisfaction (Hong, 2002; Ocker & Yaverbaum, 1999; Ropp, 2000). Therefore, if students of color lack online skills or experience, student satisfaction ratings could be affected.

Students of color (Latinos, African-Americans, Native Americans) tend to be more field dependent, while Caucasian students are more field independent (Rovai, 2007). Traditional and web-based courses in higher education are often designed to accommodate field independence (Rovai, et al., 2008); a more individualistic, competitive style. Furthermore, the dominant cultural communication style in the United States is low context, yet minority cultures (non-whites) tend to come from high context backgrounds. In a low context culture, communication is direct and explicit and commitment to the group is low (Ibarra, 2001). Members of high context cultures tend to communicate indirectly in engaging, agreeable ways and take disagreement personally (Rovai, Gallien, & Wighting, 2005). Cooperation and collaboration are central to minority groups' learning and communication styles. "Underlying values of human connectedness and collaborative problem solving are high priorities in the cultures of most groups of color in the United States" (Gay, 2000, p. 158).

Cooperative learning can have positive effects across genders, abilities, and ethnicities (Stevens & Slavin, 1995). Yet given the research literature, one might speculate that students of

color may be more willing to work collaboratively in small groups than Caucasian classmates and more satisfied with the collaboration process. But potential feelings of isolation, particularly when a student of color is the only representative of his or her ethnicity within a small group (Barkley, et al., 2005), and inequitable treatment provoked by the relative anonymity of asynchronous group work (Herring, 1996; Selfe & Meyer, 1991) could sour any satisfaction produced by working collaboratively. Such dissatisfaction in a diverse group's communication process may ultimately lead to dissatisfaction in the collaborative experience as a whole and possibly deter minority students from taking part in other collaborative experiences in the future.

Student Perceptions of the Community of Inquiry

The Community of Inquiry (CoI) framework, discussed earlier in this paper, identifies three essential elements to a successful higher education experience: cognitive presence, teaching presence, and social presence. This model of critical thinking and inquiry utilizes the three essential elements as mutual support for assessing asynchronous online interaction (Shea, et al., 2004) and assumes that learning occurs through the interaction of the three essential elements (Rourke, et al., 1999). Ice (2008) suggests that the CoI framework can be used to assess the impact and utility of learning environments and strategies on online interaction. Used as a tool to conceptualize the online learning experience (Garrison & Arbaugh, 2007), each of the three presences is multi-dimensional and is operationally defined in terms of its descriptive categories (see Figure 3).

ELEMENTS	CATEGORIES
Social Presence	Open communication Group Cohesion Affective Expression
Cognitive Presence	Triggering Event Exploration Integration Resolution
Teaching Presence	Design & Organization Facilitating Discourse Direct Instruction
Figure 3 Community of Inquiry elements and categories. Adapted from Garrison & Arbaugh (2007).	

Social presence. Social presence is interpreted as the ability of learning community members to project their personal characteristics and to connect with others socially and emotionally (Garrison, 2006; Ice, et al., 2008) and functions as a support for cognitive presence (Garrison, et al., 2000a). Three categories, open communication, group cohesion, and affective expression, are represented in the CoI student survey and serve to operationally define social presence. The first category, open communication is measured in the CoI student survey by questions that pertain to students' comfort with conversing online and interacting with other students (Arbaugh, et al., 2007a). Student responses in this area may relate to a student's preference for working collaboratively and will likely influence student satisfaction.

The second category of social presence, group cohesion, assesses students' comfort in disagreeing with others during discussion, whether student's points of view were acknowledged, and whether they developed a sense of collaboration (Arbaugh, et al., 2007a). The third category, affective expression, assesses students' sense of belonging in their group, whether they were able to get distinct impressions of other group members, and if students feel that web-based communication works well for interaction (Arbaugh, et al., 2007a).

According to Garrison and Arbaugh (2007), social presence can be seen as an evolution from the first category, open communication, where student interaction begins, through the second category, group cohesion, where discourse takes place, and finally to the last step, affective expression, where students feel a sense of camaraderie. In this study, students' perception of each category helped explain if and how social presence evolved in their group. Perceptions of social presence have the potential to influence student's satisfaction, perceptions of cognitive presence, and learning outcomes. Therefore, investigating possible differences in social presence perceptions as a function of learning strategy and course delivery mode is vital to identifying best practices for cooperative and collaborative learning.

Cognitive presence. Cognitive presence is defined as the "extent to which participants in a community of inquiry are able to construct meaning through sustained communication" (Garrison, et al., 2000a, p. 89), reflection, and discourse (Ice, et al., 2008), and represents the process of higher-order thinking and learning (Garrison & Anderson, 2003). The other two elements of the CoI framework, teaching presence and social presence, act as vital support for cognitive presence, by facilitating the critical thinking process(Garrison, et al., 2000a).

Cognitive presence is operationalized by four phases taken from the practical inquiry model: triggering event, exploration, integration, and resolution (Akyol & Garrison, 2008; Garrison, et al., 2001). The triggering event represents the phase where an issue is identified for investigation or inquiry (Arbaugh, 2007). The CoI student survey examines this phase by asking the student if problems and activities piqued their interest and if they were motivated to explore content-related issues (Arbaugh, et al., 2007a). The exploration phase represents when students "explore an issue, both individually and corporately through critical reflection and discourse" (Garrison & Arbaugh, 2007, p. 161) and is measured by the CoI survey in regard to the use of

information sources, the usefulness of brainstorming and finding information in resolving issues, and the value of online discussions in examining different perspectives (Arbaugh, et al., 2007a). Varying student responses between groups during this phase may point to differences in students' perceptions of the value of their group work.

The third phase of cognitive presence, integration, examines how learners construct meaning based on ideas developed during the exploration phase (Garrison & Arbaugh, 2007). Because students often do not come together naturally in order to move toward integration and resolution phases (Garrison & Arbaugh, 2007), this phase may require increased teaching presence to "probe and diagnose ideas so that learners will move to higher level thinking in developing their ideas" (Arbaugh, 2007, p. 74). Additionally, learners may need more time for reflection if they are to reach the third and fourth phases of cognitive presence (Meyer, 2003). In the current study, if increased teaching presence is needed to reach this phase, a difference in cooperative and collaborative student responses may be noticeable.

The final phase, resolution, is illustrated by students applying newly gained knowledge to educational contexts (Garrison & Arbaugh, 2007) and is measured via students' reports on their ability to apply what they learned in other contexts (Arbaugh, et al., 2007a). Since application and synthesis of knowledge are objectives of any instruction, the ability for student groups to reach this level is important. However, because social and teaching presence act as supports for cognitive presence, deficiencies in those preferences may affect students reaching the resolution level (Garrison, et al., 2000a). Comparing any differential student responses in regard to learning strategy or delivery mode is valuable in assessing the effectiveness of the module activity in this study.

Teaching presence. Teaching presence refers to the design of a course and the facilitation of communication within the course (Garrison, 2006). The teaching presence construct is defined by three components: design and course organization, discourse facilitation, and direct instruction (Shea, et al., 2003). The first component, design and organization, is assessed via CoI student survey questions regarding instructor communication of pertinent topics, goals, instructions on participation, and important due dates (Arbaugh, et al., 2007a). Results from this portion of the survey reveal potential design issues. The second element of teaching presence is discourse facilitation. Items on the CoI survey relate to the instructor helping to guide student understanding, engage learners in participation, and encourage the development of a sense of community (Arbaugh, et al., 2007a). Discourse facilitation can be an important factor in reaching higher levels of cognitive presence. According to Murphy (2004), instructor strategies for promoting interaction and critical discourse are essential for students to think and learn critically. In the current study, the lack of direct instructor facilitation in the collaborative group could have affected students' perceptions of cognitive presence and potentially influence achievement.

The third element of teaching presence, direct instruction, focuses on directing discussion to relevant issues and providing helpful feedback (Arbaugh, et al., 2007a). Similar to the third cognitive presence phase, student responses regarding discourse facilitation and direct instruction may differ according to learning strategy, with cooperative students providing more positive responses. Teaching presence has been found to influence student perceptions of learning. Therefore, differences in reported teaching presence may influence perceptions of cognitive presence.

Community of Inquiry summary. This study used the Community of Inquiry Student survey to investigate students' perceptions of cognitive, social and teaching presence within their cooperative or collaborative activity and thereby aimed to reveal the complex internal dynamics of each of the three presences as they occurred within the two instructional strategies. The survey instrument is based on a well established framework and has been validated in the research literature (Akyol & Garrison, 2008; Arbaugh, et al., 2007b)

Given the complexities of the internal dynamics of each of the three presences, as well as their interdependencies (Akyol & Garrison, 2008) understanding the three presences as they relate to cooperative and collaborative learning, as well as how they relate to blended and online learning, was valuable in terms of evaluating the effectiveness of the instructional strategies and course delivery modes in this study as well as adding to the research literature.

Student Perception of Group Structure

A common frustration for students participating in online collaboration is the difficulty in coordinating tasks and negotiating decisions, particularly when they do not have the chance to meet face-to-face. Additionally, if each individual must submit a worksheet or report, students may not feel as motivated to try to interact at a substantive level (Cohen, 1994). As a result, in order to get the group project finished, students who are assigned to a collaborative structure, where the group works together to come up with a solution, may end up switching to a cooperative approach, where individual tasks are divided among group members based on individual skills and knowledge (Hathorn & Ingram, 2002; Kitchen & McDougall, 1998; Paulus, 2005a, 2005b). While the resulting project may be just as good as if the group had worked collaboratively, one may question whether a deeper level of knowledge would have been constructed using a collaborative approach (Paulus, 2005a), or if students with less knowledge or

skill in certain areas of the project could have benefited more if they had negotiated all decisions together.

The nature of an assigned task also seems to be a factor in how participants approach group work. A study conducted by Paulus (2005b) revealed that a majority of group discussion was cooperative (non-conceptual, focusing on completing the task) rather than collaborative (conceptual). Once task type was factored in, the results revealed that application tasks tended to result in a more cooperative approach while synthesis type tasks resulted in a collaborative approach. On application tasks students were more product-oriented, focusing on completing the task by taking on individual tasks that reflected each members' skills and strengths (Graham & Misanchuk, 2004). In contrast, synthesis task groups students were more learning-oriented, focusing on the process of learning instead of on the end product (Graham & Misanchuk).

The tasks assigned to cooperative and collaborative groups in the present study were at the application level. Given the findings in the research literature as well as the nature of the assigned task, it is likely that some of the collaborative groups used cooperative methods to complete their group projects. Knowing how students approached their group projects was essential in this study, because their approach may have influenced their learning, satisfaction, preference for collaboration and perceptions of community of inquiry.

Summary

The purpose of this study was to investigate how the differing structures of cooperative and collaborative strategies and the differing environments associated with blended and online learning may influence student achievement, preferences for collaboration, satisfaction, and perceptions of the community of inquiry in a short-term group project. Examination of student characteristics, attitudes and perceptions enhanced understanding of the group dynamics

associated with group strategies in computer-mediated environments. Additionally, student perceptions of how their groups approached their group project, either cooperatively or collaboratively, better informed the analysis of data in this study.

Chapter III: Methodology

Introduction

This study examined a short-term, small-group, project-based learning activity set in blended versus completely online sections of a technology integration educational foundations course. The primary goal was to compare small groups (three to five students) enrolled in online or blended course sections that were randomly assigned to cooperative or collaborative learning strategies on the following dependent variables: (a)individual achievement, (b) group achievement, (c) attitude toward collaboration, (d) process satisfaction, (e) solution satisfaction, and student perceptions of (f) teaching presence, (g) social presence and (h) cognitive presence.

Media comparison. Despite the classic articles by Clark (1983) that maintain that media do not influence learning, media comparison studies still appear in research literature. Where earlier studies tried to investigate whether face-to-face or distance learning was more effective in enhancing learning, newer studies have sought to demonstrate that distance instruction is at least equivalent to face-to-face versions (Lockee et al., 1999). No matter the twist on the media comparison study, significant results are generally confounded because they do not control for teaching method (Clark).

Instead of trying to see if one media enhances learning more than the other, this study took the form of a media replication study (Ross & Morrison, 1996), where instructional strategies or methods are conducted on different media with the goal of investigating "the consistency of effects" (Ross & Morrison, p. 1168) of collaborative learning delivered by two different media.

Research Design

This study was a 2 x2 between-subjects factorial design that utilized course delivery method and learning strategy as the independent variables. The outcome variables were (a) individual

achievement, (b) group achievement, (c) value of collaboration, (d) process satisfaction, (e) solution satisfaction, (f) perception of teaching presence, (g) perception of social presence, and (h) perception of cognitive presence. Pretest and posttest measures were used to assess students' value of collaboration. Posttest-only measures were used to assess students' process satisfaction, solution satisfaction, and perceptions of teaching presence, social presence, and cognitive presence. Individual achievement and group achievement were assessed via an individual quiz and a group project rubric.

The sample potentially consisted of 389 undergraduate and graduate students enrolled in an educational technology integration foundations course. Students self-selected into online or blended (hybrid) sections of the course. Each course section was randomly assigned to either the cooperative or collaborative treatment. Activities within the course required students to form small groups of three to five participants. Prior to this experiment, small groups were formed based on students' availability to participate in certain synchronous chat assignments.

Because this study used intact groups, the equivalence of the groups needed to be established in order to eliminate the possibility of confounding variables accounting for any group differences found (Leedy & Ormrod, 2005). Although students in the study were all enrolled in the education program, a factorial MANOVA using course delivery method and instructional method (cooperative or collaborative study) as the independent variables and demographic information (age, gender, ethnicity, and experience with online learning) as the dependent variables was conducted to establish homogeneity of the sample. When significant differences between groups were found, variables on which the groups differed were used as covariates in all relevant statistical tests.

Research Questions

To guide the study, four major research questions were examined.

Within subjects:

1. Do learning strategy (collaborative vs. cooperative) and course delivery method (online vs. blended) differentially impact students' group grades and individual assessment grades (assessed after the group project)?
2. Do learning strategy (cooperative vs. collaborative) and course delivery method (online vs. blended) differentially impact students' attitude toward collaboration?

Between Subjects:

3. Do learning strategy (collaborative vs. cooperative) and course delivery method (online vs. blended) differentially impact students' satisfaction scores?
4. Do learning strategy (collaborative vs. cooperative) and course delivery method (online vs. blended) differentially impact students' perceptions of teaching presence, social presence, and cognitive presence in the project-based learning activity?

Setting and Sample

Participants. This study utilized undergraduate and graduate teacher education students enrolled in ECI 430/530: PK-12 Instructional Technology - a technology integration educational foundations course (see Appendix F for the course syllabus and course schedule). The course was designed for students who are at an academic standing of Junior or above. Generally, students complete their general education courses prior to enrolling in this course. Prior studies using this population have shown the age of students to range from 20 years old to over 50 years of age (Overbaugh, Nickel, & Brown, 2006).

Participants self-selected into blended or online sections of the course, taught by various instructors. Although the course sections are taught by various instructors, the objectives, content and design of the course were the same for each section. Students in the blended sections of the course met three hours per week in "class time", but interacted with classmates and the instructor and submitted assignments via the *Blackboard Learning Management System* and the *LiveText Accreditation Management System.* Online students learned completely online, utilizing the asynchronous and synchronous (virtual chat) features of *Blackboard* and submitting assignments via *LiveText.* Student participation in the pre-treatment and post-treatment surveys was voluntary and did not affect student grades. Both the online and traditional sections followed the 15-week university calendar, with the blended class meeting for 3 hours weekly. Each section allowed approximately 20 students to enroll. The sample size was 25 students.

Independent variables. The study utilized the following independent variables: (a) learning strategy (cooperative vs. collaborative learning) and (b) course delivery method (blended vs. online). The two independent variables are dichotomous and nominal in scale. The following variables were used as covariates: (a) gender, (b) age, (c) ethnicity, (d) academic level (undergraduate vs. graduate), (e) online experience, (f) current teaching status (currently teaching vs. not currently teaching), and professional teaching experience. Gender, ethnicity, academic level, and teaching status were treated as nominal variables. Online experience was measured using the question "In the past, have you taken any courses that were taught online (no classroom time)?" Response choices were: (a) No, (b) Yes, 1 Class, (c) Yes, 2 classes, (d) Yes 3 or more classes. Age (below 20, 21-25, 26-30, 31-35, 36-40, 41-50, 51-60, >60) and online experience were transformed into categorical, or "dummy" variables.

Dependent variables. The five dependent variables used in this study were in interval or ordinal scale. The first variable, achievement, was measured according to an individual's (a) individual quiz grade and (b) group grade on the group project. The individual quiz grade was determined through the use of a multiple-choice quiz delivered at the end of the instructional module in *Blackboard.* The group grade on the group project was determined through the use of a researcher-created rubric. Each student's group project submission was graded and then the group member's scores were averaged to determine a group grade. The group project rubric and Individual quiz questions can be found in Appendix D and Appendix E.

The second dependent variable was student attitude toward collaboration and was measured in three domains: (a) student's value of connectedness, (b) student's value of collaborative learning, and (c) student's recognition of the added achievement potential of collaborative learning.

Student satisfaction was the third dependent variable and was measured according to two domains: (a) student's process satisfaction score, (b) student's solution satisfaction score. Process satisfaction was measured by asking students to describe their group's problem-solving process. Solution satisfaction was measured by asking students how satisfied or dissatisfied they were with the quality of their group's decision. Students were also asked the following questions regarding their solution satisfaction: (a) "To what extent do you feel personally responsible for the correctness of the group's solutions?", (b) "To what extent does the group's final solution reflect your inputs?", (c) "To what extent are you confident that the group's solutions are correct?", and (d) "To what extent do you feel committed to the group's solution?". Responses could range from "not at all" to "very great extent" on a five-point Likert scale.

The fourth dependent variable, student perception of the community of inquiry, consisted of three domains: (a) student's perceptions of social presence, (b) student perception of cognitive presence, and (c) student perception of teaching presence. Instruments and materials are described in more detail below.

Measures

Pre-experimental data instruments.

Demographic information. Demographic information was gathered on the pre-experimental survey (See Appendix G) and included age, gender, ethnicity, experience with online courses, academic level (undergraduate or graduate) and teaching experience. Names were used for matching pretest and posttest results and demographic data were used to prove homogeneity of the groups. All information was kept confidential.

Value of Connectedness, Preference for Collaborative Learning, and Recognition of the potential of collaborative learning. The sample was surveyed before and after the treatment to investigate student attitudes toward three aspects of academic community: (a) value of connectedness, (b) value of collaborative learning and, (c) recognition of the added achievement potential of collaborative learning. These three aspects were measured via the following three survey items: (a) I value a feeling of connectedness to others in my classes; (b) If given the choice I would prefer to work with others to solve complex problems; and (c) I have the potential to achieve more academically by collaborating with others (Overbaugh & Nickel, 2008). Each item was measured on a 5-point Likert scale (see Appendix F). In the current study, pre-treatment value of collaboration questions revealed a reliability of α=.808. Post-treatment value of collaboration questions revealed similar results.

Post-experiment instruments

Group project grades. The cooperative, project-based lesson plan, was created by each small group but submitted individually by each student. In some groups, students submitted essentially the same lesson plan. In other groups, individual students added to or changed elements of the lesson plan before submitting to the instructor. Individual project submissions were assessed by the researcher using a rubric based on a 100-point scale. The rubric included points for using and justifying cooperative and project-based elements in the lesson plan, as well as points for justifying use of technology in the lesson. Additionally, participation in online group activities was graded in the rubric. The rubric was developed utilizing Jonassen's (1997) process for solving ill-structured problems (see Appendix D). Prior to conducting this study, the rubric was reviewed by instructors who teach the course to ensure content validity.

Individual Quiz Grades. Students were required to take a quiz after completing the individual readings in Blackboard and discussing content with their small groups. The test was developed utilizing Bloom's Taxonomy (see Appendix E). Validity of the test questions was established via a blueprint and consultation with experts.

Student Satisfaction. The sample's satisfaction with the process of group collaboration or cooperation and their satisfaction with their group's project solution was measured via self-report. Process and solution satisfaction were measured by five-item scales developed by Green and Taber (1980) (see Appendix F). Process satisfaction was measured by asking students to describe their group's problem-solving process. Using a five-point Likert scale where one and five represented the extremes, students were asked to rate their group's process as (a) inefficient vs. efficient, (b) uncoordinated vs. coordinated, (c) unfair vs. fair, (d) confusing vs. understandable, and (e) unsatisfying vs. satisfying. Solution satisfaction was measured by asking

students how satisfied or dissatisfied they were with the quality of their group's decision. Student responses could range from "very dissatisfied" to "very satisfied" on a five-point Likert scale. Students were also asked the following questions regarding their solution satisfaction: (a) "To what extent do you feel personally responsible for the correctness of the group's solutions?", (b) "To what extent does the group's final solution reflect your inputs?", (c) "To what extent are you confident that the group's solutions are correct?", and (d) "To what extent do you feel committed to the group's solution?". Responses could range from "not at all" to "very great extent" on a five-point Likert scale. Ocker and Yaverbaum (2001) reported the reliability of the process satisfaction scale as α=.91 and the solution satisfaction scale as α=.75. In the current study, the Process Satisfaction scale revealed a reliability of α=.944 and the Solution Satisfaction scale revealed a reliability of α=.851.

Student perceptions of teaching presence, social presence and cognitive presence. An adapted form of the Community of Inquiry (CoI) Survey Instrument (Arbaugh, et al., 2007a) was used with the authors' permission to measure students' perceptions of teaching presence, social presence and cognitive presence in the treatment (see Appendix F). The instrument was originally designed to measure student perceptions of social presence, cognitive presence, and teaching presence for an entire online or web-based course. In the present study, the survey items were re-worded to ask questions about the cooperative or collaborative activity, not the entire course. The 34-item Likert-type survey instrument is comprised of three subscales – teaching presence, social presence, and cognitive presence. In previous studies the Chronbach's alpha for the teaching presence subscale was α= .94, the Chronbach's alpha for the social presence subscale was α=.91, and the Chronbach's alpha for the cognitive presence subscale was α=.95 (Arbaugh, et al., 2007b; Swan, et al., 2008). In the present study, the scores from the three

subscales within the CoI Survey instrument were analyzed independently to differentiate students' perceptions of teaching presence, social presence and cognitive presence within the course delivery methods and learning strategies. Teaching presence had a reliability of α=.962, Social Presence had a reliability of α=.895 and Cognitive Presence had a reliability of α=.926. Within each scale are a set of subscales. All subscales had a reliability of α=.712 or above.

Student perceptions of group structure. Groups that were formed to work collaboratively may have adapted to a more cooperative approach, and vice versa. A two-item instrument was created to investigate student perceptions of their group structure. The instrument asked the following questions: (1) Was each of your group members assigned a specific role or task in this activity? and (2) Was your group more likely to work on the whole project together or divide the work up among individual group members? The first question was answered with a yes or no answer. The second question was answered as either "worked on the whole project together" or "divided the work up among members".

Treatment

Twenty-two sections of ECI 430/530: PK-12 Instructional Technology were offered during the Spring 2009 semester. Thirteen of the course sections were taught utilizing a blended course delivery method and nine sections were taught completely online. Students self-selected into online or blended sections of the course. Each section was randomly assigned to a cooperative or collaborative learning strategy for the short-term, project-based assignment. Within the course sections, students self-selected into groups of three or four students based on their reported availability to work asynchronously.

When the students began the module utilized in this study, they were told to complete the assigned readings and videos (stored in Blackboard) within three days. The readings and videos

included foundational information on cooperative learning and current examples of cooperative, project-based learning in primary and secondary school classrooms. On the fourth day of the module assignment, students were expected to enter their small group discussion board and chat areas in Blackboard. Group assignments took place prior to the treatment (due to another module that required students to work in groups). Group assignments were generally based on students' availability to meet in the virtual chat room (as required by the previous group activity).

Each group was required to investigate cooperative and project-based learning (utilizing materials provided as well as investigating on their own) and produce a summary for a cooperative, project-based lesson. Groups could decide to meet asynchronously, using the discussion board in their small group area, or they could meet synchronously, utilizing the chat function in their small group area. The group was directed to decide how they would meet within one day of entering the small group area. Students were asked to archive all synchronous communication for later analysis.

Each group was given a template (see Appendix C) to help them create the lesson plan, but was allowed to choose the target audience (age, grade of students) and the subject matter based on identified Virginia Standards of Learning. Students worked on the lesson plan in groups of three or four students using either the cooperative or collaborative learning strategy.

Learning strategy. Cooperative and collaborative groups were distinguished by the amount of structure provided to and required in the small groups. Cooperative groups were provided with extra instructions that detailed specific roles for group members, scaffolding for promotive interaction and teamwork skills, and group processing (Johnson & Johnson, 1991). Examples of the specific roles, scaffolding, and directions for group processing can be found in

Appendix B. Collaborative groups were encouraged to work together to accomplish the assigned tasks, but were not provided with specific member roles or other scaffolding.

While one might argue that cooperative treatment groups were being provided additional instruction, they were actually being provided with more structure than the collaborative group. One of the differences between cooperative and collaborative learning is that collaborative groups are expected to know how to work as a team, while that assumption is not made for cooperative groups. Therefore an essential element of cooperative learning is the scaffolding of teamwork skills. Furthermore, collaborative groups are expected to resolve most of their own conflicts and are not generally guided as to how to evaluate their group process. In contrast, cooperative groups are expected to reflect on how well they are working together. Thus, another essential element of cooperative learning is reflection on the group process, which is often guided by the instructor.

Both cooperative and collaborative groups were informed that the assignment was complex and needed to be worked on together in order to succeed, thereby emphasizing positive interdependence (Johnson & Johnson, 1991). At the same time, students understood that they were individually accountable for the work they did, and that work was reflected in their individual project grade and quiz grade.

Submitting assignments (group projects). Although students worked in groups, each student was required to turn in their own version of the assignment for grading due to university issues regarding students' digital portfolios and the need for evidence of individual assessments for accreditation requirements. Project instructions for the cooperative and collaborative groups can be found in Appendix B.

Upon completion of the project, each individual submitted a completed cooperative, project-based lesson plan to the LiveText portfolio software system and was asked to complete the post-experiment survey (see Appendix C). Students were directed on the proper way to submit their assignment via LiveText, a web-based electronic portfolio tool used to assess and measure student learning ("LiveText,"). Both the instructors and the researcher received the individual assignments through LiveText, however for the purpose of the current study, all submitted assignments were graded by the researcher.

Individual quizzes. After submitting the cooperative, project-based lesson plan, each student was instructed to complete a short module quiz. The quiz assessed the student's knowledge retention of the material covered in the course module used in the study. The quiz was created utilizing the Cognitive Process Dimension of the revised version of Bloom's Taxonomy (Krathwohl, 2002) and a blue print. The quiz assessed students' knowledge from a knowledge level through an application level. The Blueprint and quiz questions can be found in Appendix E.

Data collection. An application for research was submitted to the School of Education's Institutional Review Board at the beginning of the Spring 2009 semester. The application was approved and permission was granted to begin data collection in February 2009. A pre-treatment survey was developed using the Inquisite survey software. The survey consisted of demographic questions, including age, gender, ethnicity, experience with online courses, academic level, and teaching experience. The pre-treatment survey also included questions regarding the student's value of connectedness, preference for collaborative learning, and recognition of the potential of collaborative learning for higher achievement. The survey was offered online (via Inquisite) and

a link to the survey was sent to students via ODU student email and through the announcements page in Blackboard. Students were notified that their participation in the survey was voluntary.

Group projects, which were submitted individually by students due to departmental requirements regarding accreditation issues, were downloaded by the researcher and graded. The researcher utilized the group project rubric (see Appendix D) to grade each individually submitted project. Moreover, the individually submitted projects were graded randomly and not by course section or group so that the researcher would not be influenced by grades given to similar submissions from group members. Group project grades were created by summing the project grades from each group member and then finding the mean for the group. Group project grades were recorded in SPSS.

Upon submission of the group project, students were required to take a quiz in Blackboard (quiz questions can be found in Appendix E). The quiz results were automatically tallied via the Blackboard quiz feature and recorded in each course section's Gradebook. Quiz grades from each section were copied from the Blackboard Gradebook into SPSS by the researcher.

After completing the course quiz, students were asked to respond to the post-treatment survey (see Appendix G). The post-treatment survey was created using the Inquisite survey software and included questions pertaining to students' value of collaboration, the student process and solution satisfaction instrument, The Community of Inquiry (CoI) Survey Instrument, and questions pertaining to students' perception of the assignment of student roles and structure in their groups. A link to the survey was provided to students in the course module directions. A follow-up email asking students to complete the post-treatment survey was sent a week after the projects and quizzes were due. Student participation in the post-treatment survey

was voluntary. Student responses were downloaded from the Inquisite survey database and copied into SPSS for analysis.

Ethical Protection of Participants

Students involved in the study were informed that a research study investigating their group projects was taking place. Although students were not told the specific purpose of the study, to avoid confounding results due to the subject effects (Leedy & Ormrod, 2005), they were informed of the activities that would take place, including any pre- or post treatment surveys they would be asked to take. Additionally, the name and contact information of the researcher were provided. Completion of pre- and post treatment surveys was voluntary. Students were guaranteed that all information regarding their grades, pre- and post treatment survey responses, and all archived communication on Blackboard was kept confidential and none of their survey responses were seen by their instructor. Student names were only used to match pre and post treatment survey data and then were discarded.

Conclusion

The purpose of this study was to examine the differential effects of cooperative and collaborative strategies and blended and online learning on group and individual achievement, student process and solution satisfaction, attitudes about collaboration, perceptions of community of inquiry, and perceptions of group structure. The researcher's goal is to add to the research literature on cooperative and collaborative learning and blended and online learning in terms of the dependent variables studied. Finally, the researcher hopes to add to the literature on the Community of Inquiry Framework and specifically add to research on the Community of Inquiry Student Survey.

Chapter IV: Results

Introduction

This study examined whether cooperative versus collaborative learning strategies taking place in online versus blended environments had differential effects on (a) students' achievement (individual and group), (b) value and preference for collaboration, (c) process and solution satisfaction, and (d) perceptions of teaching presence, social presence and cognitive presence. To conduct the investigation, a 2x2 between-subjects factorial design was used with the following statistical procedures: two step-wise modeled analyses of covariance (ANCOVA) and three stepwise modeled multivariate analyses of covariance (MANCOVA). This chapter consists of four major sections: (a) Characteristics of Participants, (b) Reliability of Instruments, (c) Data Analysis, and (d) Results. The four major sections are followed by a summary.

Characteristics of the Participants

A total of 22 sections of the ECI 430/530 (Instructional Technology and the Classroom) course participated in the study with 389 students enrolled. Of the 22 course sections, 13 sections were taught via blended delivery method and included 58.9% (n=229) of the total student enrollment. Nine sections of the course were taught via the online delivery method and included 41.1% (n=160) of the student enrollment. The 22 course sections were randomly assigned to the cooperative or collaborative learning strategy. A total of 52.7% (n=205) of the students utilized the cooperative learning strategy while 47.3% (n=184) of the students utilized the collaborative learning strategy (see Table 1).

Table 1
Descriptive Statistics for Students Enrolled in ECI 430/530

		Frequency	Percent (%)
Course Format			
	Blended	229	58.9%
	Online	160	41.1%
Learning Strategy			
	Cooperative	205	52.7%
	Collaborative	184	47.3%

Of the 389 students enrolled, 91% (n=353) responded to the pre-treatment survey that gathered data about the participants' characteristics and values of connectedness, preference for collaboration, and recognition of the academic potential of collaboration. Of the 353 students, 73.9% (n=261) were undergraduate students and 26.1% (n=92) were graduate students.

Data was discarded due to a student's failure in or withdrawal from the course, a student's failure to submit his or her project, or a student's decision to work individually instead of in a group. Of the 389 original participants, 3.9% (n=15) students worked independently and 1.8% (n=7) failed to turn in their project. 6.4% (n=25) withdrew from the course and 8.5% (n=33) failed the course. Additionally, of the 22 course sections, results from 4 sections were discarded due to potential conflicts with the study. One section was discarded because the students and instructor failed to provide the researcher with the student projects for grading. Another section was discarded because the students completed all of their group work in class, instead of online. A third section was discarded because students were allowed to attempt the unit quiz twice. Finally, the fourth section was discarded because the cooperative learning module was offered at a later time in the semester than the rest of the course sections. All of the discarded sections utilized blended delivery method. After discarding participants for the reasons

listed above, the total number of participants used in the analysis was 254. The number of students in the blended learning sections equaled 134 (52.8%) while 120 students (47.2%) were enrolled in online sections of the course. The cooperative learning strategy was utilized by 134 students (52.8%) and the collaborative learning strategy was utilized by 120 (47.2%) students (see Table 2).

Table 2
Descriptive Statistics on Actual Study Participants

		Frequency	Percent (%)
Course Format			
	Blended	134	52.8%
	Online	120	47.2%
Learning Strategy			
	Cooperative	134	52.8%
	Collaborative	120	47.2%

Once student responses were discarded due to failures, withdrawals, and course section discrepancies 254 students were used for the data analysis. Females made up 79.5% (n=202) of the particiants and 20.5% (n=52) were male.

Students were asked to classify their ages according to the following categories: (a) 20 or under, (b) 21 to 25, (c), 26 to 30, (d) 31 to 35, (e) 36 to 40 , (f) 41 to 50, and (g) 51 and over. Of the participants, 24.6% (n= 61) respondents were age 20 or under and 36.7% (n=91) fell in the 21 to 25 age group. Students ages 26 to 30 were represented by 11.7% (n=29) of the sample, while 10.5% of respondents (n=26) were ages 31 to 35. Respondents ages 36 to 40 and 41 to 50 each represented 7.3% (n=18) of the sample. Respondents ages 51 or over made up 2% (n=5) of the sample.

Students were asked to classify their ethnicity but could elect to not answer the question. Of the participants, 74.1% (n=183) categorized themselves as white, not Hispanic and 11.3%

(n=28) categorized themselves as Black, not Hispanic. Nine (3.6%) students classified themselves as Hispanic, eight (3.2%) students classified themselves as Asian or Pacific Islander, and three (1.2%) students classified themselves as American Indian or Alaskan Native. Ten students (4%) classified themselves as "other" and six (2.4%) students chose not to answer the question.

A majority of students, 89.9% (n=223), were not currently teaching, however 10.1% (n=25) claimed to be currently teaching in some capacity. Further, 59.7% (n=117) of participants stated that they did not have professional teaching experience. Of those who reported having professional teaching experience, 7.1% (n=14) respondents had over 2 years experience teaching full-time in a public or private school and 5.1% (n=10) had less than 2 years full-time teaching experience. Participants who had 2 or more years teaching part-time in a public or private school made up 2% (n=4) of the sample. Seven respondents (3.6%) had 2 or more years substitute teaching experience while 8.2% (n=16) of respondents had less than 2 years substitute teaching experience. Participants who taught in an area other than a public or private school made up 7.1% (n=14) of the sample while another 7.1% (n=14) of participants stated that they had "other" teaching experience.

Finally, in regard to online experience 110 participants (44.5%) indicate that they had no experience taking courses online. Forty-three participants (17.4%) had taken one online course, 19 students (7.7%) had taken two online courses, and 75 students (29.5%) had taken three or more online courses (see Table 3).

Table 3
Descriptive Statistics on Characteristics of Participants

		Frequency	Percent (%)
Academic status			
	Undergraduate	181	72.1%
	Graduate	70	27.6%
Gender			
	Male	52	20.5%
	Female	202	79.5%
Age			
	20 or under	61	24.6%
	21 to 25	91	36.7%
	26 to 30	29	11.7%
	31 to 35	26	10.5%
	36 to 40	18	7.3%
	41 to 50	18	7.3%
	51 or over	5	2%
Ethnicity	Black, not Hispanic	28	11.3%
	Hispanic	9	3.6%
	American Indian / Alaskan Native	3	1.2%
	Asian, Pacific Islanders	8	3.2%
	White, not Hispanic	183	74.1%
	Other	10	4%
	I choose not to answer this question	6	2.4%
Currently Teaching			
	Yes	25	10.1%
	No	223	89.9%
Professional Teaching Experience			
	Over 2 years teaching full-time in a public or private school	14	7.1%
	Less than 2 years full-time teaching experience	10	5.1%
	2 or more years teaching part-time in a public or private school	4	2%
	2 or more years substitute teaching experience	7	3.6%
	Less than 2 years substitute teaching experience	16	8.2%

	Teaching in an area other than a public or private school	14	7.1%
	No professional teaching experience	117	59.7%
	Other	14	7.1%
Online Experience			
	No	110	44.5%
	Yes, 1 class	43	17.4%
	Yes, 2 classes	19	7.7%%
	Yes, 3 or more classes	75	29.5%

Given that there are often differences in student demographics and experiences when comparing blended and online courses, the data was split to investigate differences in the study's sample (see Table 3a). Of particular note are the differences in academic status, age, current teaching status, professional teaching experience, and online experience. The online course sections consisted of more graduate students (42%) than the blended course sections (15.2%). Students in the age ranges "under 20 to 25" made up 79.6% of the blended course sections, whereas student in those same age ranges made up only 40.5% of the online student enrollment. More online students were currently teaching (16.4%) than were the blended students (4.5%), and more online students had some type of teaching experience (60%) as compared to blended students (49.5%). Finally, 63.6% of blended course students had no previous experience with online coursework. In contrast, only 22.6% of online students had no online experience and 51.7% of online students indicated they had taken 3 or more courses online. Given the demographic and experiential differences of students in the course delivery methods, the variables listed above were used as covariates in the data analysis.

Table 3a
Descriptive Statistics on Characteristics of Participants Separated by Course Delivery Method

		Blended Course Sections n=134		*Online Course Sections* n=120	
		Frequency	Percent (%)	Frequency	Percent (%)
Academic status					
	Undergraduate	112	84.8%	70	58%
	Graduate	22	15.2%	50	42%
Gender					
	Male	25	18.7%	27	22.5%
	Female	109	81.3%	93	77.5%
Age					
	20 or under	53	40.2%	8	6.9%
	21 to 25	52	39.4%	39	33.6%
	26 to 30	12	9.1%	17	14.7%
	31 to 35	6	4.5%	20	17.2%
	36 to 40	3	2.3%	15	12.9%
	41 to 50	6	4.5%	12	10.3%
	51 or over	0	0%	5	4.3%
	Age not provided	2		4	
Ethnicity					
	Black, not Hispanic	19	14.5%	9	7.8%
	Hispanic	5	3.8%	4	3.4%
	American Indian / Alaskan Native	0	0%	3	2.6%
	Asian, Pacific Islanders	6	4.6%	2	1.7%
	White, not Hispanic	92	70.2%	91	78.4%
	Other	7	5.3%	3	2.6%
	I choose not to answer this question	5	3.7%	8	6.7%
Currently Teaching					
	Yes	6	4.5%	19	16.4%
	No	126	95.5%	97	83.6%
Professional Teaching Experience					
	Over 2 years teaching full-time in a public or private school	3	2.2%	11	9.2%

	Less than 2 years full-time teaching experience	5	3.7%	5	4.2%
	2 or more years teaching part-time in a public or private school	1	.7%	3	2.5%
	2 or more years substitute teaching experience	2	1.5%	5	4.2%
	Less than 2 years substitute teaching experience	5	3.7%	11	9.2%
	Teaching in an area other than a public or private school	2	1.5%	12	10%
	No professional teaching experience	69	51.5%	48	40%
	Other	7	5.2%	7	5.8%
	Not provided	40	29.9%	18	15%
Online Experience					
	No	84	63.6%	26	22.6%
	Yes, 1 class	26	19.7%	17	14.2%
	Yes, 2 classes	9	6.8%	10	8.7%
	Yes, 3 or more classes	13	9.7%	62	51.7%

Reliability of the Instruments

Table 4 provides the reliability coefficients for each of the instruments used in the study. Chronbach's alpha was computed using the data collected from the 254 study participants. The reliability of the Student Satisfaction instrument (Green & Taber, 1980) was .923 overall, however an inter-item correlation matrix revealed that certain items in the process satisfaction scale had a correlation of less than .3 with certain items in the Solution Scale, meaning that some

process satisfaction items were weakly correlated with certain solution satisfaction items. When the process and solution satisfaction scales were looked at separately the Process Satisfaction scale revealed a reliability of .944 and the Solution Satisfaction scale revealed a reliability of .851.

The three value of collaboration questions were tested for reliability for both the pre-treatment and post-treatment survey data. Pre-survey value of collaboration questions revealed a reliability of .808, although SPSS results indicated that if the first item, "I value a feeling of connectedness to others in my classes" was deleted, the reliability would increase to .852. Similar results were found with the post-survey data, in which overall reliability was .807 but deletion of the first item would increase the reliability to .846. The survey item is important to the research study and the original intent was to utilize these items separately. Therefore, it was decided that these three items would not be combined into one instrument, but would be used separately.

The Community of Inquiry (CoI) Student Survey revealed an overall reliability of .962, however an inter-item correlation matrix revealed that certain items within differing scales had a correlation of less than .3. When reliability was examined by scales (teaching presence, social presence and cognitive presence), Teaching presence had a reliability of .962, Social Presence had a reliability of .895 and Cognitive Presence had a reliability of .926. Within each scale are a set of subscales. All subscales had reliability of .712 or above (see Table 4 for more details).

Table 4

Internal Consistencies of Pre-treatment and Post-treatment Surveys, Including Student Satisfaction, Value of Collaboration, and Community of Inquiry (CoI) Student Survey

Student Satisfaction (Process and Solution Satisfaction)		
Process Satisfaction	.944	
Solution Satisfaction	.851	
Overall	.923	
Value of Collaboration		
	Pretest	Posttest
Overall	.808	.807
Community of Inquiry (CoI) Student Survey		
Teaching Presence – Design & Organization subscale	.932	
Teaching Presence – Facilitating Discourse subscale	.951	
Teaching Presence – Direct Instruction subscale	.881	
Overall Teaching Presence	.962	
Social Presence – Open Communication subscale	.712	
Social Presence – Group Cohesion subscale	.868	
Social Presence – Affective Expression subscale	.782	
Overall Social Presence	.895	
Cognitive Presence – Triggering Event subscale	.932	
Cognitive Presence – Exploration subscale	.732	
Cognitive Presence – Integration subscale	.894	
Cognitive Presence – Resolution subscale	.876	
Overall Cognitive Presence	.926	
Overall Community of Inquiry	.962	

Data Analysis

Statistical procedures in this study included factorial ANCOVAs to test for statistically significant differences on the following dependent variables: individual achievement (quiz grade) and group achievement (group project grade). Factorial MANCOVAs were used to test for main effects and interactions of the independent variables on the following dependent variables: student process satisfaction, student solution satisfaction, student attitude toward connectedness and collaboration, and student perceptions of Teaching Presence, social presence and cognitive presence.

1. Do learning strategy (collaborative vs. cooperative) and course delivery method (online vs. blended) differentially impact students' group grades and individual assessment grades (assessed after the group project)? To answer the first question a step-wise ANCOVA was conducted with cooperative or collaborative learning strategy and blended or online course delivery method as the independent variables. Quiz grade was used as the dependent variable. A second ANCOVA was conducted utilizing the same independent variables but with group project grade as the dependent variable. Due to indications from previous research that student demographics may play a confounding role in research results, the following were used as covariates: actual learning strategy used (actual group structure), student age, gender, ethnicity, online experience, academic standing (undergraduate or graduate), teaching experience, and current teaching status.

2. Do learning strategy (cooperative vs. collaborative) and course delivery method (online vs. blended) differentially impact students' attitude toward collaboration? To answer the second research question, a step-wise MANCOVA was conducted with course delivery method (blended or online) and learning strategy (cooperative or collaborative) as the

independent variables. The post-treatment scores of the three items from the value of collaboration construct – (a) value of connectedness, (b) preference for collaboration, and (c) understanding of collaboration potential - were used as the dependent variables. The following covariates were used: pre-treatment value of collaboration construct items, actual group structure, student age, gender, ethnicity, online experience, academic standing (undergraduate or graduate), teaching experience, and current teaching status.

3. **Do learning strategy (collaborative vs. cooperative) and course delivery method (online vs. blended) differentially impact students' satisfaction scores?** To answer the third research question, a step-wise MANCOVA was conducted with course delivery method (blended or online) and learning strategy (cooperative or collaborative) as the independent variables. The process satisfaction and solution satisfaction were used as the dependent variables. The following covariates were used: post-treatment value of collaboration construct items, actual group structure, student age, gender, ethnicity, online experience, academic standing (undergraduate or graduate), teaching experience, and current teaching status.

4. Do learning strategy (collaborative vs. cooperative) and course delivery method (online vs. blended) differentially impact students' perceptions of teaching presence, social presence, and cognitive presence in the project-based learning activity? To answer the fourth research question, a step-wise MANCOVA was conducted with course delivery method (blended or online) and learning strategy (cooperative or collaborative) as the independent variables. The mean scores from the teaching presence, social presence, and cognitive presence scales (from the Community of Inquiry Student Survey) were used as the dependent variables. The following covariates were used: post-treatment value of collaboration construct items, process and solution

satisfaction scores, actual group structure, student age, gender, ethnicity, online experience, academic standing (undergraduate or graduate), teaching experience, and current teaching status.

Results

Groups that were formed to work collaboratively may have adapted to a more cooperative approach, and vice versa. A two-item instrument was created to investigate student perceptions of their group structure. The instrument asked the following questions: (1) Was each of your group members assigned a specific role or task in this activity? and (2) Was your group more likely to work on the whole project together or divide the work up among individual group members? The first question was answered with a yes or no answer. The second question was answered as either "worked on the whole project together" or "divided the work up among members". Responses to this instrument were coded into the following six options: (a) assigned cooperative, worked cooperatively; (b) assigned cooperative, partially followed assignment; (c) assigned cooperative, worked collaboratively; (d) assigned collaborative, worked collaboratively; (e) assigned collaborative, partially followed assignment; (f) assigned collaborative, worked cooperatively.

Of the 254 students who participated in the pretreatment and post treatment survey, 196 students completed the two-item instrument created to investigate student perceptions of their group structure. Descriptive statistics, shown in Table 5, indicate that in blended course environments 16.7% of students assigned to the cooperative learning strategy instead worked collaboratively. Of the blended learning students assigned to the collaborative learning strategy, 34% of the students worked cooperatively instead of collaboratively. In online course environments, 8% of students assigned to the cooperative learning strategy chose to work collaboratively instead, while 21.6% of students assigned to the collaborative learning strategy

chose to work cooperatively. Given the percentages of students that chose a different learning strategy than was assigned, the students' actual approach to the group assignment is an important element of the study and was used as a covariate in the univariate and multivariate tests.

Table 5

Descriptive Statistics for Groups' Actual Learning Strategy (Actual Group Structure)

Assigned Learning Strategy	*Actual Strategy Used*	*n*	*%*
Blended Course Delivery Method			
Cooperative	Followed assigned learning strategy	17	17.9%
	Partially followed assigned learning strategy	23	24.2%
	Did not follow assigned learning strategy	8	8.4%
	Total	48	50.5%
Collaborative	Followed assigned learning strategy	11	11.6%
	Partially followed assigned learning strategy	20	21.1%
	Did not follow assigned learning strategy	16	16.8%
	Total	47	49.5%
Online Course Delivery Method			
Cooperative	Followed assigned learning strategy	18	17.8%
	Partially followed assigned learning strategy	28	27.7%
	Did not follow assigned learning strategy	4	4%
	Total	50	49.5%
Collaborative	Followed assigned learning strategy	14	13.9%
	Partially followed assigned learning strategy	26	25.7%
	Did not follow assigned learning strategy	11	10.9%
	Total	51	50.5%

Prior research has shown that student demographics may differ based on course delivery mode and thus may unequally influence the dependent variable. To determine if there were significant differences between the course delivery methods and the learning strategies in regard to student characteristics, a MANOVA was conducted utilizing course delivery method and learning strategy as the independent variables. The following were used as dependent variables: age, gender, ethnicity, academic level, online experience, currently teaching and years of teaching experience. Results indicated that student age was significantly different between learning strategies and course delivery methods. Furthermore, statistically significant differences were found between course delivery methods in regard to academic level, online experience, whether a student is currently teaching, and prior teaching experience. Gender and ethnicity were not significantly different between learning strategies or course delivery methods. The following variables were used as covariates throughout this research study: groups' actual reported learning strategy (called actual group structure), age, academic level, online experience, current teaching status, and prior teaching experience.

Research Question 1: Achievement

The first research question addressed whether the (collaborative vs. cooperative) and course delivery method (online vs. blended) had a differential effect on individual quiz grades and group project grades. Quiz grades and projects grades were examined separately using a factorial ANCOVA for each.

Quiz grade[1]**.** A stepwise ANCOVA was performed to determine whether there were significant differences in individual quiz grades between course delivery methods (online and

[1] Data were negatively skewed beyond the acceptable range. The data were transformed to adjust for the skewed distribution. Statistical tests were conducted on transformed and non-transformed data. Because transformed results were similar to non-transformed results, the non-transformed results are reported in this paper.

blended) and learning strategies (cooperative and collaborative) with respect to age, academic level, online experience, teaching experience, whether the participant was currently teaching, and whether their group followed their assigned learning strategy (actual group structure). A preliminary analysis evaluating the homogeneity of slopes assumption indicated that the relationship between the covariate and the dependent variable did not differ significantly as a function of the independent variable

Step 1 of the step-wise ANCOVA model. In the first step of the step-wise ANCOVA model, a two-way ANOVA was performed using course delivery method (blended and online) and learning strategy (cooperative and collaborative) as the independent variables and quiz grade as the dependent variable. Figure 4 reveals interesting differences in quiz grade results between the learning strategies in combination with the course delivery methods. Estimated marginal means (see Table 6) indicate that online students achieved higher quiz grades than blended students and collaborative students achieved higher quiz scores than cooperative students. However, no significant interaction between independent variables, $F(1,238) = 1.45$, $p>.05$, partial$\square\eta^2 = .006$ was found. Additionally, no main effects for course delivery method, $F(1,238)=.171$ $p>.05$, partial$\square\eta^2 = .001$, or learning strategy, $F(1,238)=.189$ $p>.05$, partial$\square\eta^2 = .001$ were found (see Table 7).

Figure 4: Quiz Grade

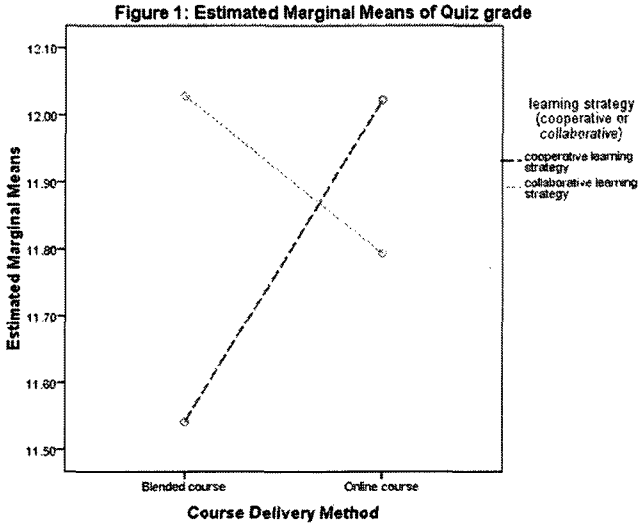


Table 6

Estimated Marginal Means of Quiz Grades

	M	*SD*
Blended Course Delivery Method (n=122)		
Cooperative	11.54	2.40
Collaborative	12.03	2.35
Online Course Delivery Method (n=120)		
Cooperative	12.02	2.07
Collaborative	11.79	2.39

Table 7

Summary of ANOVA on the Quiz Grade by Course Delivery Method and Learning Strategy (n=242)

	Quiz Grade			
	df	*F*	*p*	partial η^2
Course Delivery Method	1	.171	.679	.001
Learning Strategy	1	.189	.664	.001
Course Delivery Method * Learning Strategy	1	1.448	.230	.006

Step Two of the step-wise ANCOVA model. An examination of the learning strategies that students actually used in their group projects revealed that several groups partially followed their learning strategy instructions, while other groups chose to use a strategy more similar to the alternate strategy from which they were assigned. For example, 34% of blended students and 21.6% of online students assigned to the collaborative learning strategy tended to use a cooperative learning strategy in their group work. Given the fairly large percentages of students that chose a different learning strategy than was assigned and the focus of the study to investigate whether learning strategy affects achievement, inclusion of the groups' actual learning strategy (or group structure) as a covariate is critical to achieving reliable results.

In the second step of the step-wise ANCOVA, the covariate group structure was added to explore whether students' actual follow-through on their group directions may have affected their quiz grades. Table 8 displays estimated marginal means for the dependent variable quiz grade when the covariate group structure is taken into account. Cooperative students had similar quiz grades in blended and online delivery methods. Figure 5 indicates that blended collaborative students had higher quiz grades as opposed to online collaborative students. However, no statistically significant interaction $F(1,188) = 0.403$, $p>.05$, partial $\eta^2 = .002$ was found. Furthermore, no main effects for course delivery method, $F(1,188) = 0.449$, $p>.05$, partial $\eta^2 = .002$, or learning strategy, $F(1,188) = 0.023$, $p>.05$, partial $\eta^2 = .000$, were found (see Table 9).

Table 8
Estimated Marginal Means of Quiz Grades with Group Structure as Covariate

	M	*SD*
Blended Course Delivery Method (n=92)		
Cooperative	11.96	2.20
Collaborative	12.40	2.11
Online Course Delivery Method (n=101)		
Cooperative	11.94	2.15
Collaborative	11.97	2.23

Figure 5: Quiz Grade

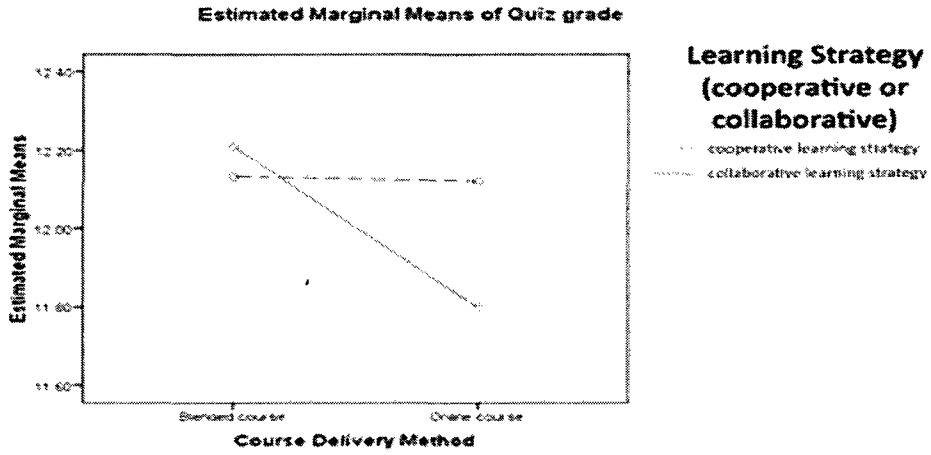


Table 9
Summary of ANOVA on the Quiz Grade by Course Delivery Method and Learning Strategy with covariate "actual group structure" (n=193)

		Quiz Grade		
	df	*F*	*p*	partial□η^2
Actual group structure (covariate)	1	.230	.632	.001
Course Delivery Method	1	.449	.504	.002
Learning Strategy	1	.023	.879	.000
Course Delivery Method * Learning Strategy	1	.403	.526	.002

Step three of the step-wise ANCOVA model. For the third step of the step-wise ANCOVA the covariates group structure, age, academic level, current teaching status, online

experience, and professional teaching experience was used to explore whether students' characteristics and prior experiences may have affected their quiz grades. Table 10 displays estimated marginal means for the dependent variable quiz grade when the covariates are taken into account. Figure 6 shows that blended students in both cooperative and collaborative learning strategies had higher quiz grades than online students in both learning strategies. However, despite the significant effects of the covariate age and academic level on the dependent variable (see Table 11), no statistically significant interaction or main effects were found.

Table 10
Estimated Marginal Means of Quiz Grades with the following covariates: group structure, age, academic level, current teaching status, online experience, and professional teaching experience

	M	*SD*
Blended Course Delivery Method (n=90)		
Cooperative	11.93	2.25
Collaborative	12.40	2.11
Online Course Delivery Method (n=100)		
Cooperative	11.95	2.17
Collaborative	11.97	2.23

Figure 6: Quiz Grade

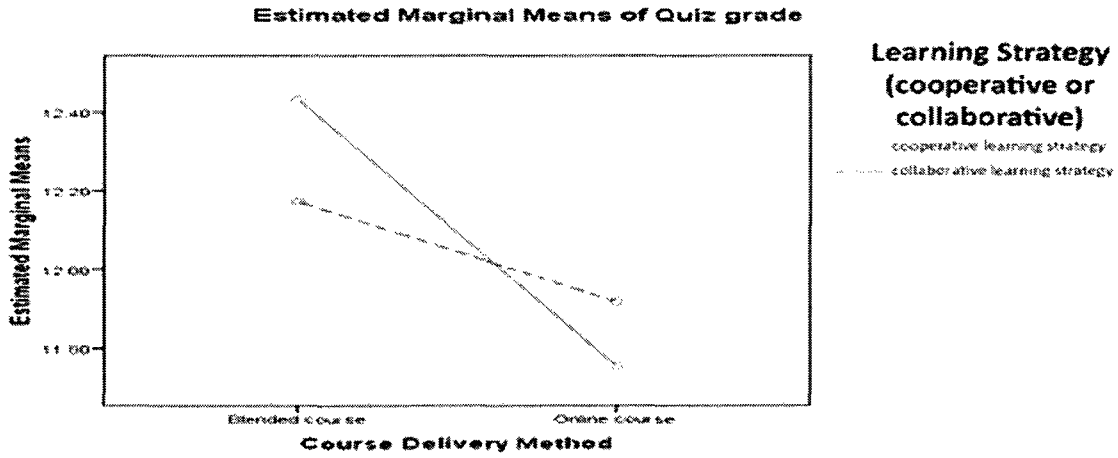


Table 11

Summary of ANCOVA on the Quiz Grade by Course Delivery Method and Learning Strategy with the following covariates: actual group structure, age, academic level, online experience, professional teaching experience, and current teaching status. (n=190)

	Quiz Grade			
	df	*F*	*p*	partial η^2
Actual group structure (covariate)	1	.216	.643	.001
Age	1	4.642	.033*	.025
Academic level	1	4.032	.046*	.022
Online experience	1	.123	.726	.001
Professional teaching experience	1	.917	.340	.005
Current teaching status	1	1.265	.262	.007
Course Delivery Method	1	1.448	.230	.008
Learning Strategy	1	.004	.953	.000
Course Delivery Method * Learning Strategy	1	.437	.510	.002

*p<.05

To summarize the findings for the quiz grade portion of this research question, neither course delivery method nor learning strategy were found to differentially affect the participants' quiz grades. The covariates age and academic level did significantly impact the dependent variable. The findings suggest that while students' ages and academic levels (undergraduate or graduate status) may influence the quiz grade, there are no significant differences in quiz grades between students enrolled in blended or online course delivery methods. Further, there is no significant difference in quiz grades between students who utilized the cooperative learning strategy and students who utilized the collaborative learning strategy.

Group project grades[2]**.** A stepwise ANCOVA was performed to determine whether there were significant differences in group project grades between course delivery methods (online and blended) and learning strategies (cooperative and collaborative) with respect to age,

[2] Data were negatively skewed beyond the acceptable range. The data were transformed to adjust for the skewed distribution. Statistical tests were conducted on transformed and non-transformed data. Because transformed results were similar to non-transformed results, the non-transformed results are reported in this paper.

academic level, online experience, teaching experience, whether the participant was currently teaching, and whether their group followed their assigned learning strategy.

Step 1 of the step-wise ANCOVA model for project grades. In the first step of the step-wise ANCOVA, a two-way ANOVA was performed using course delivery methods (blended and online) and learning strategies (cooperative and collaborative) as the independent variables and group project grade as the dependent variable. Estimated marginal means (see Table 12) indicate that blended cooperative students had a larger standard deviation than the other treatments and had a lower mean group grade ($M = 24.71$). Figure 7 shows that while online students in cooperative and collaborative learning strategies had similar group project grades, blended students' group grades differed based on the learning strategy to which they were randomly assigned. Results of the ANOVA (see Table 13) indicate a significant interaction between independent variables, $F(1,250) = 40.23$, $p<.01$, partial $\square\eta^2 = .139$, showing that the combination of a blended course delivery method and a collaborative learning strategy results in higher group grades than the combination of an online course delivery method and collaborative learning strategy. Additionally, the combination of an online course delivery method and cooperative learning strategy results in significantly higher group grades than the combination of a blended course delivery method and cooperative learning strategy. The strength of the relationship between the independent variables (course delivery method and learning strategy) and the group project grade was large, with the independent variables accounting for 13.9% of the variance of the dependent variable (group project grade).

Table 12

Estimated Marginal Means of Group Project Grades

	M	*SD*
Blended Course Delivery Method (n=134)		
Cooperative	24.71	3.07
Collaborative	28.33	1.12
Online Course Delivery Method (n=120)		
Cooperative	27.39	1.97
Collaborative	27.45	2.00

Figure 7: Group Project Grade

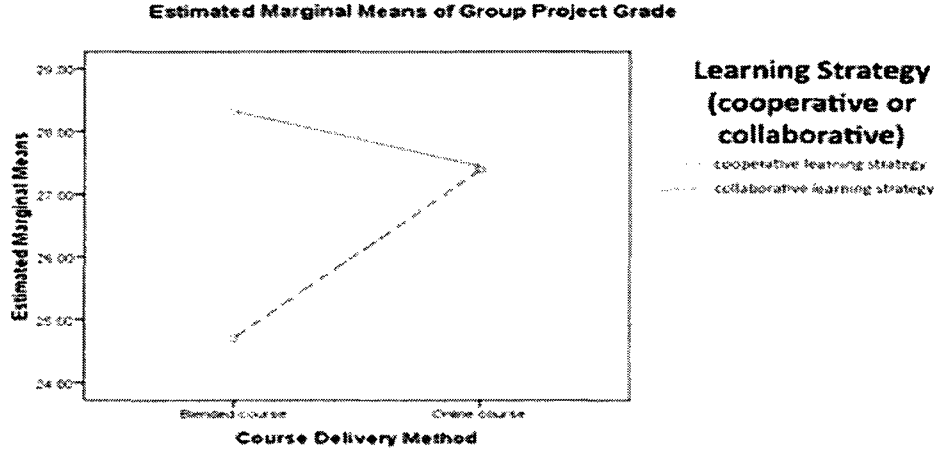


Table 13

Summary of ANOVA on the Project Grade by Course Delivery Method and Learning Strategy (n=254)

	df	*F*	*p*	partial□η^2
Course Delivery Method	1	10.365	.001*	.040
Learning Strategy	1	42.795	.000*	.146
Course Delivery Method * Learning Strategy	1	40.225	.000*	.139

*p<.05

Step two of the step-wise ANCOVA model for project grades. In the second step of the step-wise ANCOVA, the covariate group structure was used to explore whether students' actual

follow-through on their group directions may have affected their group project grades. Table 14 displays estimated marginal means for the dependent variable group project grade when the covariate *group structure* is taken into account. Table 14 and Figure 8 indicate that while online students had slight differences between learning strategies in group grades with cooperative online students achieving higher grades, blended learners who utilized the cooperative learning strategy achieved much lower group grades ($M = 25.59$) and a wider standard deviation ($SD = 2.93$) than blended students who utilized the collaborative learning strategy ($M = 28.32$, $SD = 1.10$). Results of the ANCOVA (see Table 15) indicate a significant interaction between the independent variables, $F(1,191) = 17.66$, $p<.01$, partial $\eta^2 = .085$. The strength of the relationship between the independent variables (course delivery method and learning strategy) and the group project grade was moderate, with the independent variables accounting for 8.5% of the variance of the dependent variable (group project grade), holding constant the actual group structure.

Table 14
Estimated Marginal Means of Group Project Grades with Group Structure as Covariate

	M	*SD*
Blended Course Delivery Method (n=95)		
Cooperative	25.59	2.93
Collaborative	28.32	1.10
Online Course Delivery Method (n=101)		
Cooperative	27.30	1.95
Collaborative	27.53	1.88

Figure 8: Group Project Grades

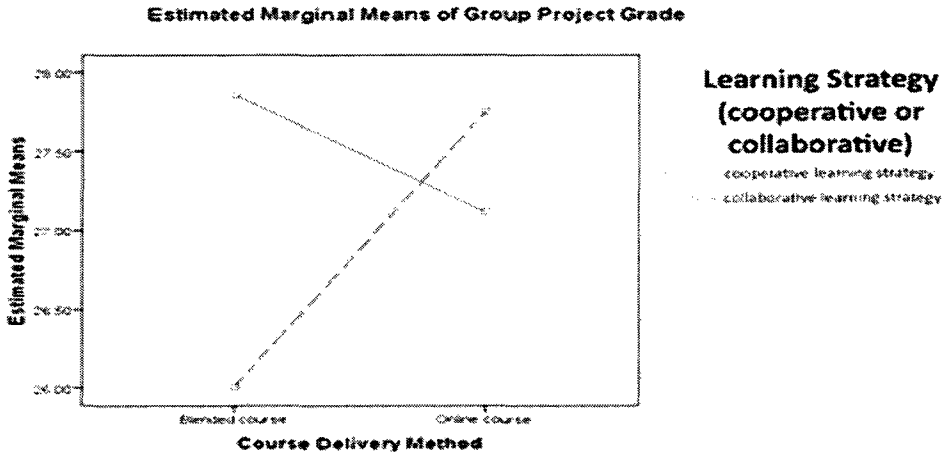


Table 15

Summary of ANCOVA on the Group Project Grade by Course Delivery Method and Learning Strategy accounting for actual group structure (n=*196)*

	Group Project Grade			
	df	*F*	*p*	partial□η^2
Actual group structure (covariate)	1	1.572	.211	.008
Course Delivery Method	1	2.846	.093	.015
Learning Strategy	1	.634	.427	.003
Course Delivery Method * Learning Strategy	1	17.661	.000*	.085

*p**<.05

Step three of the step-wise ANCOVA model for project grades. The third step of the step-wise ANCOVA utilized the following as covariates: group structure, age, academic level, current teaching status, online experience, and professional teaching experience. The independent variables used were course delivery method (online or blended) and learning strategy (cooperative or collaborative). Table 16 and Figure 9 indicate that online students' group project grades only differ slightly based on learning strategy. Blended learners' grades differ much more depending on whether they were randomly assigned to the cooperative learning

strategy (M=25.46, SD=2.93) or the collaborative learning strategy (M=28.32, SD=1.10). Results of the ANCOVA (see Table 17) indicate that the covariates age and academic level (undergraduate or graduate), were significantly related to the independent variables, course delivery method and learning strategy, $F(1,183) = 15.08$, $p<.001$, partial $\square\eta^2 = .076$. There was also a statistically significant interaction between the independent variables, $F(1,183)=21.36$, $p<.001$, partial $\square\eta^2 = .105$. The strength of the relationship between the independent variables (course delivery method and learning strategy) and the group project grades was moderate with the independent variables accounting for 10.5% of the variance of the dependent variable (group project grade), holding constant the following: group structure, age, academic level, current teaching status, online experience, and professional teaching experience.

Table 16
Estimated Marginal Means of Group Project Grades with the following covariates: group structure, age, academic level, current teaching status, online experience, and professional teaching experience

	M	*SD*
Blended Course Delivery Method (n=95)		
Cooperative	25.46	2.93
Collaborative	28.32	1.10
Online Course Delivery Method (n=101)		
Cooperative	27.27	1.96
Collaborative	27.53	1.88

Figure 9: Group Project Grades

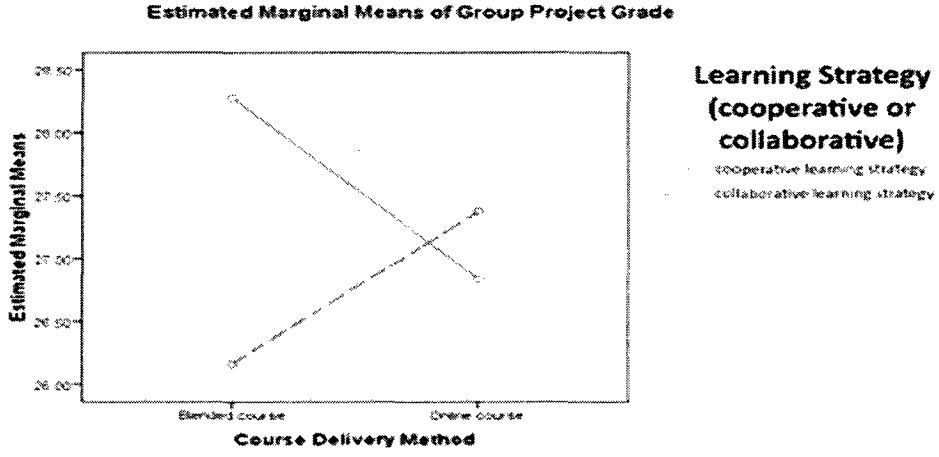


Table 17

Summary of ANCOVA on the Project Grade by Course Delivery Method and Learning Strategy with the following covariates: group structure, age, academic level, current teaching status, online experience, and professional teaching experience (n=*196)*

	df	*F*	*p*	partial □η^2
Actual group structure (covariate)	1	1.572	.211	.008
Age	1	3.984	.047*	.021
Academic level	1	15.080	.000***	.076
Online experience	1	2.311	.130	.012
Professional teaching experience	1	1.389	.240	.008
Current teaching status	1	2.296	.131	.012
Course Delivery Method	1	2.846	.093	.015
Learning Strategy	1	.634	.427	.003
Course Delivery Method * Learning Strategy	1	17.661	.000***	.085

***p<.001. *p<.05

Further investigation of the academic level covariate revealed that graduate students had a higher mean group project score (*M*=27.87, *SD*=2.05) than undergraduate students (*M*=26.43, *SD*=2.71). Additionally, for both academic levels, group project grade mean scores for the collaborative learning strategy in the blended course environment were substantially higher than

the cooperative learning strategy in the blended environment. In the online course delivery method, the group project grades only differed slightly between the learning strategies (see Table 18). An examination of the age covariate found interactions between course delivery method and learning strategy for students ages 20 or under, 21 to 25, and 41 to 50 (see Table 19). In all three age categories students who were enrolled in a blended course and utilized the collaborative learning strategy scored significantly higher than students who utilized the cooperative learning strategy (see Figure 10).

Table 18

Descriptive Statistics for Group Project Grades, divided by academic level (n=253)

Course Delivery Method	Learning Strategy		*M*	*SD*
Undergraduate Students				
Blended	Cooperative		24.12	2.85
	Collaborative		28.20	1.11
		Total	26.02	3.01
Online	Cooperative		26.96	2.12
	Collaborative		27.23	1.82
		Total	27.10	1.97
Graduate Students				
Blended	Cooperative		27.41	2.67
	Collaborative		29.26	.80
		Total	27.97	2.41
Online	Cooperative		27.95	1.56
	Collaborative		27.72	2.20
		Total	27.82	1.92

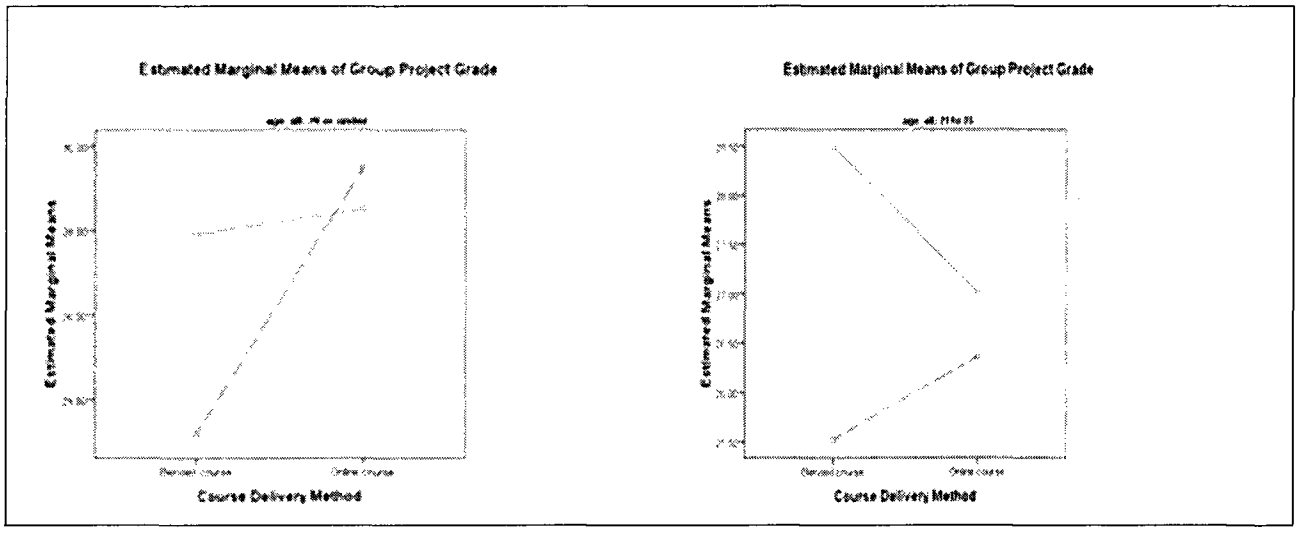
Table 19

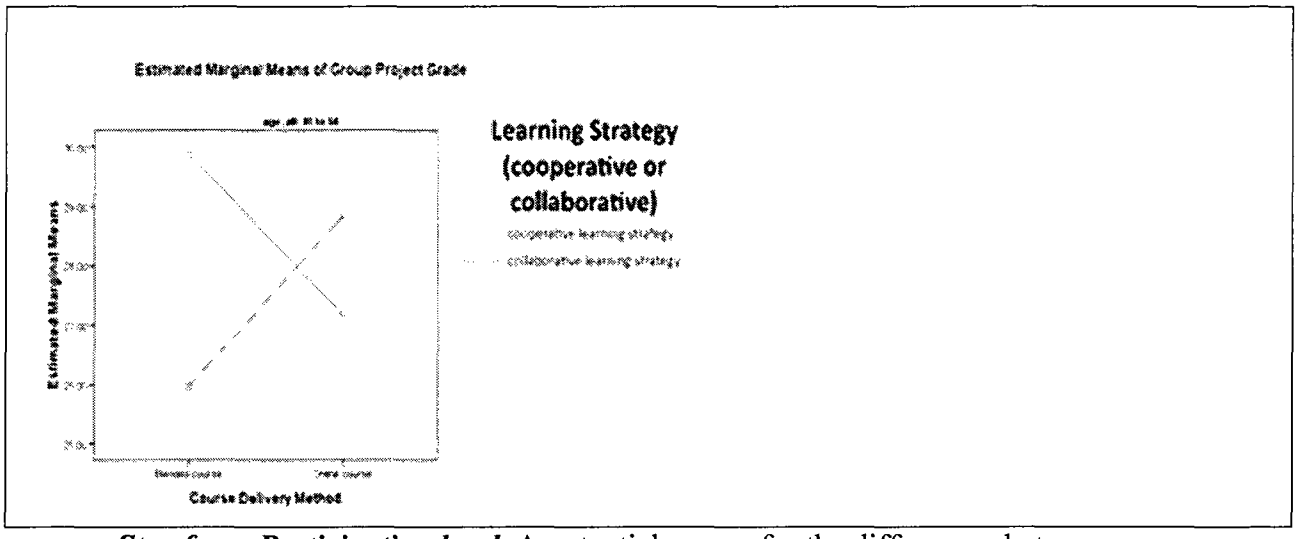
Group Project Grades – Interactions for Ages 20 or Under, 21 to 25, and 41 to 50

		df	*Group Grade* *F*	*p*	partial η^2
20 or Under					
	Course Delivery Method * Learning Strategy	1	17.491	.000***	.235
21 to 25					
	Course Delivery Method * Learning Strategy	1	5.640	.020*	.061
41 to 50					
	Course Delivery Method * Learning Strategy	1	5.296	.037*	.274

***p<.001. *p<.05

Figure 10: Interactions between Course Delivery Method and Learning Strategy for Group Project Grade – Ages 20 or Under; 21 to 25; and 41 to 50





Step four: Participation level. A potential reason for the differences between group grades may have been the participation component of the group project rubric (see Appendix D). Although students were instructed to communicate via their group discussion board or group virtual chat, it was posited that cooperative students in the blended courses may have chosen to communicate mostly face-to-face to coordinate their division of labor and would therefore have created few posts in their group discussion board. When grading group projects, a lack of communication in group discussion boards or chat areas meant that student group grades could have lost up to five points on the group project rubric.

The researcher wanted to investigate whether statistical differences were due to participation grades or if the differences had another cause. Therefore, the researcher created a new variable called "participation grade". The rubrics for each student (which were averaged to create group project grades) were examined for the student's participation grade. The original participation grade equaled 5 points for full participation. For the participation grade variable, students who received a four or five on the participation section of the rubric were labeled as "high participation". Students who received a two or three on the rubric participation section

were labeled as "moderate participation" and students who received a score of zero or one on the rubric participation were labeled "low participation".

An investigation of frequencies (see Table 20) showed that one-third of cooperative, blended students were labeled as low participation or moderate participation. In contrast, only one (1.7%) blended collaborative student was labeled as moderate participation and no blended collaborative students were labeled as low participation. Only five (9.25%) cooperative online students were labeled as low or moderate participation and only three (4.9%) online collaborative students were labeled as moderate participation.

Table 20
Frequencies of Level of Participation

	Frequency	*Valid Percent*
Blended Course Delivery Method (n=134)		
Cooperative Learning Strategy		
Low Participation	10	13.5%
Moderate Participation	15	18.7%
High Participation	50	66.7%
Collaborative Learning Strategy		
Low Participation	0	0%
Moderate Participation	1	1.7%
High Participation	58	98.3%
Online Course Delivery Method (n=112)		
Cooperative Learning Strategy		
Low Participation	3	5.1%
Moderate Participation	2	3.4%
High Participation	54	91.5%
Collaborative Learning Strategy		
Low Participation	0	0%
Moderate Participation	3	4.9%
High Participation	58	95.1%

It was evident that substantially more blended cooperative students received lower participation scores than did the other treatment groups. Therefore, to determine if participation

level had a significant influence on group project grades, an ANCOVA[3] was performed, utilizing all of the previous covariates with the addition of the participation level covariate. The ANCOVA results (see Table 21) show a significant interaction between course delivery method and learning strategy, $F(1, 182) = 19.726$, $p<.000$, partial $\eta^2=.098$. The covariates participation level, $F(1, 182) = 24.802$, $p<.000$, partial $\eta^2=.120$, and academic level, $F(1, 182) = 14.859$, $p<.000$, partial $\eta^2=.075$ significantly influenced the group project grade. Figure 11 shows that the interaction between course delivery method and learning strategy is disordinal. The results indicate that participation level is responsible for 12 percent of the variance of the group project grade.

Table 21

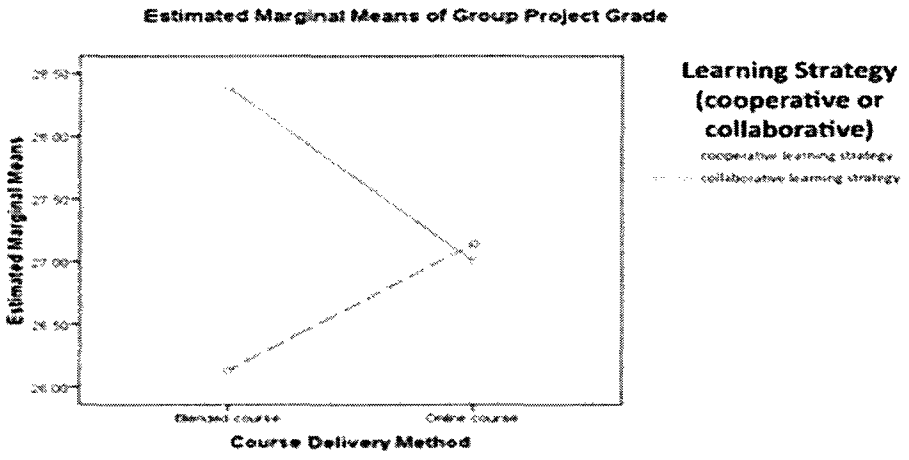
Summary of ANCOVA on the Project Grade by Course Delivery Method and Learning Strategy accounting for all covariates (n=193)

	df	*F*	*p*	partial η^2
Participation Level	1	24.802	.000***	.120
Actual group structure	1	.405	.525	.002
Age	1	3.849	.051	.021
Academic level	1	14.859	.000***	.075
Online experience	1	2.367	.126	.013
Professional teaching experience	1	.985	.322	.005
Current teaching status	1	1.663	.199	.009
Course Delivery Method	1	.323	.570	.002
Learning Strategy	1	2.413	.122	.013
Course Delivery Method * Learning Strategy	1	19.726	.000***	.098

***p<.001

[3] The Levene's test was found to be significant, indicating that the error variance across groups was not equal.

Figure 11: Group Project Grades



Observation of the student's rubric scores showed that some students had high participation levels but still scored lower on the rest of the rubric. Therefore, the researcher wanted to investigate whether there was a significant difference in group grades once the students with low and moderate participation levels were excluded from the data set. An ANCOVA was performed using only students who were labeled high participation level. Covariates included actual group structure, age, academic level, online experience, current teaching status, and professional teaching experience. Descriptive statistics (see Table 22) indicate that mean scores for the blended cooperative treatment group were still lower than the rest of the treatment groups. Results of the ANCOVA[4] show an interaction between the independent variables, $F(1, 176) = 11.584$, $p<.001$, partial $\eta^2=.065$. Additionally, the following covariates significantly influenced the group project grade: age, $F(1, 176) = 7.660$, $p<.006$, partial $\eta^2=.044$, and academic level, $F(1, 176) = 13.182$, $p<.001$, partial $\eta^2=.074$. The findings

[4] The Levene's test was found to be significant, indicating that the error variance across groups was not equal.

indicate that even when students with low and moderate participation levels were excluded, students from the blended cooperative treatment scored significantly lower than the other treatment groups.

Table 22

Descriptive Statistics for Group Project Grades with Low and Moderate Participation Excluded (n=176)

Course Delivery Method	Learning Strategy		*M*	*SD*
Blended	Cooperative		26.32	2.49
	Collaborative		28.34	1.10
		Total	27.44	2.10
Online	Cooperative		27.36	1.99
	Collaborative		27.61	1.87
		Total	27.49	1.92

Table 23

Summary of ANCOVA on the Project Grade for High Participation Level Students by Course Delivery Method and Learning Strategy accounting for all covariates (n=176)

	df	*F*	*p*	partial η^2
Actual group structure	1	.106	.745	.001
Age	1	7.660	.006**	.044
Academic level	1	13.182	.000***	.074
Online experience	1	.751	.388	.005
Professional teaching experience	1	2.028	.156	.012
Current teaching status	1	1.153	.285	.007
Course Delivery Method	1	1.801	.181	.011
Learning Strategy	1	2.863	.093	.017
Course Delivery Method * Learning Strategy	1	11.584	.001***	.065

***$p<.001$, **$p<.05$

To summarize the results of the first research question, no significant differences were found between course delivery methods and learning strategies in regard to individual quiz grades. A significant interaction was found however, between course delivery method and learning strategy in regard to group project grades. For course sections delivered through the blended method, group grades were significantly higher for students who utilized the collaborative learning strategy than for students who utilized the cooperative strategy. Online course sections showed generally equivalent group grades for students who utilized the cooperative and collaborative learning strategies. Moreover, the covariates age and academic level significantly influenced the dependent variable. The findings suggest that for blended course delivery methods in particular, collaborative learning methods resulted in significantly higher group grades than cooperative methods.

Research Question 2: Value of Collaboration

The second research question sought to determine if learning strategy (cooperative vs. collaborative) and course delivery method (online vs. blended) differentially impact students' attitude toward collaboration. The value of collaboration construct is made up of three survey items: (1) students' value of connectedness, (2) students' preference for collaboration, and (3) students' recognition of the potential of collaboration. Before investigating the potential differences between course delivery methods and learning strategy in regard to student attitude toward collaboration as revealed in post-treatment surveys, students' responses from the pre-treatment survey were examined to determine if any differences existed between course delivery methods or learning strategies prior to the treatment.

Pre-treatment value of collaboration scores. A separate ANOVA was conducted for each of the three items used in the value of collaboration construct. The first item examines a student's value of feeling connectedness to others in his or her classes. Descriptive statistics (see Table 24) indicate that students in the blended course method placed a higher value of connectedness with others than their online colleagues. Results of the ANOVA show a statistically significant difference between course delivery methods $F(1,241) = 14.05, p<.001$, partial $\square\eta^2 = .058$.

Table 24
Estimated Marginal Means of Pre-treatment Survey item: Value a feeling of Connectedness

	M	*SD*
Blended Course Delivery Method (n=131)	3.94	1.01
Cooperative	3.86	.95
Collaborative	4.03	1.08
Online Course Delivery Method (n=114)	3.46	.93
Cooperative	3.53	.90
Collaborative	3.41	.97

Table 25
Summary of ANOVA on the Pre-treatment Value of Collaboration scores by Course Delivery Method and Learning Strategy (n=245)

	df	*F*	*p*	partial □ □η^2
Course Delivery Method	1	14.817	.000***	.058
Learning Strategy	1	.041	.839	.000
Course Delivery Method * Learning Strategy	1	1.361	.245	.006

***p<.001

The second item in the value of collaboration construct was preference for working with others. Descriptive statistics (Table 26) indicate that students in the blended courses preferred working with other classmates more than student enrolled in the online course delivery method. Results of the ANOVA (see Table 27) show a statistically significant difference between the course delivery methods in regard to preference for working with others, $F(1,241) = 30.75$, $p<.001$, partial □ □$\eta^2 = .113$.

Table 26
Estimated Marginal Means of Pre-treatment Survey item: Preference for working with others

	M	*SD*
Blended Course Delivery Method (n=131)	4.02	.93
Cooperative	4.04	.99
Collaborative	4.00	.86
Online Course Delivery Method (n=114)	3.29	1.11
Cooperative	3.42	1.17
Collaborative	3.17	1.05

Table 27

Summary of ANOVA on the Pre-treatment Preference for working with others scores by Course Delivery Method and Learning Strategy (n=*245)*

	df	*F*	*p*	partial□ □η^2
Course Delivery Method	1	30.752	.000***	.113
Learning Strategy	1	1.222	.270	.005
Course Delivery Method * Learning Strategy	1	.627	.429	.003

***p<.001

The third item in the value of collaboration construct was recognition of the academic potential for working with others. Descriptive statistics (Table 28) indicate that students in the blended courses recognize the academic potential of collaboration more than students enrolled in the online courses Results of the ANOVA (see Table 29) show a statistically significant difference between the course delivery methods in regard to recognition of the potential of collaboration, $F(1,241) = 25.78$, $p<.001$, partial□ □$\eta^2 = .097$.

Table 28

Estimated Marginal Means of Pre-treatment Survey item: Recognition of the potential to achieve more academically by collaborating with others

	M	*SD*
Blended Course Delivery Method (n=131)	3.95	.90
Cooperative	4.01	.89
Collaborative	3.88	.92
Online Course Delivery Method (n=114)	3.32	1.03
Cooperative	3.44	1.00
Collaborative	3.20	1.03

Table 29

Summary of ANOVA on the Pre-treatment Value of Collaboration item: Recognition of the potential to achieve more academically by collaborating with others scores by Course Delivery Method and Learning Strategy (n=245)

	df	*F*	*p*	partial □ □η^2
Course Delivery Method	1	25.780	.000***	.097
Learning Strategy	1	2.215	.138	.009
Course Delivery Method * Learning Strategy	1	.160	.690	.001

***p<.001

Note: Levene's Test was significant

Pre-treatment value of collaboration scores differed significantly between course delivery methods. In each case, students enrolled in the blended course delivery modes responded with higher values of collaboration. Given that pretreatment value of collaboration scores significantly differ between course delivery methods, the pre-treatment scores were used as covariates when investigating the post-treatment scores.

Post-treatment value of collaboration scores. In the first step of the step-wise MANCOVA, a MANOVA was performed using course delivery methods (blended and online) and learning strategies (cooperative and collaborative) as the independent variables and the three value of collaboration construct items (value of connectedness, preference for collaboration, and recognition of the academic potential of collaboration) as the dependent variables. Descriptive statistics (Table 30) show that students enrolled in the blended courses provided more favorable responses to the three items in comparison to the students enrolled in the online courses. However, results of the MANOVA (see Table 31) indicate no significant interaction between independent variables or main effect.

Table 30

Estimated Marginal Means of Value of Collaboration Construct

1. Value of Feeling of Connectedness with others in classes

		M	*SD*
Blended Course Delivery Method (n=96)			
Cooperative		3.82	.95
Collaborative		3.85	1.14
	Total	3.83	1.04
Online Course Delivery Method (n=102)			
Cooperative		3.70	1.04
Collaborative		3.60	1.03
	Total	3.65	1.03

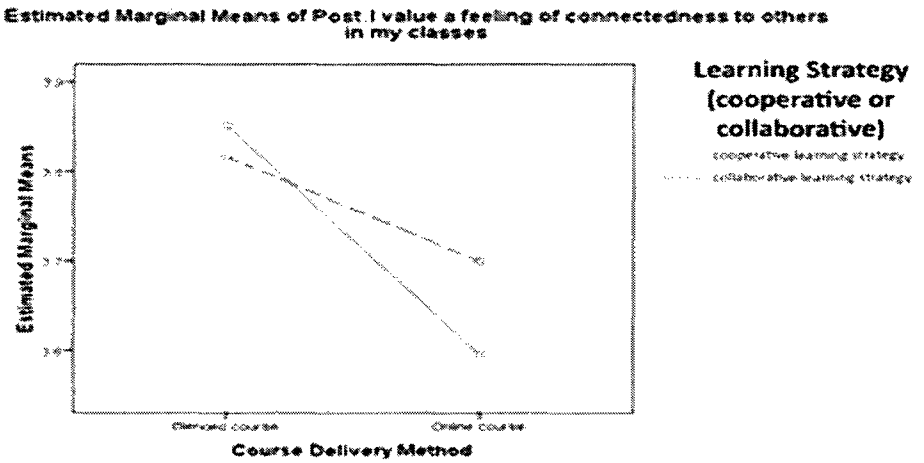
2. Preference for working with others

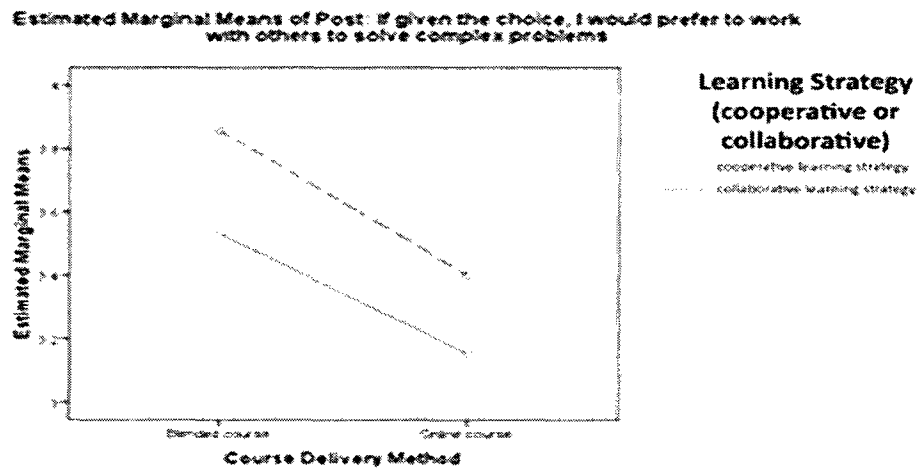
		M	*SD*
Blended Course Delivery Method (n=96)			
Cooperative		3.86	1.02
Collaborative		3.53	1.16
	Total	3.70	1.10
Online Course Delivery Method (n=102)			
Cooperative		3.40	1.14
Collaborative		3.15	1.26
	Total	3.27	1.20

3. Recognition of the academic potential of collaboration

		M	*SD*
Blended Course Delivery Method (n=96)			
Cooperative		3.94	.97
Collaborative		3.66	1.03
	Total	3.80	1.00
Online Course Delivery Method (n=102)			
Cooperative		3.44	1.07
Collaborative		3.46	1.09
	Total	3.45	1.08

Figure 12: Post-Treatment Value of Collaboration





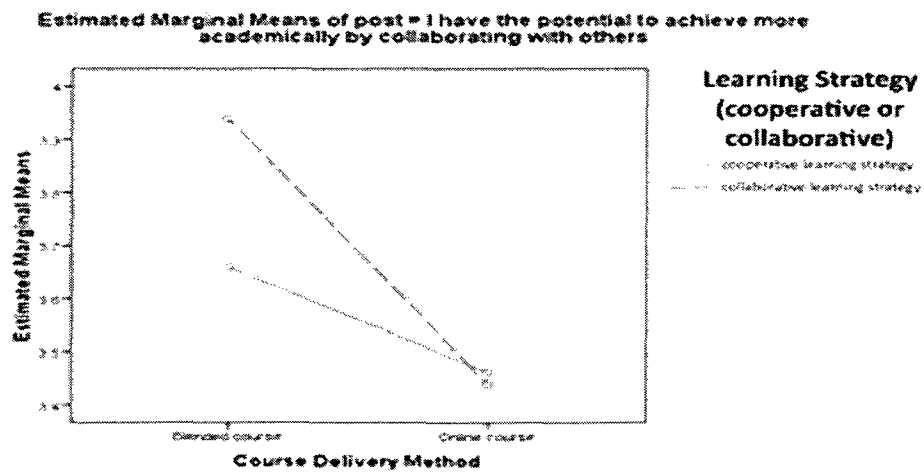


Table 31

Summary of MANOVA on the Post-treatment Value of Collaboration scores by Course Delivery Method and Learning Strategy (n=198)

	Wilks'Λ	*F*	*Hypothesis df*	*Error df*	*p*	partial□ □η^2
Course Delivery Method	.965	2.334	3	192	.075	.035
Learning Strategy	.980	1.301	3	192	.275	.020
Course Delivery Method * Learning Strategy	.988	.772	3	192	.511	.012

Step two. For the second step of the step-wise MANCOVA, a MANCOVA was performed using course delivery methods (blended and online) and learning strategies (cooperative and collaborative) as the independent variables and the three value of collaboration construct items (value of connectedness, preference for collaboration, and recognition of the academic potential of collaboration) as the dependent variables. The pre-treatment value of collaboration construct items were used as covariates. Descriptive statistics (Table 32) show that students enrolled in the blended course delivery method responded with higher scores than online students to the value of collaboration items. Results of the MANCOVA indicate no significant interaction between independent variable (Wilks'Λ = .99, $F(3,186) = .750$, p=.524). Similarly, no significant main effects can be found for course delivery method (Wilks'Λ = 1.00, $F(3,186) = 1.20$, p=.948) or learning strategy (Wilks'Λ = .98, $F(3,186) = 1.27$, p=.286). All three pre-treatment value of collaboration items significantly affect the dependent variables (see Table 33).

Table 32

Estimated Marginal Means of Value of Collaboration Construct

1. *Value of Feeling of Connectedness with others in classes*

		M	*SD*
Blended Course Delivery Method (n=95)			
Cooperative		3.79	.94
Collaborative		3.85	1.14
	Total	3.82	1.04
Online Course Delivery Method (n=100)			
Cooperative		3.69	1.05
Collaborative		3.57	1.03
	Total	3.63	1.03

2. *Preference for working with others*

		M	*SD*
Blended Course Delivery Method (n=95)			
Cooperative		3.83	1.02
Collaborative		3.53	1.16
	Total	3.68	1.09
Online Course Delivery Method (n=100)			
Cooperative		3.41	1.15
Collaborative		3.14	1.27
	Total	3.27	1.21

3. *Recognition of the academic potential of collaboration*

		M	*SD*
Blended Course Delivery Method (n=95)			
Cooperative		3.92	.96
Collaborative		3.66	1.03
	Total	3.79	1.00
Online Course Delivery Method (n=100)			
Cooperative		3.43	1.08
Collaborative		3.43	1.08
	Total	3.43	1.08

Table 33

Summary of MANCOVA on the Post-treatment Value of Collaboration scores by Course Delivery Method and Learning Strategy, accounting for pre-treatment Value of Collaboration scores (n=195)

	Wilks'Λ	*F*	*Hypothesis df*	*Error df*	*p*	partial η^2
Pre-treatment value of connectedness	.874	8.933	3	186	.000***	.126
Pre-treatment preference to work with others	.885	8.050	3	186	.000***	.115
Pre-treatment Recognition of collaboration potential	.934	4.384	3	186	.005**	.066
Course Delivery Method	.998	.120	3	186	.948	.002
Learning Strategy	.980	1.270	3	186	.286	.020
Course Delivery Method * Learning Strategy	.988	.750	3	186	.524	.012

***p<.001, **p<.010

Step three. For the third step of the step-wise MANCOVA, a MANCOVA was performed using course delivery methods (blended and online) and learning strategies (cooperative and collaborative) as the independent variables and the three value of collaboration construct items (value of connectedness, preference for collaboration, and recognition of the academic potential of collaboration) as the dependent variables. The following covariates were used: (a) the three pre-treatment value of collaboration construct items, (b) age, (c) academic level, (d) online experience, (e) professional teaching experience, (f) current teaching status, and (g) actual group structure. Descriptive statistics (Table 34) show that students enrolled in the blended course delivery method responded with higher scores than online students to the value of collaboration items.

Table 34

Estimated Marginal Means of Value of Collaboration Construct

1. Value of Feeling of Connectedness with others in classes			
		M	*SD*
Blended Course Delivery Method (n=92)			
Cooperative		3.78	.95
Collaborative		3.85	1.14
	Total	3.82	1.05
Online Course Delivery Method (n=98)			
Cooperative		3.69	1.06
Collaborative		3.62	.97
	Total	3.65	1.01
2. Preference for working with others			
		M	*SD*
Blended Course Delivery Method (n=92)			
Cooperative		3.89	1.01
Collaborative		3.53	1.16
	Total	3.71	1.10
Online Course Delivery Method (n=98)			
Cooperative		3.42	1.16
Collaborative		3.18	1.24
	Total	3.30	1.20
3. Recognition of the academic potential of collaboration			
		M	*SD*
Blended Course Delivery Method (n=92)			
Cooperative		3.91	.97
Collaborative		3.66	1.03
	Total	3.78	1.00
Online Course Delivery Method (n=98)			
Cooperative		3.46	1.07
Collaborative		3.48	1.04
	Total	3.47	1.05

Results of the MANCOVA indicate no significant interaction between independent variables (Wilks'Λ = .98, $F(3,175)$ = .965, p=.411). Similarly, no significant main effects can be found for course delivery method (Wilks'Λ = .99, $F(3,175)$ = .732, p=.534) or learning strategy (Wilks'Λ = .97, $F(3,175)$ = 1.87, p=.136). All three pre-treatment value of collaboration items

significantly affect the dependent variables, but no other covariates had a significant effect on the dependent variables. (see Table 35).

Table 35

Summary of MANCOVA on the Post-treatment Value of Collaboration scores by Course Delivery Method and Learning Strategy, accounting for pre-treatment Value of Collaboration scores (n=195)

	Wilks'Λ	*F*	*Hypothesis df*	*Error df*	*p*	partial η^2
Pre-treatment value of connectedness	.869	8.755	3	175	.000***	.131
Pre-treatment preference to work with others	.895	6.835	3	175	.000***	.105
Pre-treatment Recognition of collaboration potential	.932	4.271	3	175	.006**	.068
Actual Group Structure	.970	1.774	3	175	.154	.030
Age	.966	2.072	3	.75	.106	.034
Academic Level	.959	2.510	3	75	.060	.041
Online Experience	.970	1.808	3	175	.147	.030
Current Teaching Status	.986	.809	3	175	.491	.014
Professional Teaching Experience	.968	1.922	3	175	.128	.032
Course Delivery Method	.988	.732	3	175	.534	.012
Learning Strategy	.969	1.874	3	175	.136	.031
Course Delivery Method * Learning Strategy	.984	.965	3	175	.411	.016

***$p<.001$, **$p<.010$

Results of the MANCOVA revealed no significant differences between course delivery methods or learning strategies in regard to students' value of connectedness, preference for collaboration, or recognition of the potential for collaboration.

Research Question 3: Process and Solution Satisfaction

The third research question addressed whether the learning strategy and course delivery method had a differential effect on process satisfaction and solution satisfaction scores.

Satisfaction scores were examined in regard to mean process scale scores and mean solution scale scores. A stepwise MANCOVA was performed to determine whether there were significant differences in course delivery method (blended or online) and learning strategy (cooperative and collaborative) for process satisfaction and solution satisfaction scores when accounting for age, academic level, online experience, teaching experience, whether the participant was currently teaching, and whether groups followed their assigned learning strategy.

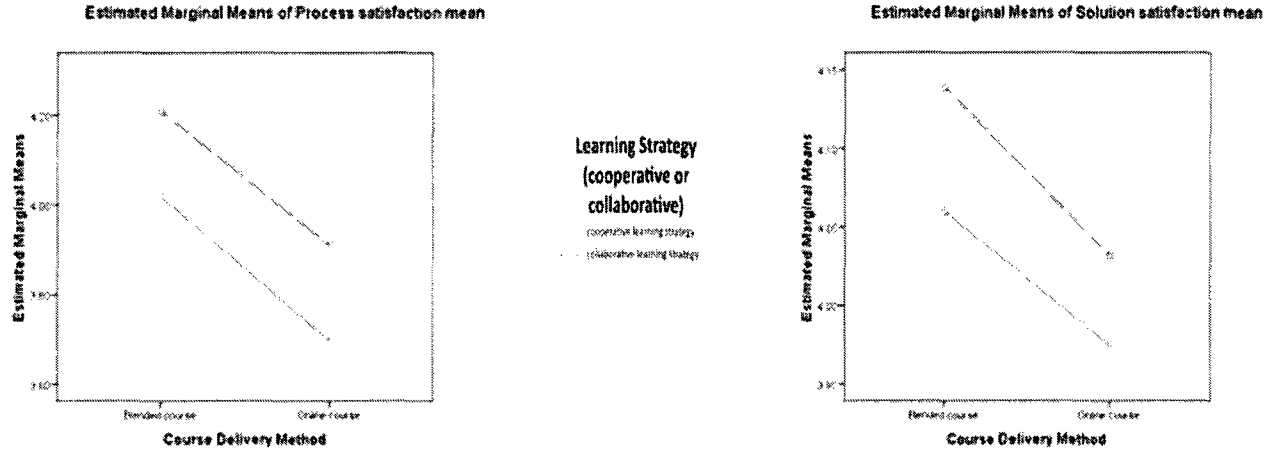
In the first step of the step-wise MANCOVA, a MANOVA was performed using course delivery methods (blended and online) and learning strategies (cooperative and collaborative) as the independent variables and process satisfaction and solution satisfaction scores as the dependent variables. Descriptive statistics (see Table 36) indicate that students enrolled in the blended course sections were more satisfied with the group project process (M=4.11, SD=.91) than the students enrolled in the online course sections (M=3.80, SD=1.05). Additionally, students who utilized the cooperative learning strategy tended to be more satisfied with the process (M=4.06, SD=.95) than students who utilized the collaborative learning strategy (M=3.85, SD=1.03). Figure 13 further illustrates the differences between course delivery methods and learning strategies.

Table 36

Estimated Marginal Means of Process and Solution Satisfaction Scores

	M	*SD*
Process Satisfaction Scores		
Blended Course Delivery Method (n=96)		
Cooperative	4.21	.86
Collaborative	4.02	.95
Total	4.11	.91
Online Course Delivery Method (n=102)		
Cooperative	3.91	1.02
Collaborative	3.70	1.09
Total	3.80	1.05
Learning Strategy Totals (n=198)		
Cooperative	4.06	.95
Collaborative	3.85	1.03
Solution Satisfaction Scores		
Blended Course Delivery Method (n=96)		
Cooperative	4.14	.58
Collaborative	4.06	.67
Total	4.10	.63
Online Course Delivery Method (n=102)		
Cooperative	4.03	.72
Collaborative	3.98	.75
Total	4.00	.73
Learning Strategy Totals (n=198)		
Cooperative	4.08	.66
Collaborative	4.02	.71

Figure 13: Process & Solution Satisfaction



Results of the two-way MANOVA (see Table 37) indicate no significant interaction between independent variables (Wilks'Λ = 1.00, $F(2,193) = .025$, $p>.05$). Similarly, no significant main effects were found. A Test of Between Subjects Effects (see Table 38) shows that the course delivery method significantly affects process satisfaction ($F(1, 194) = 4.89$, $p<.05$, partial $\square\eta^2=.025$), but not solution satisfaction.

Table 37

Summary of MANOVA on Process and Solution Satisfaction scores by Course Delivery Method and Learning Strategy (n=198)

	Wilks'Λ	*F*	*Hypothesis df*	*Error df*	*p*	partial$\square\eta^2$
Course Delivery Method	.974	2.546	2	193	.081	.026
Learning Strategy	.989	1.058	2	193	.349	.011
Course Delivery Method * Learning Strategy	1.00	.025	2	193	.976	.000

Table 38
Test of Between Subjects for Process & Satisfaction Scores

	df	*F*	*p*	partial □ □η^2
Course Delivery Method				
Process Satisfaction	1	4.886	.028*	.025
Solution Satisfaction	1	.963	.328	.005
Learning Strategy				
Process Satisfaction	1	2.070	.152	.011
Solution Satisfaction	1	.488	.486	.003
Course Delivery Method * Learning Strategy				
Process Satisfaction	1	.007	.935	.000
Solution Satisfaction	1	.013	.909	.000

*$p<.05$

Step two. For the second step in the stepwise MANCOVA, a MANCOVA was performed using course delivery methods (blended and online) and learning strategies (cooperative and collaborative) as the independent variables and process satisfaction and solution satisfaction scores as the dependent variables. The following covariates were used: actual group structure, post-treatment value of connectedness, post-treatment preference for working with others, and post-treatment recognition of the potential of collaboration. Descriptive statistics (see Table 39) indicate that students enrolled in the blended course sections were more satisfied with the group project process (M=4.10, SD=.91) than the students enrolled in the online course sections (M=3.83, SD=1.02). Moreover, students assigned the cooperative learning strategy were more satisfied with the group project process (M=4.05, SD=.95) than students assigned the collaborative learning strategy (M=3.88, SD=1.00).

Table 39

Estimated Marginal Means of Process and Solution Satisfaction with the following covariates: Actual group structure, post-treatment value of connectedness, post-treatment preference for working with others, and post-treatment recognition of the potential of collaboration

	M	*SD*
Process Satisfaction Scores		
Blended Course Delivery Method (n=95)		
Cooperative	4.19	.86
Collaborative	4.02	.95
Total	4.10	.91
Online Course Delivery Method (n=101)		
Cooperative	3.91	1.02
Collaborative	3.75	1.03
Total	3.83	1.02
Learning Strategy Totals (n=196)		
Cooperative	4.05	.95
Collaborative	3.88	1.00
Solution Satisfaction Scores		
Blended Course Delivery Method (n=95)		
Cooperative	4.12	.57
Collaborative	4.06	.67
Total	4.10	.62
Online Course Delivery Method (n=101)		
Cooperative	4.03	.72
Collaborative	4.03	.66
Total	4.03	.69
Learning Strategy Totals (n=196)		
Cooperative	4.08	.65
Collaborative	4.04	.66

Results of the two-way MANCOVA (see Table 40) indicate no significant interaction between independent variable (Wilks'Λ = 1.00, $F(2,187) = .036$, p=.964). Similarly, no significant main effects were found for course delivery method (Wilks'Λ = .99, $F(2,187) = 1.26$, p=.287) or learning strategy (Wilks'Λ = 1.00, $F(2,187) = .416$, p=.660).

Table 40

Summary of MANCOVA on Process and Solution Satisfaction scores by Course Delivery Method and Learning Strategy (n=*198)*

	Wilks'Λ	*F*	*Hypothesis df*	*Error df*	*p*	partial□ □η^2
Actual group structure	.997	.310	2	187	.734	.003
Post-treatment value of connectedness	.985	1.379	2	87	.254	.015
Post-treatment preference for collaboration	.990	.900	2	187	.408	.010
Post-treatment recognition of the academic potential of collaboration	.996	.433	3	187	.649	.005
Course Delivery Method	.987	1.256	2	187	.287	.013
Learning Strategy	.996	.416	2	187	.660	.004
Course Delivery Method * Learning Strategy	1.00	.036	2	187	.964	.000

Step three. For the third step in the step-wise MANCOVA, a MANCOVA was performed using course delivery method (blended and online) and learning strategy (cooperative and collaborative) as the independent variables and process satisfaction and solution satisfaction scores as the dependent variables. The following covariates were used: actual group structure, post-treatment value of connectedness, post-treatment preference for working with others, a post-treatment recognition of the potential of collaboration, age, academic level (undergraduate or graduate), online experience, professional teaching experience, and current teaching status.

Descriptive statistics (see Table 41 and Figure 14) indicate that students enrolled in the blended course sections were more satisfied with the group project process (*M*=4.10 *SD*=.91) than the students enrolled in the online course sections (*M*=3.83, *SD*=1.03). Additionally, students who utilized the cooperative learning strategy were more satisfied with the process (*M*=4.04, *SD*=.96) than students who utilized the collaborative learning strategy (*M*=3.88,

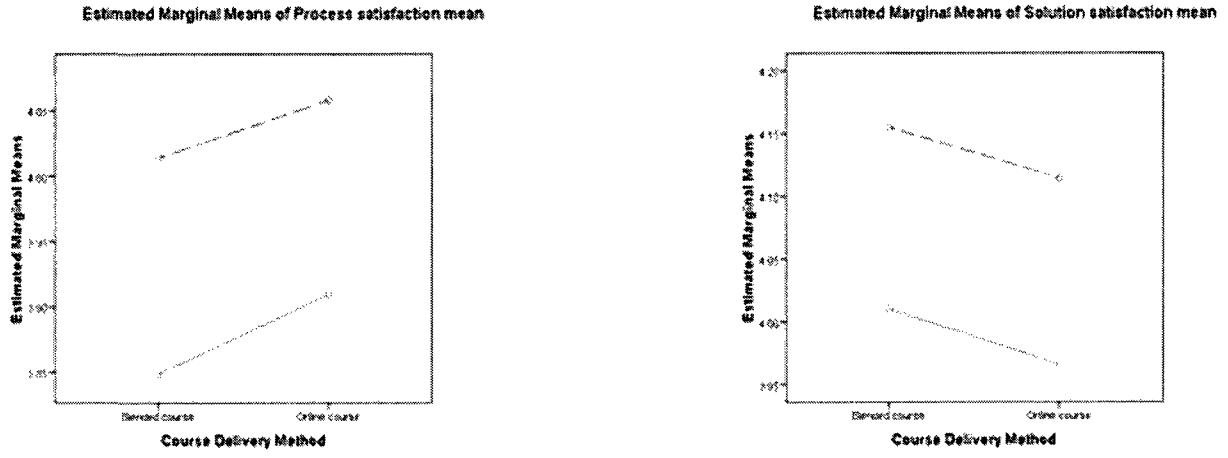
SD=1.00). Solution satisfaction scores were similar for students enrolled in both course delivery methods and for students who used both learning strategies.

Table 41

Estimated Marginal Means of Process and Solution Satisfaction with the following covariates: Actual group structure, post-treatment value of connectedness, post-treatment preference for working with others, and post-treatment recognition of the potential of collaboration

	M	*SD*
Process Satisfaction Scores		
Blended Course Delivery Method (n=93)		
Cooperative	4.17	.87
Collaborative	4.02	.95
Total	4.09	.91
Online Course Delivery Method (n=100)		
Cooperative	3.92	1.03
Collaborative	3.75	1.03
Total	3.83	1.03
Learning Strategy Totals (n=193)		
Cooperative	4.04	.96
Collaborative	3.88	1.00
Solution Satisfaction Scores		
Blended Course Delivery Method (n=93)		
Cooperative	4.10	.58
Collaborative	4.06	.67
Total	4.09	.63
Online Course Delivery Method (n=100)		
Cooperative	4.05	.72
Collaborative	4.03	.66
Total	4.04	.68
Learning Strategy Totals (n=193)		
Cooperative	4.08	.65
Collaborative	4.04	.66

Figure 14: Process & Solution Satisfaction



Results of the MANCOVA indicate no significant interaction between independent variables (Wilks'□Λ = 1.00, $F(2,179) = .004$, p=.1.00). Similarly, no significant main effects were found. It is interesting to note that the following covariates significantly affect the dependent variables: academic level (Wilks'Λ=.954, $F(2,179)=4.331$, $p<.05$, partial □η^2=.046) and online experience (Wilks'Λ =.952, $F(2,179)=4.524$, $p<.05$, partial □η^2=.048).

Table 42

Summary of MANCOVA on Process and Solution Satisfaction scores by Course Delivery Method and Learning Strategy (n=*193)*

	Wilks'Λ	*F*	*Hypothesis df*	*Error df*	*p*	Partial □η^2
Actual group structure	.996	.340	2	179	.712	.004
Post-treatment value of connectedness	.984	1.426	2	179	.243	.016
Post-treatment preference for collaboration	.983	1.519	2	179	.222	.017
Post-treatment recognition of the academic potential of collaboration	.997	.282	2	179	.755	.003
Age	.995	.432	2	179	.650	.005
Academic level	.954	4.331	2	179	.015*	.046
Online experience	.952	4.524	2	179	.012*	.048
Current Teaching status	.987	1.137	2	179	.323	.013
Professional Teaching experience	.991	.848	2	179	.430	.009
Course Delivery Method	.997	.259	2	179	.772	.003
Learning Strategy	.998	.184	2	179	.832	.002
Course Delivery Method * Learning Strategy	1.00	.004	2	179	.996	.000

*$p<.05$

To summarize results of this research question, no statistically significant differences were found between course delivery methods or learning strategies in regard to process satisfaction or solution satisfaction.

Research Question 4: Perception of Teaching, Social and Cognitive Presence

The fourth research question addressed whether the learning strategy and course delivery method had a differential impact on students' perceptions of teaching presence, social presence and cognitive presence in regard to the project-based group learning activity.

The scores from the three subscales within the CoI Survey instrument, teaching presence, social presence and cognitive presence, were analyzed together using multivariate statistical

methods. A stepwise MANCOVA was performed to determine whether there were significant differences in course delivery method (blended or online) and learning strategy (cooperative and collaborative) for students' perceptions of teaching presence, social presence and cognitive presence when accounting for students' value of collaboration, process satisfaction, solution satisfaction, age, academic level, online experience, teaching experience, whether the participant was currently teaching, and whether groups followed their assigned learning strategy.

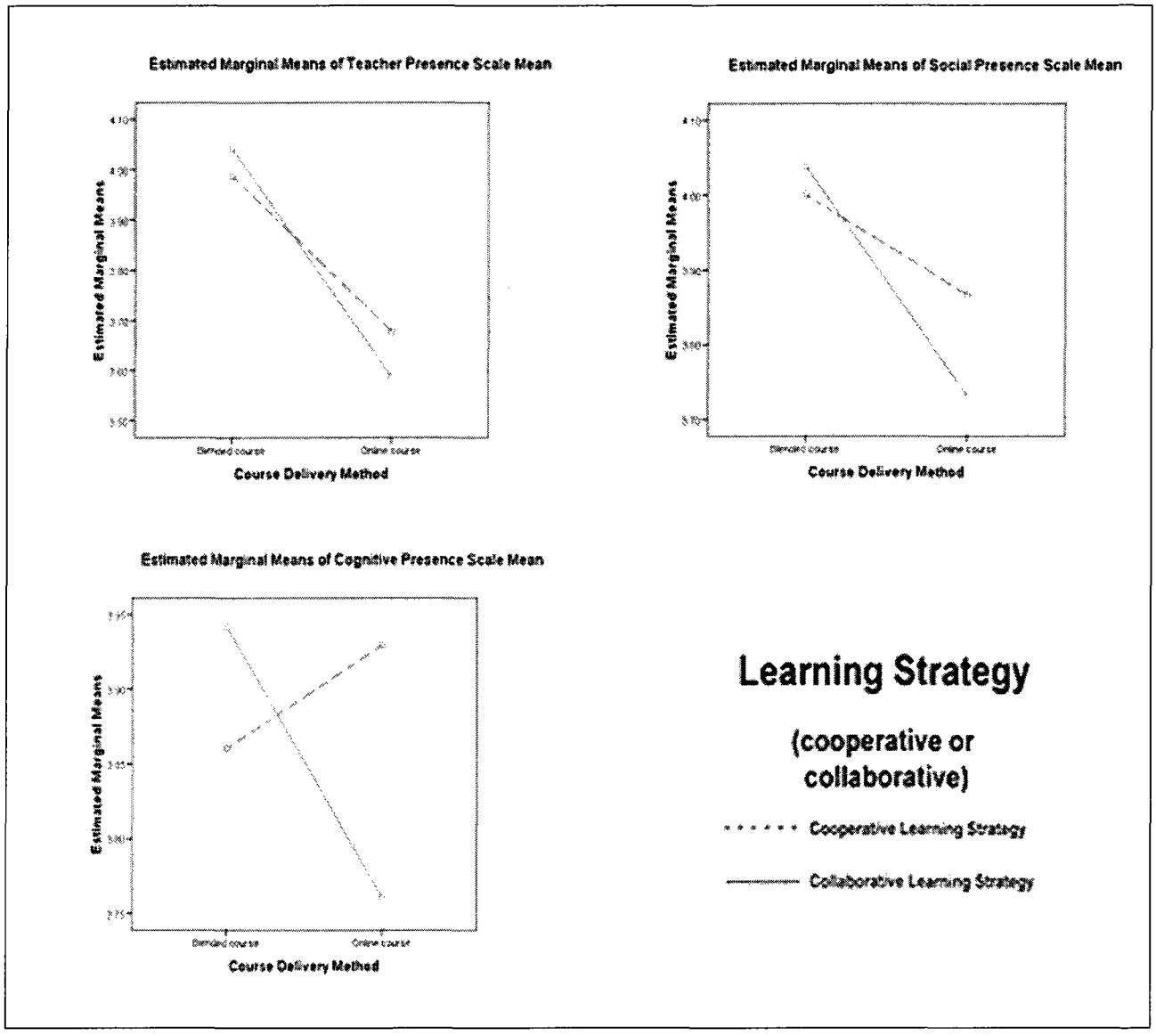
Step one. In the first step of the step-wise MANCOVA, a MANOVA was performed using course delivery method (blended and online) and learning strategy (cooperative and collaborative) as the independent variables and teaching presence, social presence, and cognitive presence mean scores as the dependent variables. Descriptive statistics (see Table 43) indicate that student students enrolled in the blended course delivery method reported higher perceptions of teaching presence (M=4.01, SD=.85) than students enrolled in the online course delivery method (M=3.63, SD=.72). Similarly, social presence scores were higher for blended students (M=4.02, SD=.57) than online students (M=3.80, SD=.67). Cognitive presence scores were only slightly higher for blended students (M=3.90, SD=.60) then for online students (M=3.84, SD=.61). For all three CoI subscales, the mean scores for students who utilized the cooperative learning strategy were slightly higher than the mean scores for those students who utilized the collaborative learning strategy, although Figure 15 illustrates that in terms of cognitive presence, blended collaborative students reported substantially higher cognitive presence scores than online collaborative students.

Table 43

Estimated Marginal Means of Teaching Presence, Social Presence and Cognitive Presence Scores (n=198)

	M	*SD*
Teaching Presence		
Blended Course Delivery Method (n=96)		
Cooperative	3.99	.93
Collaborative	4.04	.76
Total	4.01	.85
Online Course Delivery Method (n=102)		
Cooperative	3.68	.70
Collaborative	3.59	.74
Total	3.63	.72
Learning Strategy Totals (n=198)		
Cooperative	3.83	.83
Collaborative	3.80	.78
Social Presence		
Blended Course Delivery Method (n=96)		
Cooperative	4.00	.53
Collaborative	4.04	.62
Total	4.02	.57
Online Course Delivery Method (n=102)		
Cooperative	3.87	.65
Collaborative	3.73	.69
Total	3.80	.67
Learning Strategy Totals (n=198)		
Cooperative	3.93	.60
Collaborative	3.88	.67
Cognitive Presence		
Blended Course Delivery Method (n=96)		
Cooperative	3.86	.60
Collaborative	3.94	.60
Total	3.90	.60
Online Course Delivery Method (n=102)		
Cooperative	3.92	.52
Collaborative	3.76	.68
Total	3.84	.61
Learning Strategy Totals (n=198)		
Cooperative	3.90	.56
Collaborative	3.85	.65

Figure 15: Community of Inquiry Subscales



No statistically significant interaction was found between the independent variables (Wilks' Λ = .91, $F(3,192) = .708$, p=.548). However, statistical significant differences were found between course delivery method (Wilks' Λ = .91, $F(3,192) = 6.57$, p<.001, partial η^2=.093). No main effect was found for learning strategy (Wilks' Λ = .99, $F(3,192) = .118$, p=.95). An examination of the Tests of Between-Subjects Effects (Table 45) indicates that students enrolled in the blended course delivery method reported significantly higher perceptions

of teaching presence and social presence than students enrolled in the online course delivery method. There was no significant difference between blended and online students in regard to perceptions of cognitive presence.

Table 44

Summary of MANOVA on the Community of Inquiry scores by Course Delivery Method and Learning Strategy, accounting for pre-treatment Value of Collaboration scores (n=198)

	Wilks'Λ	*F*	*Hypothesis df*	*Error df*	*p*	partial □ □η^2
Course Delivery Method	.907	6.565	3	192	.000***	.093
Learning Strategy	.998	.118	3	192	.949	.002
Course Delivery Method * Learning Strategy	.989	.708	3	192	.548	.011

***p<.001

Table 45

Test of Between Subjects for Community of Inquiry scores by Course Delivery Method and Learning Strategy (n=198)

	df	*F*	*p*	partial □ □η^2
Course Delivery Method				
Teaching Presence	1	11.630	.001***	.057
Social Presence	1	6.059	.015***	.030
Cognitive Presence	1	.422	.517	.002
Learning Strategy				
Teaching Presence	1	.025	.873	.000
Social Presence	1	.295	.587	.002
Cognitive Presence	1	.256	.613	.001
Course Delivery Method * Learning Strategy				
Teaching Presence	1	.422	.517	.002
Social Presence	1	.936	.335	.005
Cognitive Presence	1	2.096	.149	.011

***p<.001, *p<.05

Step two. In the second step of the step-wise MANCOVA, a MANCOVA was performed using course delivery method (blended and online) and learning strategy (cooperative and

collaborative) as the independent variables and teaching presence, social presence, and cognitive presence mean scores as the dependent variables. Post-treatment value of collaboration scores were used as covariates. Descriptive statistics (see Table 46) indicate that, like the first step in the step-wise MANCOVA model, students enrolled in the blended course delivery method reported higher perceptions of teaching presence, social presence, and cognitive presence than students enrolled in the online course delivery method. Also similar to the first step of the model, the mean scores for each of the three CoI scales for students who utilized the cooperative learning strategy were only slightly higher than the mean scores for those students who utilized the collaborative learning strategy, although blended collaborative students reported substantially higher cognitive presence scores than online collaborative students.

Table 46

Estimated Marginal Means of Teaching Presence, Social Presence and Cognitive Presence Scores (n=198)

	M	*SD*
Teaching Presence		
Blended Course Delivery Method (n=96)		
Cooperative	3.99	.93
Collaborative	4.04	.76
Total	4.01	.85
Online Course Delivery Method (n=102)		
Cooperative	3.68	.70
Collaborative	3.59	.74
Total	3.63	.72
Learning Strategy Totals (n=198)		
Cooperative	3.83	.83
Collaborative	3.82	.80
Social Presence		
Blended Course Delivery Method (n=96)		
Cooperative	4.00	.53
Collaborative	4.04	.62
Total	4.02	.57
Online Course Delivery Method (n=102)		
Cooperative	3.87	.65
Collaborative	3.73	.69
Total	3.80	.67
Learning Strategy Totals (n=198)		
Cooperative	3.93	.60
Collaborative	3.88	.67
Cognitive Presence		
Blended Course Delivery Method (n=96)		
Cooperative	3.86	.60
Collaborative	3.94	.60
Total	3.90	.60
Online Course Delivery Method (n=102)		
Cooperative	3.93	.52
Collaborative	3.76	.68
Total	3.84	.61
Learning Strategy Totals (n=198)		
Cooperative	3.90	.56
Collaborative	3.85	.64

Results of the MANCOVA (see Table 47) indicated no statistically significant interaction between the independent variables (Wilks' □Λ = .99, $F(3,189) = .924$, p=.430). Moreover, no main effect was found for learning strategy (Wilks' □Λ = 1.00, $F(3,189) = .100$, p=.96). However, a main effect was found for course delivery method (Wilks' □Λ = .92, $F(3,189) = 5.411$, $p<.001$, partial □η^2=.079). Additionally, the covariates post-value of connectedness (Wilks' □Λ = .91, $F(3,189) = 6.204$, $p<.001$, partial □η^2=.090) and post-collaboration potential (Wilks' □Λ = .90, $F(3,189) = 6.833$, $p<.001$, partial η^2=.098) were found to significantly affect the dependent variables.

Table 47

Summary of MANCOVA on the Community of Inquiry scores by Course Delivery Method and Learning Strategy, accounting for post-treatment Value of Collaboration scores (n=*198)*

	Wilks'Λ	*F*	*Hypothesis df*	*Error df*	*p*	partial□ η^2
Post-treatment Value of Connectedness	.910	6.204	3	189	.000***	.090
Post-treatment Preference for Collaboration	.964	2.378	3	189	.071	.036
Post-treatment Recognition of Collaboration Potential	.902	6.833	3	189	.000***	.098
Course Delivery Method	.921	5.411	3	189	.001**	.079
Learning Strategy	.998	.100	3	189	.960	.002
Course Delivery Method * Learning Strategy	.986	.924	3	189	.430	.014

***$p<.001$, **$p<.01$

An examination of the Tests of Between-Subjects Effects (Table 48) indicates that the only CoI scale that significantly differed between the course delivery methods was teaching presence. The covariate post-value of connectedness significantly affected teaching presence,

social presence, and cognitive presence mean scores. The covariate post-preference for collaboration only affected teaching presence mean scores. The covariate post-recognition of collaboration only significantly affected mean social presence scores.

Table 48

Test of Between Subjects for Community of Inquiry scores by Course Delivery Method and Learning Strategy, accounting for post-treatment Value of Collaboration scores (n=198)

	df	*F*	*p*	partial η^2
Post-treatment Value of Connectedness				
Teaching Presence	1	8.887	.003**	.044
Social Presence	1	4.536	.034*	.023
Cognitive Presence	1	16.689	.000***	.080
Post-treatment Preference for Collaboration				
Teaching Presence	1	4.635	.033*	.024
Social Presence	1	.041	.840	.000
Cognitive Presence	1	.012	.914	.000
Post-treatment Recognition of Collaboration Potential				
Teaching Presence	1	2.567	.111	.013
Social Presence	1	8.910	.003**	.045
Cognitive Presence	1	2.584	.110	.013
Course Delivery Method				
Teaching Presence	1	8.968	.003**	.045
Social Presence	1	2.898	.090	.015
Cognitive Presence	1	.010	.921	.000
Learning Strategy				
Teaching Presence	1	.025	.874	.000
Social Presence	1	.092	.762	.000
Cognitive Presence	1	.115	.735	.001
Course Delivery Method * Learning Strategy				
Teaching Presence	1	.197	.657	.001
Social Presence	1	1.598	.208	.008
Cognitive Presence	1	2.473	.117	.013

***$p<.001$, **$p<.01$, *$p<.05$

Step three. For the third step of the step-wise MANCOVA, a MANCOVA was performed using course delivery method (blended and online) and learning strategy (cooperative and collaborative) as the independent variables and teaching presence, social presence, and cognitive presence mean scores as the dependent variables. The following were used as covariates: post-treatment value of collaboration scores, process satisfaction scores, and solution satisfaction scores. Descriptive statistics (see Table 49) indicate that, like the first and second steps in the step-wise MANCOVA model, students enrolled in the blended course delivery method reported higher perceptions of teaching presence, social presence, and cognitive presence than students enrolled in the online course delivery method. Also similar to the first two steps of the model, the mean scores for each of the three CoI scales for students who utilized the cooperative learning strategy were only slightly higher than the mean scores for those students who utilized the collaborative learning strategy, although blended collaborative students reported substantially higher cognitive presence scores than online collaborative students.

Table 49

Estimated Marginal Means of Teaching Presence, Social Presence and Cognitive Presence Scores with Post-value of collaboration scores, Process satisfaction scores, and Solutions satisfaction scores as covariates. (n=198)

	M	*SD*
Teaching Presence		
Blended Course Delivery Method (n=96)		
Cooperative	3.99	.93
Collaborative	4.04	.76
Total	4.01	.85
Online Course Delivery Method (n=102)		
Cooperative	3.68	.70
Collaborative	3.59	.74
Total	3.63	.72
Learning Strategy Totals (n=198)		
Cooperative	3.83	.83
Collaborative	3.80	.78
Social Presence		
Blended Course Delivery Method (n=96)		
Cooperative	4.00	.53
Collaborative	4.04	.62
Total	4.02	.57
Online Course Delivery Method (n=102)		
Cooperative	3.87	.65
Collaborative	3.73	.69
Total	3.80	.67
Learning Strategy Totals (n=198)		
Cooperative	3.93	.60
Collaborative	3.88	.67
Cognitive Presence		
Blended Course Delivery Method (n=96)		
Cooperative	3.86	.60
Collaborative	3.94	.60
Total	3.90	.60
Online Course Delivery Method (n=102)		
Cooperative	3.93	.52
Collaborative	3.76	.68
Total	3.84	.61
Learning Strategy Totals (n=198)		
Cooperative	3.90	.56
Collaborative	3.85	.65

Results of the MANCOVA (see Table 50) indicated no statistically significant interaction between the independent variables (Wilks' Λ = .98, $F(3,187) = 1.460$, p=.227). Moreover, no main effect was found for learning strategy (Wilks' Λ = 1.00, $F(3,187)$ = .182, p=.91). However, a main effect was found for course delivery method (Wilks' Λ = .93, $F(3,187)$ = 4.733, p<.01, partial η^2=.071). Additionally, the covariates post-value of connectedness (Wilks' Λ = .93, $F(3,187) = 4.814$, p<.01, partial η^2=.072), post-collaboration potential (Wilks' Λ = .91, $F(3,187) = 6.269$, p<.001, partial η^2=.091), process satisfaction (Wilks' Λ = .78, $F(3,187) = 18.007$, p<.001, partial η^2=.224), and solution satisfaction (Wilks' Λ = .87, $F(3,187) = 9.165$, p<.001, partial η^2=.128) were found to significantly affect the dependent variables.

Table 50

Summary of MANCOVA on the Community of Inquiry scores by Course Delivery Method and Learning Strategy, accounting for pre-treatment Value of Collaboration scores, process satisfaction and solution satisfaction (n=198)

	Wilks' Λ	*F*	*Hypothesis df*	*Error df*	*p*	partial η^2
Post-treatment Value of Connectedness	.928	4.814	3	187	.003**	.072
Post-treatment Preference for Collaboration	.960	2.597	3	187	.054	.040
Post-treatment Recognition of Collaboration Potential	.909	6.269	3	187	.000***	.091
Process Satisfaction	.776	18.007	3	187	.000***	.224
Solution Satisfaction	.872	9.165	3	187	.000***	.128
Course Delivery Method	.929	4.733	3	187	.003**	.071
Learning Strategy	.997	.182	3	187	.909	.003
Course Delivery Method * Learning Strategy	.977	1.460	3	187	.227	.023

***p<.001, **p<.01

An examination of the Tests of Between-Subjects Effects (Table 51) indicates that the only COI scale that significantly differed between the course delivery methods was teaching presence ($F(1,189) = 7.276$, $p<.01$, partial $\square\eta^2=.037$) . The covariate post-value of connectedness significantly affected teaching presence ($F(1,189) = 5.173$, $p<.05$, partial $\square\eta^2=.027$), and cognitive presence ($F(1,189) = 12.854$, $p<.001$, partial $\square\eta^2=.064$) mean scores. The covariate post-recognition of collaboration significantly affected mean teaching presence ($F(1,189) = 5.788$, $p<.05$, partial $\square\eta^2=.030$) and social presence scores ($F(1,189) = 8.258$, $p<.01$, partial $\square\eta^2=.042$). Process satisfaction scores significantly affected teaching presence ($F(1,189) = 18.938$, $p<.001$, partial $\square\eta^2=.091$), social presence ($F(1,189) = 42.278$, $p<.001$, partial $\square\eta^2=.183$), and cognitive presence scores ($F(1,189) = 30.654$, $p<.001$, partial $\square\eta^2=.140$). Solution satisfaction scores also significantly affected teaching presence ($F(1,189) = 4.136$, $p<.05$, partial $\square\eta^2=.021$), social presence ($F(1,189) = 22.917$, $p<.001$, partial $\square\eta^2=.108$), and cognitive presence ($F(1,189) = 17.557$, $p<.001$, partial $\square\eta^2=.085$).

Table 51

Test of Between Subjects for Community of Inquiry scores by Course Delivery Method and Learning Strategy, accounting for post-treatment Value of Collaboration scores, Process Satisfaction, and Solution Satisfaction (n=*198)*

	df	*F*	*p*	partial□ □η^2
Post-treatment Value of Connectedness				
Teaching Presence	1	5.173	.024*	.027
Social Presence	1	1.161	.283	.006
Cognitive Presence	1	12.854	.000***	.064
Post-treatment Preference for Collaboration				
Teaching Presence	1	3.262	.072	.017
Social Presence	1	1.718	.192	.009
Cognitive Presence	1	1.066	.303	.006
Post-treatment Recognition of Collaboration Potential				
Teaching Presence	1	5.788	.017*	.030
Social Presence	1	8.258	.005**	.042
Cognitive Presence	1	1.136	.288	.006
Process Satisfaction				
Teaching Presence	1	18.938	.000***	.091
Social Presence	1	42.278	.000***	.183
Cognitive Presence	1	30.654	.000***	.140
Solution Satisfaction				
Teaching Presence	1	4.136	.043*	.021
Social Presence	1	22.917	.000***	.108
Cognitive Presence	1	17.557	.000***	.085
Course Delivery Method				
Teaching Presence	1	7.276	.008**	.037
Social Presence	1	1.616	.205	.008
Cognitive Presence	1	.936	.335	.005
Learning Strategy				
Teaching Presence	1	.476	.491	.003
Social Presence	1	.181	.671	.001
Cognitive Presence	1	.082	.775	.000
Course Delivery Method * Learning Strategy				
Teaching Presence	1	.197	.658	.001
Social Presence	1	2.603	.108	.014
Cognitive Presence	1	3.657	.057	.019

***p<.001, **p<.01, *p<.05

Step four. For step four of the step-wise MANCOVA model, a MANCOVA was performed using course delivery method (blended and online) and learning strategy (cooperative and collaborative) as the independent variables and teaching presence, social presence, and cognitive presence mean scores as the dependent variables. The following were used as covariates: post-treatment value of collaboration scores, process satisfaction scores, solution satisfaction, age, academic level, online experience, professional teaching experience, current teaching status, and actual group structure. Descriptive statistics (see Table 52) indicate that, like the first three steps in the step-wise MANCOVA model, students enrolled in the blended course delivery method reported higher perceptions of teaching presence, social presence, and cognitive presence than students enrolled in the online course delivery method. Also similar to the first three steps of the model, the mean scores for each of the three CoI scales for students who utilized the cooperative learning strategy were only slightly higher than the mean scores for those students who utilized the collaborative learning strategy, although blended collaborative students reported substantially higher cognitive presence scores than online collaborative students.

Table 52

Estimated Marginal Means of Teaching Presence, Social Presence and Cognitive Presence Scores with Post-value of collaboration scores, Process satisfaction scores, and Solutions satisfaction scores as covariates (n=193)

	M	*SD*
Teaching Presence		
Blended Course Delivery Method (n=93)		
Cooperative	3.95	.93
Collaborative	4.04	.76
Total	4.00	.85
Online Course Delivery Method (n=100)		
Cooperative	3.67	.71
Collaborative	3.57	.73
Total	3.62	.72
Learning Strategy Totals (n=193)		
Cooperative	3.81	.83
Collaborative	3.80	.78
Social Presence		
Blended Course Delivery Method (n=93)		
Cooperative	3.96	.52
Collaborative	4.04	.62
Total	4.00	.57
Online Course Delivery Method (n=100)		
Cooperative	3.89	.64
Collaborative	3.76	.67
Total	3.82	.66
Learning Strategy Totals (n=193)		
Cooperative	3.92	.58
Collaborative	3.89	.66
Cognitive Presence		
Blended Course Delivery Method (n=93)		
Cooperative	3.82	.59
Collaborative	3.94	.60
Total	3.88	.60
Online Course Delivery Method (n=100)		
Cooperative	3.93	.52
Collaborative	3.78	.68
Total	3.85	.61
Learning Strategy Totals (n=193)		
Cooperative	3.87	.55
Collaborative	3.86	.64

Results of the MANCOVA (see Table 53) indicated no statistically significant interaction between the independent variables (Wilks'□Λ = .98, $F(3,176) = .982$, $p=.356$). Moreover, no main effect was found for learning strategy (Wilks'□□Λ = 1.00, $F(3,187) = .121$, $p=.95$). However, a main effect was found for course delivery method (Wilks'□□Λ = .93, $F(3,176) = 4.312$, $p<.01$, partial $\eta^2=.068$). Additionally, the covariates post-value of connectedness (Wilks'□□Λ = .93, $F(3,176) = 4.558$, $p<.01$, partial $\eta^2=.072$), post-collaboration potential (Wilks'□□Λ = .92, $F(3,176) = 4.824$, $p<.01$, partial $\eta^2=.076$), process satisfaction (Wilks'□□Λ = .76, $F(3,176) = 18.219$, $p<.001$, partial $\eta^2=.237$), and solution satisfaction (Wilks'□□Λ = .87, $F(3,176) = 8.511$, $p<.001$, partial $\eta^2=.127$) were found to significantly affect the dependent variables.

Table 53

Summary of MANCOVA on the CoI scores by Course Delivery Method and Learning Strategy, accounting for pre-treatment Value of Collaboration, process satisfaction, solution satisfaction, actual group structure, age, academic level, online experience, teaching status, and teaching experience (n=193)

	Wilks'Λ	*F*	*Hypothesis df*	*Error df*	*p*	partial η^2
Post-treatment Value of Connectedness	.928	4.558	3	176	.004**	.072
Post-treatment Preference for Collaboration	.966	2.046	3	176	.109	.034
Post-treatment Recognition of Collaboration Potential	.924	4.824	3	176	.003**	.076
Process Satisfaction	.763	18.219	3	176	.000***	.237
Solution Satisfaction	.873	8.511	3	176	.000***	.127
Actual Group Structure	.996	.232	3	176	.874	.004
Age	.990	.604	3	176	.613	.010
Academic Level	.994	.381	3	176	.767	.006
Online Experience	.974	1.596	3	176	.192	.026
Current Teaching Status	.991	.547	3	176	.650	.009
Professional Teaching Experience	.976	1.471	3	176	.224	.024
Course Delivery Method	.932	4.312	3	176	.006**	.068
Learning Strategy	.998	.121	3	176	.356	.018

Table 53

Summary of MANCOVA on the CoI scores by Course Delivery Method and Learning Strategy, accounting for pre-treatment Value of Collaboration, process satisfaction, solution satisfaction, actual group structure, age, academic level, online experience, teaching status, and teaching experience (n=193)

Course Delivery Method * Learning Strategy	.982	1.087	3	176	.356	.018

***p<.001, **p<.01

An examination of the Tests of Between-Subjects Effects (Table 54) indicates that the only COI scale that significantly differed between the course delivery methods was teaching presence ($F(1,178) = 6.091$, $p<.05$, partial $\eta^2=.033$) . The covariate post-value of connectedness significantly affected teaching presence ($F(1,178) = 5.124$, $p<.05$, partial $\eta^2=.028$), and cognitive presence ($F(1,178) = .696$, $p<.001$, partial $\eta^2=.004$) mean scores. The covariate post-recognition of collaboration significantly affected mean teaching presence ($F(1,178) = 4.707$, $p<.05$, partial $\eta^2=.026$) and social presence scores ($F(1,178) = 6.428$, $p<.05$, partial $\eta^2=.035$). Process satisfaction scores and solution satisfaction scores significantly affected teaching presence, social presence and cognitive presence scores. Online experience significantly affected social presence scores ($F(1,178) = 4.358$, $p<.05$, partial $\eta^2=.024$). Additionally, professional teaching experience significantly affected social presence scores ($F(1,178) = 4.279$, $p<.05$, partial $\eta^2=.023$).

Table 54

Test of Between Subjects for Community of Inquiry scores by Course Delivery Method and Learning Strategy, accounting for post-treatment Value of Collaboration scores, Process Satisfaction, Solution Satisfaction, Actual Group Structure, Age, Academic Level, Online Experience, Current Teaching Status, Professional Teaching Experience (n=193)

	df	*F*	*p*	partial η^2
Post-treatment Value of Connectedness				
Teaching Presence	1	5.124	.025*	.028
Social Presence	1	1.076	.301	.006
Cognitive Presence	1	11.860	.001***	.062
Post-treatment Preference for Collaboration				
Teaching Presence	1	3.262	.073	.018
Social Presence	1	.853	.357	.005
Cognitive Presence	1	.696	.405	.004
Post-treatment Recognition of Collaboration Potential				
Teaching Presence	1	4.707	.031	.026
Social Presence	1	6.428	.012*	.035
Cognitive Presence	1	1.001	.318	.006
Process Satisfaction				
Teaching Presence	1	18.854	.000***	.096
Social Presence	1	43.639	.000***	.197
Cognitive Presence	1	27.922	.000***	.136
Solution Satisfaction				
Teaching Presence	1	6.119	.014*	.033
Social Presence	1	19.184	.000***	.097
Cognitive Presence	1	17.522	.000***	.090
Actual Group Structure				
Teaching Presence	1	.280	.597	.002
Social Presence	1	.109	.742	.001
Cognitive Presence	1	.067	.796	.000
Age				
Teaching Presence	1	.004	.950	.000
Social Presence	1	1.771	.185	.010
Cognitive Presence	1	.354	.552	.002
Academic Level				
Teaching Presence	1	.114	.736	.001
Social Presence	1	1.147	.286	.006
Cognitive Presence	1	.288	.592	.002
Online Experience				
Teaching Presence	1	.439	.508	.002
Social Presence	1	4.358	.038*	.024
Cognitive Presence	1	.001	.975	.000
Current Teaching Status				
Teaching Presence	1	.317	.574	.002
Social Presence	1	1.055	.306	.006
Cognitive Presence	1	.001	.975	.000

Table 54

Test of Between Subjects for Community of Inquiry scores by Course Delivery Method and Learning Strategy, accounting for post-treatment Value of Collaboration scores, Process Satisfaction, Solution Satisfaction, Actual Group Structure, Age, Academic Level, Online Experience, Current Teaching Status, Professional Teaching Experience (n=*193)*

Professional Teaching Experience				
Teaching Presence	1	.007	.936	.000
Social Presence	1	4.279	.040*	.023
Cognitive Presence	1	.355	.552	.002
Course Delivery Method				
Teaching Presence	1	6.091	.015*	.033
Social Presence	1	3.357	.069	.019
Cognitive Presence	1	.355	.552	.002
Learning Strategy				
Teaching Presence	1	.028	.867	.000
Social Presence	1	.031	.861	.000
Cognitive Presence	1	.243	.623	.001
Course Delivery Method * Learning Strategy				
Teaching Presence	1	.449	.504	.003
Social Presence	1	1.393	.239	.008
Cognitive Presence	1	3.141	.078	.017

****p*<.001, ***p*<.01, **p.05*

Teaching presence subscales. The Teaching Presence scale consists of three subscales: Design and organization, Facilitation, and Direct Instruction. The statistically significant difference in the teaching presence scores between the course delivery methods lead to further investigation of differences according to the subscales. Each subscale was examined utilizing all of the covariates used in the previous ANCOVAs.

Teaching presence subscale: Design and organization. An ANCOVA was used to examine differences between course delivery methods and learning strategies in regard to the teaching presence subscale, design and organization. The following covariates were used: post-treatment value of connectedness, post-treatment preference for collaboration, post-treatment recognition of collaboration potential, actual group structure, process satisfaction, solution

satisfaction, age, academic level, online experience, current teaching status, and professional teaching experience. Descriptive statistics (Table 55) indicate that blended students responded more favorably to design and organization questions than did online students. Additionally, in the blended environment, collaborative students responded more favorably than did cooperative students, while in the online environment cooperative students responded more favorably than the collaborative students.

Table 55
Estimated Marginal Means of Teaching Presence Subscale Design and Organization with the following covariates: post-treatment value of collaboration, process & solution satisfaction, group structure, age, academic level, current teaching status, online experience, and professional teaching experience (n=193)

	M	*SD*
Blended Course Delivery Method (n=93)		
Cooperative	4.08	1.04
Collaborative	4.42	.67
Online Course Delivery Method (n=100)		
Cooperative	4.12	.78
Collaborative	3.93	.84

Results of the ANCOVA (see Table 56) indicate that an interaction between course delivery and learning strategy occurred, $F(1,178)=5.00$, $p<.05$, partial $\square\eta^2 = .027$. The interaction was significantly affected by the following covariates: process satisfaction, $F(1,178)=16.947$, $p<.001$, partial $\square\eta^2 = .087$, and solution satisfaction, $F(1,178)=5.719$, $p<.05$, partial $\square\eta^2 = .031$. The strength of the relationship between the independent variables (course delivery method and learning strategy) and the design and organization subscale was small with the independent variables accounting for 2.7% of the variance of the dependent variable, holding

constant the following: post-treatment value of collaboration, process and solution satisfaction, group structure, age, academic level, current teaching status, online experience, and professional teaching experience. Figure 16 illustrates that the interaction is disordinal in nature. More specifically, blended collaborative students responded more favorably in regard to the design and organization of the instruction than did blended cooperative students. Conversely, online cooperative students responded more favorably than did online collaborative students.

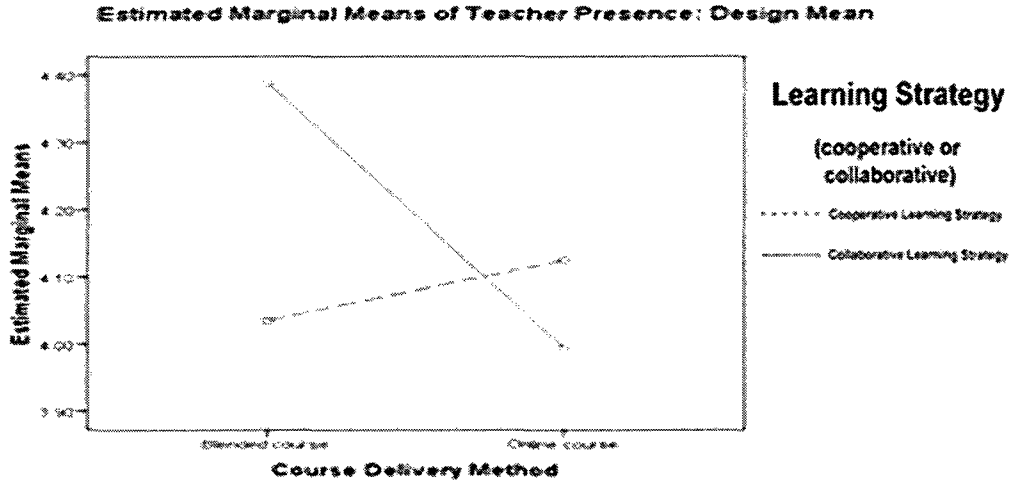
Table 56

Summary of ANCOVA on the Design and Organization Subscale by Course Delivery Method and Learning Strategy (n=*193)*

	df	*F*	*p*	partial η^2
Post-value of connectedness	1	3.124	.079	.017
Post-preference for collaboration	1	2.628	.107	.015
Post-recognition of collaboration potential	1	3.318	.070	.018
Process satisfaction	1	16.947	.000***	.087
Solution Satisfaction	1	5.719	.018*	.031
Actual group structure	1	.040	.842	.000
Age	1	.341	.560	.002
Academic level	1	.014	.907	.000
Online experience	1	.013	.908	.000
Professional teaching experience	1	.003	.959	.000
Current teaching status	1	.047	.828	.000
Course Delivery Method	1	1.291	.257	.007
Learning Strategy	1	.163	.383	.001
Course Delivery Method * Learning Strategy	1	5.002	.027*	.027

***p<.001. *p<.05

Figure 16: Teaching Presence Subscale: Design and Organization



Teaching Presence subscale: facilitation. An ANCOVA was used to examine differences between course delivery methods and learning strategies in regard to the teaching presence subscale, facilitation. The following covariates were used: post-treatment value of connectedness, post-treatment preference for collaboration, post-treatment recognition of collaboration potential, actual group structure, process satisfaction, solution satisfaction, age, academic level, online experience, current teaching status, and professional teaching experience. Descriptive statistics (Table 57) indicate that blended students responded more favorably to design and organization questions than did online students. Collaborative and cooperative learning strategies differed slightly, with collaborative students responding more favorably in the blended environment, while in the online environment cooperative students responded more favorably than the collaborative students.

Table 57
Estimated Marginal Means of Teaching Presence Subscale Facilitation with the following covariates: post-treatment value of collaboration, process & solution satisfaction, group structure, age, academic level, current teaching status, online experience, and professional teaching experience (n=193)

	M	*SD*
Blended Course Delivery Method (n=93)		
Cooperative	3.90	.91
Collaborative	3.87	.94
Online Course Delivery Method (n=100)		
Cooperative	3.43	.81
Collaborative	3.38	.80

Results of the ANCOVA (see Table 58) indicate no significant interaction between the independent variables. Additionally, no significant difference was found between learning strategies. However a main effect was found for course delivery method, $F(1,178)=8.24$, $p<.01$, partial $\square\eta^2 = .044$. The strength of the relationship between the course delivery method and the facilitation subscale was small with the independent variable accounting for 4.4% of the variance of the dependent variable. The following covariates significantly influenced the dependent variable: post-value of connectedness, $F(1,178)=4.318$, $p<.05$, partial $\square\eta^2 = .024$, post-preference for collaboration, $F(1,178)=4.388$, $p<.05$, partial $\square\eta^2 = .024$, post-recognition of collaboration potential, $F(1,178)=4.169$, $p<.05$, partial $\square\eta^2 = .023$, process satisfaction, $F(1,178)=13.348$, $p<.001$, partial $\square\eta^2 = .070$, and solution satisfaction $F(1,178)=5.901$, $p<.05$, partial $\square\eta^2 = .032$.

Table 58

Summary of ANCOVA on the Facilitation Subscale by Course Delivery Method and Learning Strategy (n=193)

	df	*F*	*p*	partial η^2
Post-value of connectedness	1	4.318	.039*	.024
Post-preference for collaboration	1	4.388	.038*	.024
Post-recognition of collaboration potential	1	4.169	.043*	.023
Process satisfaction	1	13.348	.000***	.070
Solution Satisfaction	1	5.901	.016*	.032
Actual group structure	1	.556	.457	.003
Age	1	..054	.816	.000
Academic level	1	.671	.414	.004
Online experience	1	.872	.352	.005
Professional teaching experience	1	.005	.942	.000
Current teaching status	1	.265	.608	.001
Course Delivery Method	1	8.242	.005**	.044
Learning Strategy	1	.269	.605	.002
Course Delivery Method * Learning Strategy	1	.071	.790	.000

***$p<.001$, **$p<.01$, *$p<.05$

Teaching Presence subscale: direct instruction. An ANCOVA was used to examine differences between course delivery methods and learning strategies in regard to the teaching presence subscale, direct instruction. The following covariates were used: post-treatment value of connectedness, post-treatment preference for collaboration, post-treatment recognition of collaboration potential, actual group structure, process satisfaction, solution satisfaction, age, academic level, online experience, current teaching status, and professional teaching experience. Descriptive statistics (Table 59) indicate that blended students responded more favorably to direct instruction questions than did online students. Collaborative and cooperative learning strategies differed slightly, with collaborative students responded more favorably in the blended environment, while in the online environment cooperative students responded more favorably than the collaborative students.

Table 59
Estimated Marginal Means of Teaching Presence Subscale Direct Instruction with the following covariates: post-treatment value of collaboration, process & solution satisfaction, group structure, age, academic level, current teaching status, online experience, and professional teaching experience (n=193)

	M	*SD*
Blended Course Delivery Method (n=93)		
Cooperative	3.86	.99
Collaborative	3.84	.89
Online Course Delivery Method (n=100)		
Cooperative	3.48	.84
Collaborative	3.41	.76

Results of the ANCOVA (see Table 60) indicate no significant interaction between the independent variables. Additionally, no significant difference was found between learning strategies. However a main effect was found for course delivery method, $F(1,178)=6.23$, $p<.05$, partial $\square\eta^2 = .034$. The strength of the relationship between the course delivery method and the facilitation subscale was small with the independent variable accounting for 3.4% of the variance of the dependent variable. The following covariates significantly influenced the dependent variable: post-value of connectedness, $F(1,178)=4.595$, $p<.05$, partial $\square\eta^2 = .024$, and process satisfaction, $F(1,178)=14.083$, $p<.001$, partial $\square\eta^2 = .073$.

Table 60

Summary of ANCOVA on the Direct Instruction Subscale by Course Delivery Method and Learning Strategy (n=193)

	df	*F*	*p*	partial η^2
Post-value of connectedness	1	4.595	.033*	.024
Post-preference for collaboration	1	1.206	.274	.007
Post-recognition of collaboration potential	1	3.564	.061	.020
Process satisfaction	1	14.083	.000***	.073
Solution Satisfaction	1	3.110	.080	.017
Actual group structure	1	.205	.651	.001
Age	1	.026	.872	.000
Academic level	1	.001	.978	.000
Online experience	1	.479	.490	.003
Professional teaching experience	1	.034	.854	.000
Current teaching status	1	.552	.458	.003
Course Delivery Method	1	6.232	.013*	.034
Learning Strategy	1	.095	.758	.001
Course Delivery Method * Learning Strategy	1	.014	.904	.000

***p<.001, **p<.01, *p<.05

Summary

The research questions in this study aimed at investigating the effects of course delivery method and learning strategy on student achievement and satisfaction. To investigate student achievement in detail, the first research question addressed whether individual quiz grades and group project grades differed according to course delivery method and learning strategy. Student attitudes are often correlated with satisfaction. Therefore, the second research question examined students' attitude toward, preference for, and metacognition regarding collaboration. Student satisfaction was addressed in the third research question, where students' satisfaction with the process of group learning and satisfaction with the group solution were explored. Finally, the fourth research question, which investigated students' perceptions of teaching presence, social presence and cognitive presence, was used to further explain the results of the achievement and satisfaction questions.

In summary, individual achievement did not differ according to course delivery method or learning strategy, but a disordinal interaction was found for group project grade, indicating that students in the blended course delivery method performed much more favorably when using the collaborative learning strategy as opposed to the cooperative learning strategy. It is worth noting that no significant difference was found between online cooperative and online collaborative students. Additionally, the online students performed at a similar level to the blended collaborative group. Second, blended students scored higher on pre-treatment value of collaboration items than online students. Once pre-treatment scores were accounted for, post-treatment value of collaboration scores did not differ between course delivery method or learning strategy. Third, no difference was found between course delivery methods or learning strategy for process satisfaction or solution satisfaction. Finally, blended students perceived higher teaching presence than online students. Perceptions of social and cognitive presence did not significantly differ by course delivery method or learning strategy. Teaching presence did not differ according to learning strategy. However an investigation of teaching presence subscales found a disordinal interaction between the independent variables for design and organization, indicating that blended collaborative students responded more favorably than blended cooperative students, while online cooperative students responded more favorably than online collaborative students.. The facilitation subscale and the direct instruction subscale significantly differed according to course delivery method, with blended students responding more favorably than online students.

Chapter V: Discussion

This final chapter consists of five major sections. First, the interpretations of the findings from each of the four research questions are addressed. Limitations of the Study, Recommendations for Future Research, Summary, and Overall Conclusion sections follow the interpretation of research findings.

Findings

Factors influencing individual student achievement. The first research question addresses whether course delivery method and learning strategy had a differential effect on individual quiz grades and group project grades. The findings suggest that neither course delivery method nor learning strategy significantly affected individual quiz grades. However, group project grades were significantly affected by the interaction of course delivery method and learning strategy.

Course delivery method. With regard to quiz grades, the non-significant results contradict previous findings in terms of course delivery mode. Tutty and Klein (2008) found that groups working in environments with a face-to-face component performed better on quizzes than online students. The authors maintain that students who worked in groups with a face-to-face component may have scored higher on the individual quizzes because they found it easier to share information with group members than did the virtual students. The lack of significant difference in the present study may be due to the requirement that both blended and online students discuss quiz preparation questions via their group discussion board or virtual chat. This requirement may have "leveled the playing field", because all students had to use technology to discuss the practice questions.

Furthermore, contradictions between the current study results and those of Tutty and Klein may be partially due to differences in group composition and the nature of the tasks. The Tutty and Klein study utilized student dyads in face-to-face and virtual environments to explore the use of spreadsheets. While the group project was based on a case study, much of the learning was technical in nature. In contrast, the groups in the current study were generally comprised of three or more students and the nature of the task was more theoretical. Moreover, the Tutty and Klein study investigated grouping of high level and low level students, a component that was not included in the present study.

Learning strategy. Results for the influence of learning strategy on individual achievement were consistent with those of Klein and Doran (1999), but contradicted the findings of Cavalier et al. (1995). Klein and Doran found no significant difference in individual achievement when comparing high structured groups (cooperative), low structured groups (collaborative), and individual learners. On the other hand, Cavalier et al. found that structured groups performed better on individual tests than did their unstructured colleagues. The difference in findings may be due to nature of the content being learned. Participants in the Klein and Doran study were given a simulation in which they had to make decisions regarding appropriate accounting methods in various contexts. Similarly, students in the current study were asked to create a cooperative lesson plan based on theoretical knowledge and appropriate context. While specific details regarding content are unknown, the content in Cavalier et al.'s study seems to be much more procedural in nature. Therefore, one might posit that when dealing with procedural tasks, structured (cooperative) group learning strategies may result in higher individual assessment grades than unstructured learning strategies.

Cohen (1994) suggested that higher-level learning is most effective when performed in a less structured environment. However the quiz questions utilized in this study were mostly written at the remembering and understanding levels of Bloom's Taxonomy (Krathwohl, 2002) (see the quiz blueprint in Appendix E), and therefore considered lower level learning. Perhaps lower level cognitive tasks can be sufficiently accomplished whether in a high or low structured group environment. Additionally, the lack of significant difference in individual quiz grades in the current study may be due to the inclusion of a practice discussion prior to an individual actually taking the test.

Other studies that have investigated group work have found no significant differences for group types. Several of these studies have concluded that a lack of difference in achievement may be because the instruction for all group types was well-designed (Bossert, 1988-1989; Cavalier & Klein, 1998; Flynn & Klein, 2001; Klein & Doran, 1999). Perhaps the instruction for all groups in the current study was sufficiently well-designed so that no significant difference could be found between course delivery methods or learning strategies.

Factors influencing group project grades. A disordinal interaction was found between course delivery method and learning strategy when examining group project grades. More specifically, students enrolled in the blended course delivery method and assigned the cooperative learning strategy scored significantly less on the group project than the other three treatment groups.

The findings that the blended cooperative treatment had significantly lower group project scores was surprising, given that the blended learning environment offers group members a chance to interact face-to-face and the cooperative learning strategy provides a detailed structure

for group work. In regard to course delivery method, some have claimed that groups that are comprised of fully online students may suffer due to potential difficulties of coordinating tasks virtually (Harasim, 1993). Therefore, one might conjecture that students in the online treatment groups would have lower group project grades than the blended students. Moreover, the cooperative learning strategy is more structured, scaffolds teamwork, and encourages group reflection, all components which would seem to enhance group productivity, group effectiveness, and help students understand their role as part of the whole (Curtis & Lawson, 2001; Johnson, et al., 1998a; Johnson, et al., 1991; Waggoner, 1992). One might suppose then that students assigned to the collaborative learning strategy would have lower group project grades, particularly since they were required to work primarily in an online environment. Instead, quite the opposite occurred. The combination of the blended learning environment and the cooperative learning strategy caused students to score lower on group project grades than the rest of the treatment groups, even when low participation grades were removed.

The findings are inconsistent with those of Strijbos, et al. (2004) and Lou, et al. (2001) who found no significant difference in group grades when comparing high structured and low structured groups. Given that the online cooperative group outperformed the blended cooperative group in the current study, the findings were somewhat consistent with those of Tutty and Klein (2008), who found that online groups outperformed groups with a face-to-face component. However, that does not account for the fact that blended collaborative groups received equivalent grades to those of the online cooperative and collaborative groups.

One explanation for the significant difference in group project grades, is that blended cooperative students may not have engaged in higher level cognitive interactions. One criticism

of the cooperative strategy is that the assignment of individual roles may be more of a "divide and conquer strategy" (Graham & Misanchuk, 2004) than a dialogue among the group members. If blended cooperative students were simply dividing the work among themselves and engaging in surface level interaction online, this could explain their lower scores on the group projects. Other studies have found differences between high and low structured groups in regard to level of cognitive interaction. For example, Schellens, et al. (2005) found that while high structured groups had more consistent levels of interaction, low structured groups used more elaboration and critical thinking. Similarly, Brewer and Klein (2006) and Benbunan-Fich, et al. (2002) found that low structured (collaborative) groups had significantly more cognitive interactions, described as elaboration, questioning and complex discussions, than did high structured (cooperative) groups. Moreover, Cohen (1994) suggests that higher-level learning, like the group project in the present study, may be most effective when performed in a less structured method because role assignments may constrain interaction, not allowing students to freely elaborate on content. Therefore it might be that the students in the blended cooperative sections of the course did not cognitively interact at a deep level.

While the explanation that blended cooperative (high structure) sections did not score as high on group grades because the cooperative structure was too constraining is plausible, one must still wonder why the online cooperative (high structure) groups performed as well as the blended and online collaborative (low structure) groups. If the reason is just structure, then online cooperative (high structure) groups should have scored lower on the group projects as well. But perhaps engaging in group work when enrolled in an online course naturally encourages students to interact with their group members on a higher cognitive level. So in some

ways the online cooperative treatment may take on some of the characteristics of the collaborative strategy. For example, the collaborative strategy requires students to work closely together on the whole project, negotiating throughout the process. In the case of the blended and online collaborative groups, the students were forced to work closely together to negotiate meaning, no matter which course delivery method they were using, and were potentially engaged in high cognitive interaction. One could posit that online cooperative (high-structured) groups had to engage in higher levels of interaction than the blended cooperative groups in order to organize their group schedule, organize their roles, and discuss what content they would use in their lesson. Because the online cooperative groups had to engage in more discussion online than did the blended cooperative groups (who could quickly make some decisions in class), they may have engaged in more cognitive interaction as well. Further research using content analysis will be necessary to investigate differences in surface and deep interaction levels.

Factors influencing student value of collaboration. Significant differences between the blended and online students were found in pre-treatment value of collaboration scores. When asked about their value of connectedness with others in their classes, their preference for working with others, and their recognition for the potential of collaboration to increase academic achievement, students enrolled in the blended courses expressed higher values of collaboration than students enrolled in the online courses. The difference in pre-treatment value of collaboration scores is not surprising given that similar results were found in a previous study using the same population (Overbaugh & Nickel, 2008). Students who self-select into an online section of a course may be more independent than students who select blended course sections (Diaz & Cartnal, 1999), meaning that online students may have a lower affiliation motive, or positive attitude toward group work (Brewer & Klein, 2006).

The pre-treatment scores were used as covariates when investigating any potential differences in the post-treatment value of collaboration scores. When accounting for the pre-treatment scores, no significant difference in post-treatment value of collaboration scores between course delivery methods or learning strategies was found. Additionally, the mean scores for all treatments fell somewhere between the neutral and agree range in a five-point Likert scale, indicating that many students may be somewhat ambivalent toward collaboration (Dziuban, et al., 2008). The results seem to fall between previous research in which students appreciated the opportunity to collaborate and found it helpful for their learning (Brewer, et al., 2003; Dewiyanti, et al., 2007; Kim, et al., 2005; Kitchen & McDougall, 1998) and research where students preferred to work alone or denied the academic benefits of working with others (Hillard, 2006; Klein & Doran, 1999; Uribe, et al., 2003).

Student attitudes toward collaboration seem to be higher than the students studied by Tutty and Klein (2008), who had generally negative attitudes toward working with a partner and felt that they did not learn more than they would have by working alone. Similarly, Klein and Doran (1999), found that students in high structured and low structured groups were less likely to respond positively about group work than students who worked individually. An explanation for slightly higher scores in the current study may be the design of the instruction and the content studied. Some content may be more conducive for group work than other content. For example, Klein and Doran utilized an accounting simulation where student dyads consisted of a "preparer" and a "checker". Perhaps, in the Klein and Doran study, the instruction used was simple enough that student groups did not really benefit from working together on the simulation. Given that individual test grades were the same for students who worked individually as those who worked

in groups, one could make the claim that in the case of Klein and Doran's study, students did not value working with others because they realized they could have accomplished the same learning alone.

A student's attitude toward working with others may influence his/her learning as well as the group he/she joins (Williams, et al., 2006). Furthermore, value of collaboration may also influence a student's satisfaction with the process of working in a group and his/her satisfaction with the group solution (Ocker & Yaverbaum, 2001). Given that this study is focused on student achievement and satisfaction, an investigation of student attitudes toward collaboration was appropriate.

Factors influencing student satisfaction. Student satisfaction was measured utilizing an instrument that had a process satisfaction scale and a solution satisfaction scale. The purpose of using two scales was to dig deeper into student satisfaction in terms of the process of working in a group and the final group outcome. While descriptive statistics showed that students who worked in blended groups and students who worked in cooperative groups were more satisfied than their online and collaborative classmates, once student attitudes toward collaboration, the actual learning strategy (structure used), and the student characteristics were used as covariates, no statistically significant difference was found between the independent variables for process satisfaction or solutions satisfaction.

Process satisfaction. Results for process satisfaction are consistent with the findings of Francescato et al. (2006) who found no significant difference in satisfaction between face-to-face and online collaborative groups. However, the current research results are inconsistent with several previous studies that found that students engaged in an environment with a face-to-face

component tended to be more satisfied with the group process than those who worked exclusively online (Ocker & Yaverbaum, 1999; Thompson & Coovert, 2003; Warkentin, et al., 1997). Additionally, other research found that students in more structured (cooperative) groups perceived higher group efficiency than students in less structured (collaborative) groups (Strijbos, Martens, Jochems, et al., 2004). The rationale given for these differences in previous research was that students who were completely or partially engaged in peer interaction in a face-to-face environment had an easier time communicating with group members and were more familiar with the environment in which they were working than their online classmates (Olaniran, 1996; Straus & McGrath, 1994). Additionally, online students often have to deal with lags in virtual discussion and as a result may have less socio-emotional interaction, thereby decreasing satisfaction for the group process (Benbunan-Fich & Hiltz, 1999; Chidambaram, 1996).

The difference in the results of the current study and those of previous studies may be the time allowed for the group work. Several studies have noted that satisfaction with the collaboration process can increase over time (Flanagin, et al., 2004; Olaniran, 1996). While the instruction utilized in the present study has been characterized as short-term, it did last over a period of at least two weeks. Other studies that found significant differences in process satisfaction between delivery methods used much shorter amounts of time for their treatment, such as approximately two hours (Thompson & Coovert, 2003) or even 25 minutes (Warkentin, et al., 1997). While Ocker and Yaverbaum's (1999) study used two two-week case study treatments, student groups were assigned to either the face-to-face or the online condition for the first treatment and assigned to the opposite treatment for the next treatment. Students took the process and solution satisfaction measure after each treatment. Although the measure did not ask

students to compare their experience between the face-to-face group work and the online group work, one can surmise that students did make that comparison and found the face-to-face treatment more efficient.

Another explanation for the difference between results in the current study and that of previous research is the amount of computer-mediated interaction required for the activity. Several previous studies have compared online groups with groups that met entirely face-to-face (Olaniran, 1996; Straus & McGrath, 1994; Thompson & Coovert, 2003; Warkentin, et al., 1997; Whitman, et al., 2005). While one might reason that students enrolled in the blended course delivery method would tend to be more satisfied because they had the opportunity to meet face-to-face in class, the group activity required that students perform much of their interaction online. Therefore, any differences in process satisfaction between the course delivery methods that may have occurred due to difficulty communicating online and waiting for others to participate may have been negated, because students in all treatments were forced to deal with those communication issues.

Solution satisfaction. Results of the current study indicate that students' solution satisfaction did not differ either by course delivery method or learning strategy. Moreover, mean scores for solution satisfaction were over four in a five-point Likert scale, indicating that students were quite satisfied with their groups' solutions. This finding is consistent with previous studies, who found no significant difference in solution satisfaction between face-to-face and online groups (Benbunan-Fich & Hiltz, 1999; Fjermestad & Hiltz, 1998; Ocker & Yaverbaum, 1999). While some studies have found a difference in solution satisfaction between face-to-face and online groups (Thompson & Coovert, 2003; Warkentin, et al., 1997), those studies tended to

have very short treatment durations. In those cases, students in the online groups may have gone along with the first solution proposed, even if they disagreed, so that they could speed up the group process and meet the looming deadline (Harasim, 1990). In the current study, the time limit for the group project seems to have been sufficient for the groups to negotiate a solution that left group members satisfied. Additionally, any issues students may have with the process of group work did not seem to affect their satisfaction with the outcome.

Factors influencing student perceptions of cognitive presence, social presence, and teaching presence. Student perceptions of cognitive presence, social presence and teaching presence were measured utilizing the Community of Inquiry Student Survey (Arbaugh, et al., 2007a). Each scale was examined separately. While descriptive statistics showed that blended students' perceptions were higher than online students for each scale, only teaching presence was found to significantly differ by course delivery method. No significant differences were found between the learning strategies.

Social presence. The lack of difference between online and blended students in regard to social presence is surprising, given that students in online courses tend to have poorer perceptions of their discussion quality than students in courses with face-to-face components (Benbunan-Fich & Hiltz, 1999; Whitman, et al., 2005), have to deal with the lack of nonverbal cues (Benbunan-Fich & Hiltz, 1999), and often lack "relational intimacy" (Chidambaram, 1996). A lack of significant difference between learning strategies is equally surprising, given that role assignments within group tasks have been found to promote group cohesion (Rose, 2002). However, the findings from this study are consistent with Francescato et al. (2006) who also found no difference in perceptions of social presence when examining collaborative learning in online and face-to-face environments. Another reason for the lack of difference between delivery

methods or learning strategies may be that students had already worked together in their groups prior to the assigned activity in this study. Their previous work on a virtual chat session may have acted as an ice breaker, allowing students to feel more familiar with one another and able to communicate more freely. Thus, social presence may have differed between course delivery methods at the beginning of the course, but the first group activity (which took place prior to the experiment) could have potentially equalized the level of social presence of students in both delivery methods.

Cognitive presence. No significant differences were found between course delivery methods or learning strategies in regard to student perceptions of cognitive presence. Given that students' individual quiz grades were generally high, a lack of significant difference is not surprising. However one might presume that because a significant difference was found in group project grades, with blended cooperative students scoring significantly lower than all other treatment groups, that a difference in cognitive presence (defined as the extent to which students are able to construct meaning through sustained communication (Garrison, et al., 2000a)) might be present. Additionally, because teaching presence has a significant impact on cognitive presence (Garrison & Cleveland-Innes, 2005; Garrison, Cleveland-Innes, & Fung, 2010), one might deduce that the differences in teaching presence would impact cognitive presence. The fact that cognitive presence scores did not differ despite the significant differences in group project grades and teaching presence scores raises questions as to what other variables might influence cognitive presence and how closely related the three types of presence are to each other in this context. The influences on cognitive presence and its relationship with teaching presence and social presence need further study.

Teaching presence. Results of the study indicate that teaching presence scores significantly differed according to course delivery method, with blended students responding more favorably than online students. These results are not surprising, given that blended students have the advantage of being able to see and interact with their instructor on a weekly basis. However, more interesting results were found when the teaching presence subscales were examined. With regard to the design and organization teaching presence subscale, a disordinal interaction between course delivery method and learning strategy was found. More specifically, blended collaborative students responded with higher perceptions than did blended, cooperative students, while in the online environment cooperative students responded with higher perceptions than the collaborative students. The design and organization subscale examines students' perceptions of the instructor's communication of pertinent topics, goals, instruction on participation, and important due dates (Arbaugh, et al., 2007b). One might expect that online cooperative students would perceive teaching presence for design and organization higher than online collaborative students, because the online cooperative students were provided with a more structured learning strategy. But the difference between the blended cooperative and blended collaborative students is harder to explain. Perhaps the lower design and organization perceptions of the blended cooperative students are somehow connected with their lower group project scores. It could be that the blended cooperative students had a more difficult time following the instructions online because they divided the work amongst themselves and may have worked on the project more as individuals, with only minimal interaction online. Further investigation with content analysis of the group discussion boards and virtual chat areas may be necessary.

Summary of Community of Inquiry Student Survey. The three presences have been found to be interdependent (Akyol & Garrison, 2008) with social presence being a mediating factor between teaching presence and cognitive presence and teaching presence being key to creating and sustaining social presence and cognitive presence (Garrison, et al., 2010). Given the interdependencies, one might question why social presence and cognitive presence did not significantly differ between the treatments when teaching presence did. One reason for the difference may be because students value teaching presence over the other presences. Diaz, Swan, Ice & Kupczynski (2010) found that students value teaching presence over social and cognitive presence and posited that students may do so because they view teaching presence as a "necessary condition for the development of social presence" (p. 27). Student perceptions of the importance of teaching presence seem to agree with the findings of Garrison, Cleveland-Innes, and Fung (2010), which indicate that teaching presence is "core to establishing and maintaining social and cognitive presence" (p. 35). Moreover, social presence may have been established in the group chat that occurred prior to the experiment in this study. Finally, the lack of difference in cognitive presence shows that students perceived that they were able to learn together no matter the course delivery method or learning strategy; a positive result that affirms the effectiveness of the design of the instructional module.

Summary

Results of this study suggest that cooperative and collaborative strategies in online and blended environments are equally effective in regard to individual achievement, but that blended cooperative learners perform significantly poorer on group projects. Despite the differences in group achievement, students are equally satisfied with their groups' process and solution. Blended students value connectedness with classmates, prefer collaboration, and recognize the

academic potential of collaboration more than online students at the beginning of the course and the group activity did not significantly change the student attitudes. Finally, students did not differ according to their perceptions of social presence and cognitive presence, but significant differences were found in perceptions of teaching presence. Blended cooperative students responded with lower scores than blended collaborative students on design and organization, while online collaborative students responded with lower scores than online cooperative students.

Limitations and Delimitations

Threats to internal validity. Although efforts were made to eliminate threats to internal validity, potential threats that may still have occurred include differential selection of subjects, diffusion of treatment, and subject effects.

Differential selection of subjects. While course sections were randomly assigned to one of the two learning strategy treatments, students self-selected into the course delivery methods. Descriptive statistics established that there were some differences between blended and online students. While the numerous covariates were used to account for such differences, other variables may have been present that were not controlled. Additionally, small groups within each course section were formed based on availability to converse synchronously online. Students' time and family constraints may have influenced their synchronous availability, potentially resulting in study outcomes that were affected by group composition (McMillan & Schumacher, 2001).

Diffusion of treatment. This study was designed so that each course section was randomly assigned to the cooperative or collaborative learning strategy. However, there is a potential that students from one section and strategy may have interacted with students from a

different section and strategy. If that is the case, students may have shared how they approached their group project, potentially influencing each other's group process and achievement (McMillan & Schumacher, 2001)

Subject effects. Students in the current study were informed that they were participating in a research study. Often subjects want to present themselves in a positive manner, believing that certain responses on pre and post-treatment surveys are expected or desired by the researcher (McMillan & Schumacher, 2001). In order to decrease this effect, students were not told the specific purpose of the study. However, students may have guessed the purpose based on survey questions.

Threats to external validity. While an attempt was made to decrease threats to external validity in this study, potential population and ecological threats may be present.

Population threats. This study utilized a convenience sample (Leedy & Ormrod, 2005); students enrolled in a teacher education technology integration course. Although course sections were randomly assigned to the treatments, generalization of results is limited to populations with similar characteristics (McMillan & Schumacher, 2001).

Ecological threats. Definitions of cooperative and collaborative learning differ between theorists. Similarly, blended learning has been defined in various ways. Moreover, operational definitions of student satisfaction and attitudes toward collaboration (or group work) fluctuate between research studies. Because the operational definitions of the independent and dependent variables may differ from other research studies, generalization is limited (McMillan & Schumacher, 2001).

Recommendations for Future Research

Further research is recommended in the following areas: (a) group project scores in other contexts, (b) the relationship between group project scores and teaching presence scores, (c) analysis of levels of interaction, (d) analysis of levels of critical thinking, and (e) the relationship between the Community of Inquiry Student survey and the Community of Inquiry Model.

This study found that students in the blended, cooperative groups scored significantly lower on group project grades than did the students in the other three treatment groups. This finding was surprising, given that one would suspect that the blended, cooperative treatment may be the most efficient treatment, given the high structure and the students' ability to communicate face-to-face. Therefore, further study is needed, both within the same population and other populations and contexts.

Another interesting finding from this study was that blended cooperative students gave less positive survey responses than blended collaborative students in regard to the teaching presence subscale "design and organization". The design and organization subscale examines students' perceptions of the instructor's communication of pertinent topics, goals, instruction on participation, and important due dates (Arbaugh, et al., 2007b). Given the structure of the cooperative treatment, one might suppose that students in the blended cooperative treatment would respond more favorably than their blended collaborative colleagues in regard to the learning unit's design and organization. This surprising finding, coupled with the difference in group project grades, suggests that the blended cooperative students' perceptions of the learning unit's design and organization may be related to their group project grades. Further study within the same population and other populations is warranted.

The level of interaction within groups may have differed, along with the level of critical thinking reached. While the Community of Inquiry Student Survey was used to examine differences in regard to the groups' interaction and cognitive presence, the process of constructing meaning and thinking critically (Garrison & Anderson, 2003), the survey relies on student perception and self-report and results may be skewed due to subject effects (McMillan & Schumacher, 2001). Therefore, more in-depth analyses of discussion board and virtual chat content may be necessary to determine how much social presence evolved within groups in each treatment and the level of critical thinking achieved in each group. A useful model for social presence content analysis can be found in articles by Rourke, Anderson, Garrison and Archer (1999). The Practical Inquiry Model (Garrison, Anderson & Archer, 2001; Vaughan & Garrison, 2005) has been widely used for cognitive presence content analysis.

Finally, it may be valuable to compare student perceptions of community of inquiry (via the CoI Student Survey) with the results of a content analysis using the original Community of Inquiry model (Garrison, Anderson & Archer, 2000). While the student survey is based on the Community of Inquiry model and has been validated (Arbaugh et al, 2008), subject effects or other contextual factors may have skewed the results of the survey. A comparison of survey results and content analysis may provide valuable information to the research literature.

Overall Conclusions

In conclusion, this study introduces important new evidence in regard to the effectiveness of cooperative and collaborative learning in blended and online environments. Additionally, this study provides valuable information on student attitudes, satisfaction, and perceptions with regard to online and blended courses utilizing cooperative and collaborative strategies. First,

results of this study suggest that cooperative and collaborative strategies in online and blended environments are equally effective in regard to individual achievement, as measured by a unit quiz. Such results indicate that blended and online students who utilize cooperative and collaborative learning strategies can perform equally well on low-level quiz items, particularly when the written instruction and small group review are well designed for both learning environments.

Second, significant differences in group project grades indicate that the cooperative strategy may be less effective for group projects when conducted in a blended delivery method. In this study, blended cooperative students produced group projects that were lower in quality as compared to the blended collaborative, online cooperative and online collaborative groups. The results are surprising, given that blended cooperative students had the opportunity to interact face-to-face while in class and that the cooperative strategy provides a detailed structure for group work. A possible explanation for the significant difference in group grades is that blended cooperative students may have taken on a "divide and conquer" strategy (Graham & Misanchuk, 2004) to complete the work and thus did not engage in higher level interactions. The highly structured cooperative strategy may have been too constraining for higher cognitive level interactions. Moreover, it may be posited that the interactions of the online cooperative students were not constrained because working in an online group requires high levels of negotiation in order to organize the group schedule, group roles, and content of the group project. Perhaps online cooperative learning takes on the more collaborative characteristics, including more negotiation, and thus utilizes more cognitive interaction. Study results highlight the need for further research to investigate differences in surface and deep interaction levels between the course delivery methods and learning strategies.

Third, results from this study are consistent with previous research that found that online students tend to value connectedness and collaboration less than students enrolled in blended courses. Students who self-select into online courses may be more independent (Diaz & Cartnal, 1999) and have a lower affiliation motive (Brewer & Klein, 2006) than blended students. Given that student attitudes may influence individual and group learning (Williams et al., 2006) and student satisfaction (Ocker & Yaverbaum, 2001), the results of student attitudes in this study are important additions to the research literature.

Fourth, this study showed that despite differences in group achievement, students who utilized cooperative and collaborative strategies in blended and online course delivery methods were equally satisfied with their groups' process and solution. The process satisfaction results are surprising, because previous research has found that online students tend to have lower satisfaction with the process of group work in comparison to students who interact in environments with face-to-face components (Ocker & Yaverbaum, 1999; Thompson & Coovert, 2003, Warkentin, et al., 1997). Additionally, prior research has found that students are more satisfied with the efficiency of cooperative group work as compared to less structured (collaborative) group work (Strijbos, Martens, Jochems, et al.,2004). However, the previous studies utilized very short amounts of time for group work, as low as 25 minutes (Warkentin, et al.,1997) and compared online groups with face-to-face groups (as opposed to blended groups). Given that satisfaction with group work can increase over time (Flanagin, et al., 2004; Olaniran,1996), results from the current study suggest that the amount of time allowed for group work may affect student satisfaction with the process. Moreover, the fact that the group activity required both online and blended students to interact mostly online may have negated any potential differences in process satisfaction because students in both course delivery methods had

to deal with potential online communication. These findings are important additions to the research literature and emphasize the need for further study in regard to allotted time for group work and comparisons between blended and online environments.

Finally, this study found that perceptions of social presence and cognitive presence were generally high and did not differ significantly between course delivery methods or learning strategies. However, significant differences were found in students' perceptions of teaching presence. Blended cooperative students had less favorable perceptions of the design and organization of the instruction than blended collaborative students, while online collaborative students had less favorable perceptions than online cooperative students. Blended students had more favorable perceptions of the teaching presence subscales facilitation and direct instruction than online students. The results suggest that both blended and online students utilizing cooperative or collaborative learning strategies perceived that they could connect with their group members socially and emotionally in order to construct meaning (Garrison, 2006; Ice, et al., 2008). While teaching presence is said to be a vital support for cognitive presence (Garrison et al., 2000b), differences in perceptions of teaching presence did not affect perceptions of cognitive presence. However, differences in the teaching presence subscale "design and organization" show blended cooperative students to have a lower perception than the rest of the treatment groups, a result that mirrors that of the group project grades (where blended cooperative students scored significantly lower than the rest of the treatment groups). Thus, the teaching presence scores may be related to differences in achievement and requires further study.

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Appendix A: Proposal to ECI 430 Instructors

Outline for Cooperative/Collaborative Module for ECI 430

Premise of the research

The current module on Cooperative & Project-based Learning was redesigned to include a cooperative or collaborative activity in which small groups create a cooperative, project-based lesson plan (an adaptation of 5W/5E) for a cooperative learning activity. Student groups will utilize a template, as well as information from module readings and videos, to create the cooperative, project-based lesson plan using the 5 basic elements of Cooperative Learning (Positive Interdependence, Individual Accountability, Promotive Interaction, Teamwork Skills, and Group Processing).

Assessments:

- Lesson plan – Groups will cooperatively/collaboratively create the lesson plan (an adaption of the 5W/5E), but each student will turn in a final version of it (based on the work with the group). Grades were assessed by the researcher via a rubric
- Individual quiz – Each student will take a quiz following conclusion of the module.

Module Learning Objectives:

Terminal Learning Objectives	Enabling Learning Objectives
TLO 1: Given resources on cooperative learning, identify the key elements and identify contexts in which cooperative learning is most appropriate.	ELO 1.1 – Define cooperative learning (Identify the basic elements of cooperative learning, as described by theorists such as Johnson & Johnson)
	ELO 1.2 – Define project-based learning (Identify the basic elements of project-based learning)
	ELO 1.3 – Identify situations/contexts in which cooperative learning and project-based learning would be most appropriate
TLO 2: Given resources on cooperative learning and project-based learning, student groups will create a cooperative, project-based lesson plan utilizing the basic elements of cooperative learning, project-based learning and technology integration. (Basic elements include grouping strategies, duration of project, roles given to	ELO 2.1 – Identify ways that technology can be integrated into cooperative and project-based learning.
	ELO 2.2 – Evaluate their chosen subject matter for content that can be successfully learned via cooperative and project-based learning

group members, driving question or problem)	ELO 2.3 – Construct a cooperative, project-based lesson plan that utilizes CL and Pbl concepts such as grouping strategies, duration of project, specific Pbl techniques used, group member roles, driving questions, and assessment plan
	ELO 2.4 - Reflect on and defend choices based on information gathered by student

Formation of student groups:
Each course section was randomly assigned to either the collaborative or cooperative treatment (the whole class was assigned to the same treatment). Students within each section were randomly assigned to groups of 3 to 4 students.

Module Outline

Introduction to the Module

Students in both cooperative and collaborative groups were introduced to the module by way of a video announcement at the beginning of the module. I will explain that I am acting as the instructor for the module and that all questions should come to me. Students understood that they had been assigned to small groups and that they would be working together to create a cooperative, project-based lesson plan for a cooperative learning activity (the target age and subject is the group's choice). All requirements were explained. Additionally, it was explained that this module is part of a research study and that all data gathered will be confidential.

Readings/Videos

Students in both treatments will be responsible for completing the same readings and video viewings and are expected to complete the readings prior to small group discussion. Groups are welcome to conduct further investigation of content online if they wish. All readings, videos, and external links will be available within the Blackboard module. Readings and videos will explain the basic concepts behind cooperative learning and project-based learning and will include examples of cooperative project-based learning for various age groups and subjects.

Group Interaction

Collaborative	**Cooperative**
Positive Interdependence – small groups will have the mutual goal of completing the cooperative, project-based lesson plan together (positive goal interdependence). Positive Identity Interdependence – small groups will choose names for themselves	Positive Interdependence – small groups will have the mutual goal of completing the cooperative, project-based lesson plan together (positive goal interdependence). Positive Identity Interdependence – small groups will choose names for themselves Positive Role Interdependence – labor is divided into specific roles
Individual Accountability – students will understand that peers within the group will evaluate their participation in the group project. If they receive negative peer evaluations due to lack of participation, their grade may be lowered. Additionally, students will understand that they will take an individual quiz at the end of the module – a potential motivation to learn the content.	Individual Accountability – students will understand that peers within the group will evaluate their participation in the group project. If they receive negative peer evaluations due to lack of participation, their grade may be lowered. Students will be assigned roles within their groups. The success of the group is dependent on their completion of their roles. Additionally, students will understand that they will take an individual quiz at the end of the module – a potential motivation to learn the content.
Group Roles – n/a	Group Roles – Leader – schedules when and how the group

	will meet (asynchronously or synchronously); helps develop a project schedule and makes sure the group stays on schedule Checker – Checks on group comprehension and checks the grading rubric to make sure the assignment is fully completed Writer/Recorder – Records decisions (makes sure decisions are consensual); edits the final document Prober – Keeps the group from giving superficial answers to questions; encourages the group to explore alternative possibilities
Teamwork skills – n/a	Teamwork Skills – Cooperative groups will be provided with material about how to work effectively in a group. Additionally, the researcher (acting as the instructor) will frequently monitor group discussion to facilitate interaction.
Group Processing – n/a	Group Processing – Halfway through the treatment, cooperative groups will be asked to examine how they have been interacting as a group and how they might improve.

Assessments

Acting as the instructor, the researcher will be responsible for grading all cooperative, project-based lesson plan and individual quizzes. The lesson summaries (developed by the small groups but submitted individually) will be assessed via a rubric, which will assess projects based on fulfilling all cooperative and project-based learning elements, logical rationale for choices and integration of technology in the lesson plan.

Individual quizzes will be taken online via Blackboard. Open-ended questions will be graded by the researcher.

Appendix B: Project Instructions for Groups

Instructions for Both Learning Strategy Treatment Groups:

Chat or Discussion Board
For this project, you will work together in your group to review what you have read and learned. You will then create an overview of a cooperative lesson.

1. Start by following Activity readings below. Do not skip any of the readings, they were all chosen specifically for you.
2. Go to your group discussion board (found on the "Groups" button on the left).
3. In your discussion board, decide with your group whether you want to use the chat function (synchronous communication) or the discussion board (asynchronous communication) or use both to complete the review of your learning and the project template.
4. As a group, discuss the following topics. Do not skip this step – it will help you on your group lesson template as well as on the quiz. All topic readings are found in this project.

Topic 1: Compare and contrast cooperative and collaborative learning. How are they similar? How do they differ?

Topic 2: Compare positive interdependence and individual accountability. Why are both necessary for successful effective cooperative learning?

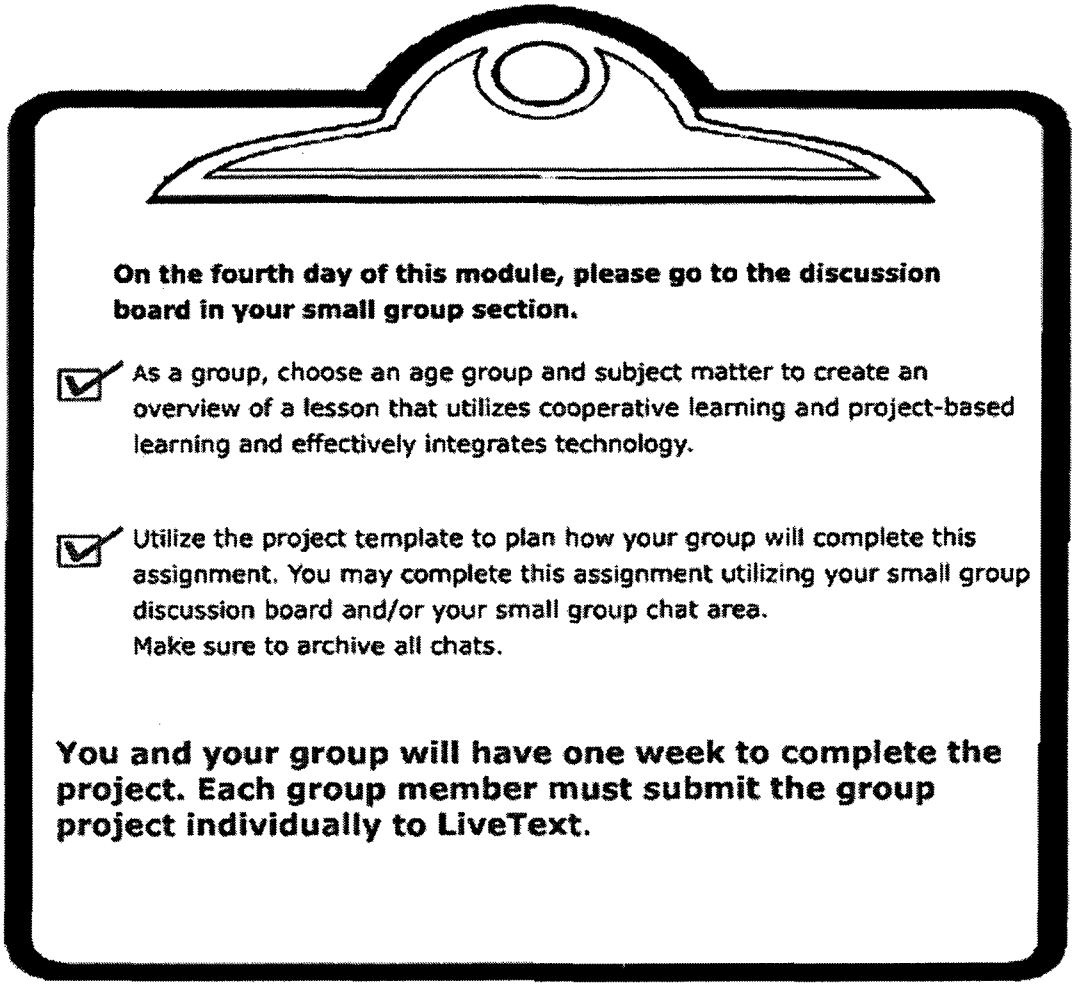
Topic 3: Discuss examples of way you can integrate technology into Project-Based and Cooperative Learning.

Topic 4: An integral part of the PBL classroom is the use of probing, thought-provoking, multi-faceted questions that get students to reach high cognitive levels. Give examples of questions or activities that relate to the Remembering, Understanding, Applying and Analyzing levels of Bloom's Taxonomy.

5. Once you are finished discussing the questions, work together to follow the next set of instructions(Activity 2) to create an overview of a cooperative lesson based on the project template. Specific instructions on how to complete the group project are below.

Instructions for students assigned to the Collaborative treatment:

Group Collaborative Work
In this activity, you will work with your group members (CLICK GROUPS button on the left) to create a summary of a cooperative, project-based lesson. Carefully look over the project template and think about what subject matter you would like to use in the lesson plan prior to meeting with your group (in the "groups section").

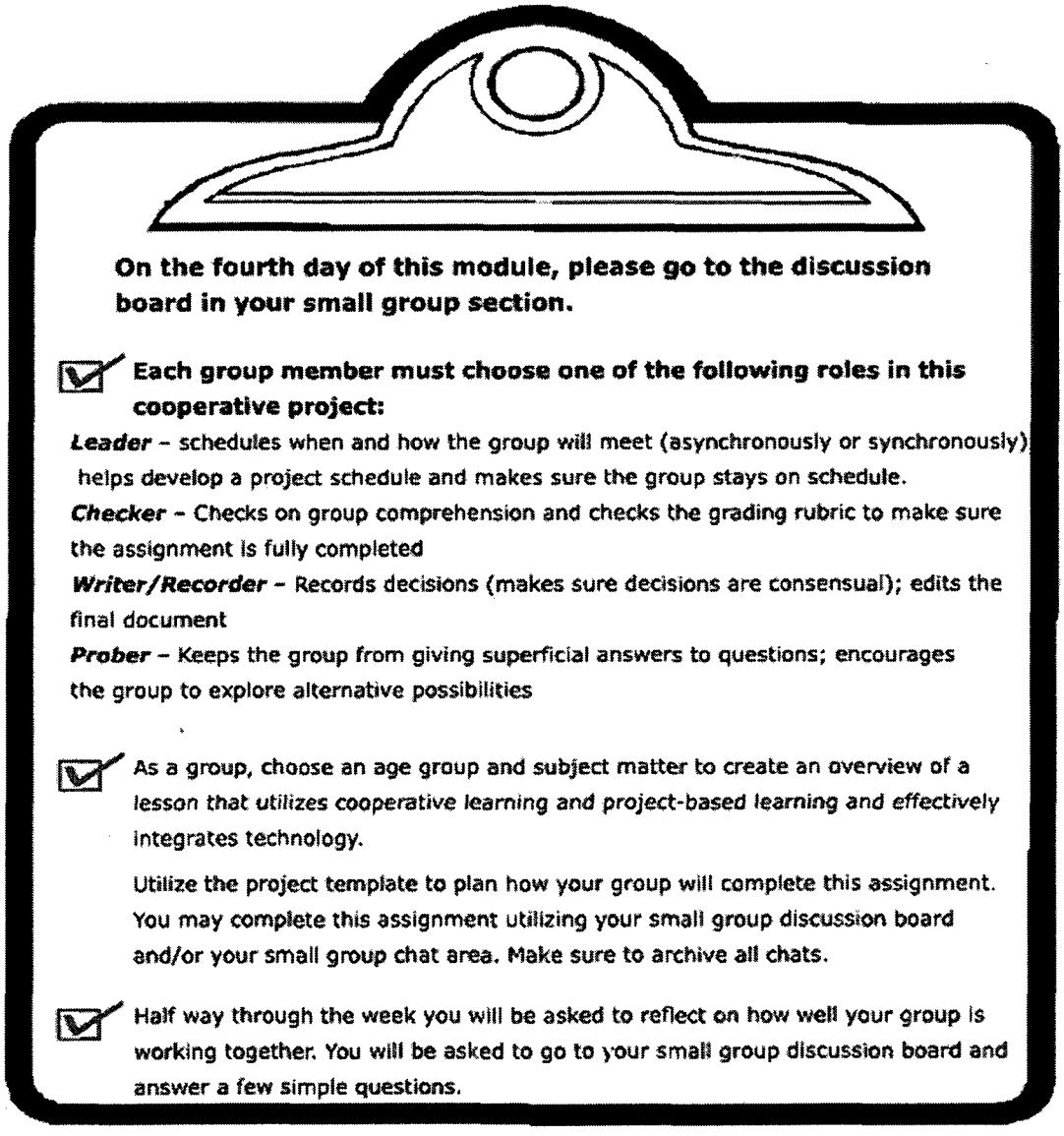


You and your group will have one week to complete the project. *Each group member must submit the group project individually to LiveText.*

Instructions for students assigned to the Cooperative treatment:

Group Cooperative Work
In this activity, you will work with your group members (CLICK GROUPS button on left) to create a summary of a cooperative, project-based lesson. Carefully look over the project template and think about what subject matter you would like to use in the lesson plan prior to meeting with your group (in the "groups section").

Before working with your group members, please read the following instructions on effective group work: **Teamwork Principles.doc**



On the fourth day of this module, please go to the discussion board in your small group section.

Each group member must choose one of the following roles in this cooperative project:

Leader – schedules when and how the group will meet (asynchronously or synchronously) helps develop a project schedule and makes sure the group stays on schedule.

Checker – Checks on group comprehension and checks the grading rubric to make sure the assignment is fully completed

Writer/Recorder – Records decisions (makes sure decisions are consensual); edits the final document

Prober – Keeps the group from giving superficial answers to questions; encourages the group to explore alternative possibilities

As a group, choose an age group and subject matter to create an overview of a lesson that utilizes cooperative learning and project-based learning and effectively integrates technology.

Utilize the project template to plan how your group will complete this assignment. You may complete this assignment utilizing your small group discussion board and/or your small group chat area. Make sure to archive all chats.

Half way through the week you will be asked to reflect on how well your group is working together. You will be asked to go to your small group discussion board and answer a few simple questions.

You and your group will have one week to complete the project. *Each group member must submit the group project individually to LiveText.*

Scaffolding Materials (provided to the Cooperative treatment groups)

TEAMWORK PRINCIPLES
These Principles are important to cooperating with others effectively. Please read and follow the following principles as you work with your group.

POSITIVE INTERDEPENDENCE
Involve People
- Ask for ideas, opinions and suggestions
- Involve people in choices and decisions that affect them
- Help people to see the 'big picture'
- Negotiate tasks and procedures
- Develop team goals together

INTERACTIVE LEARNING
Communicate
- Actively listen
- Find creative ways of sharing information
- Explain why things are important
- Keep people informed - encourage people to keep themselves informed

INDIVIDUAL ACCOUNTABILITY
Shared Responsibility
- Ensure that each individual is clear about their task/role and their contribution to the team

DEVELOPMENT OF INTERPERSONAL SKILLS
Develop Teamwork Skills
- Interpersonal skills
- Problem-solving, mediation and conflict resolution
- Effective thinking and decision-making
- Positive, pro-active style of working

REFLECTION
Give Recognition
- Encourage initiative, act on people's ideas
- Acknowledge contributions and achievements
- Accent the positives
- Give constructive feedback

RECIPROCITY

Build Reciprocity

- Actively seek to learn from others
- Take the perspective of other people
- Give and receive support
- Develop genuine partnerships with others

Adapted from
http://www.ceo.cg.catholic.edu.au/learning/re/tno/strategies/cooperative_learning.htm

Group Processing

Halfway through the treatment, cooperative groups will be asked to examine how they have been interacting as a group and how they might improve their teamwork. The groups will receive an email notifying them to post to a Group Processing thread within their small group discussion board.

Appendix C: Lesson Plan Summary Template

This lesson plan summary template is adapted from the 5W/5E that you used earlier in the course. Describe what you as the teacher need to do to facilitate learning. Include rationale for your decisions (why your choices are appropriate). And be creative! Imagine that the sky is the limit and school budgets and resources are pretty much limitless.

Please type your answers in the right side of the table. Make sure to cover each question in detail, as explained in the project rubric. Make sure to use spell check and that you meet all areas of writing expectations. DELETE the directions when complete.

Your Name:	
Names of Other Group Members:	
Lesson Title:	
Subject Area:	
WHO is targeted for this cooperative activity?	
WHAT?	
☐ What is/are the instructional goal(s) of the cooperative activity?	
☐ What technologies are available?	
☐ What technologies would the educator like to use?	
Cooperative Learning	
☐ What kinds of grouping strategies will be used (how many group members? Do members form their own groups or are they assigned?)	
☐ How will positive interdependence be promoted?	
☐ How will individual accountability be promoted?	
☐ List and describe the roles assigned to each group member.	

☐ Describe how the instructor will facilitate teamwork skills and group processing. (How will the teacher teach the group teamwork skills? How will the group examine how well they are working together?)	
☐ WHERE will the lesson be delivered? (classroom, computer lab, other?)	
☐ WHEN will the cooperative activity take place? (warm-up, wrap-up activity, after a particular lesson?	
☐ WHY are your choices for the cooperative activity appropriate?	
☐ HOW will you know that students have learned the subject matter? What kind of assessment will you use?	
Technology Integration	
☐ What type of technology will be integrated into the cooperative lesson?	
☐ Why is the technology appropriate for the lesson?	
☐ WHERE will the technology integration occur? (classroom, computer lab, other?)	
☐ WHY are you using technology integrated into the lesson? (use at least one of the 5 Es: Engage, Explore, Explain, Elaborate, Evaluate)	

Appendix D: Lesson plan Rubric

	Does Not Meet Criteria	**Incomplete** (1 pt)	**Partially Proficient** (3 pts)	**Proficient** (4 pts)	**Exemplary** (5 pts)
Target Audience & Lesson Topic (1, 16%)	Unacceptable performance is evidenced by none of the following criteria met: 1. by an explanation of the target audience, including age, grade level, and experience or previous knowledge; 2. an explanation of the lesson topic, including the goal or purpose of the lesson and the resources used in the lesson; and 3. the assignment posted in the correct location by the assignment date.	Incomplete performance is evidenced by only 1 of the following criteria met: 1. by an explanation of the target audience, including age, grade level, and experience or previous knowledge; 2. an explanation of the lesson topic, including the goal or purpose of the lesson and the resources used in the lesson; and 3. the assignment posted in the correct location by the assignment date.	Partially Proficient performance is evidenced by at least 2 of the following criteria met: 1. by an explanation of the target audience, including age, grade level, and experience or previous knowledge; 2. an explanation of the lesson topic, including the goal or purpose of the lesson and the resources used in the lesson; and 3. the assignment posted in the correct location by the assignment date.	Proficient performance is evidenced by all 3 of the following criteria met: 1. by an explanation of the target audience, including age, grade level, and experience or previous knowledge; 2. an explanation of the lesson topic, including the goal or purpose of the lesson and the resources used in the lesson; and 3. the assignment posted in the correct location by the assignment date.	Exemplary performance is evidenced by all 3 of the following criteria met: 1. by a thorough explanation of the target audience, including age, grade level, and experience or previous knowledge; 2. a clear explanation of the lesson topic, including the goal or purpose of the lesson and the resources used in the lesson; and 3. the assignment posted in the correct location by the assignment date.
Elements of Cooperative Learning Part I (1,	Unacceptable performance is evidenced by *none* of the following	Incomplete performance is evidenced by *only 1* of the following	Partially Proficient performance is evidenced by the following	Proficient performance is evidenced by the following	Exemplary performance is evidenced by all of the following

	Does Not Meet Criteria	**Incomplete** (1 pt)	**Partially Proficient** (3 pts)	**Proficient** (4 pts)	**Exemplary** (5 pts)
16%)	*criteria met:* **1. Positive Interdependence:** The learner chose at least one type of positive interdependence to be promoted, gave a detailed explanation of why it is appropriate for the proposed activity and how it will be implemented in the lesson. **2. Individual Accountability:** The learner gave a detailed explanation of how individuals will be held accountable for their own work in the proposed activity.	*criteria met:* **1. Positive Interdependence:** The learner chose at least one type of positive interdependence to be promoted, and stated (with little detail) how it will be implemented in the lesson. **2. Individual Accountability:** The learner stated (with little detail) how individuals will be held accountable for their own work in the proposed activity.	*criteria met:* **1. Positive Interdependence:** The learner chose at least one type of positive interdependence to be promoted, and stated *(with little detail)* how it will be implemented in the lesson. **2. Individual Accountability:** The learner stated *(with little detail)* how individuals will be held accountable for their own work in the proposed activity.	*criteria met:* **1. Positive Interdependence:** The learner chose at least one type of positive interdependence to be promoted, gave a *detailed explanation* of why it is appropriate for the proposed activity and how it will be implemented in the lesson. **2. Individual Accountability:** The learner stated *(with little detail)* how individuals will be held accountable for their own work in the proposed activity.	*criteria met:* **1. Positive Interdependence:** The learner chose at least one type of positive interdependence to be promoted, gave a *detailed explanation* of why it is appropriate for the proposed activity and how it will be implemented in the lesson. **2. Individual Accountability:** The learner gave a *detailed explanation* of how individuals will be held accountable for their own work in the proposed activity.
Elements of Cooperative Learning Part II (1, 16%)	Unacceptable performance is evidenced by *none* of the following criteria met:	Incomplete performance is evidenced by *only 1* of the following criteria met:	Partially proficient performance is evidenced by *at least 2* of the following	Proficient performance is evidenced by the following criteria met: **1. Group Roles:**	Exemplary performance is evidenced by the following criteria met: **1. Group Roles:**

	Does Not Meet Criteria	**Incomplete** (1 pt)	**Partially Proficient** (3 pts)	**Proficient** (4 pts)	**Exemplary** (5 pts)
	1. Group Roles: Group roles were created for the proposed activity. Each role was described and rationale for the purpose of each role was given. **2. Teamwork Skills:** A detailed explanation of how the teacher will facilitate teamwork skills was provided. **3. Group Processing:** A detailed explanation was given as to how the teacher will facilitate group processing in the proposed activity.	**1. Group Roles:** Group roles were created for the proposed activity. Each role was described and rationale for the purpose of each role was given. **2. Teamwork Skills:** A detailed explanation of how the teacher will facilitate teamwork skills was provided. **3. Group Processing:** A detailed explanation was given as to how the teacher will facilitate group processing in the proposed activity.	criteria met: **1. Group Roles:** Group roles were created for the proposed activity. Each role was described and rationale for the purpose of each role was given. **2. Teamwork Skills:** A detailed explanation of how the teacher will facilitate teamwork skills was provided. **3. Group Processing:** A detailed explanation was given as to how the teacher will facilitate group processing in the proposed activity.	Group roles were created for the proposed activity. Each role was described but the purpose of each role was not rationalized. **2. Teamwork Skills:** A brief statement of how the teacher will facilitate teamwork skills was provided. **3. Group Processing:** A brief statement was given as to how the teacher will facilitate group processing in the proposed activity.	Group roles were created for the proposed activity. Each role was described *and rationale for the purpose of each role was given.* **2. Teamwork Skills:** A *detailed explanation* of how the teacher will facilitate teamwork skills was provided. **3. Group Processing:** A *detailed explanation* was given as to how the teacher will facilitate group processing in the proposed activity.
Cooperative Activity Details (1, 16%)	Unacceptable performance is evidenced by none of the following criteria met:	Incomplete performance is evidenced by only 1 of the following criteria met:	Partially proficient performance is evidenced by 2 of the following criteria met:	Proficient performance is evidenced by 3 of the following criteria met: 1. An	Exemplary performance is evidenced by the following criteria met: 1. An

	Does Not Meet Criteria	**Incomplete** (1 pt)	**Partially Proficient** (3 pts)	**Proficient** (4 pts)	**Exemplary** (5 pts)
	1. An explanation of when the cooperative activity will take place (warm-up, wrap-up activity, after a particular). 2. An explanation of where the cooperative activity will take place (classroom, computer lab, playground, other). 3. An explanation of why this choice for a cooperative activity is appropriate (for the age group or topic). 4. An explanation of how the instructor will know that the students have learned the subject matter (rubric, quiz, interview, etc).	1. An explanation of when the cooperative activity will take place (warm-up, wrap-up activity, after a particular lesson). 2. An explanation of where the cooperative activity will take place (classroom, computer lab, playground, other). 3. An explanation of why this choice for a cooperative activity is appropriate (for the age group or topic). 4. An explanation of how the instructor will know that the students have learned the subject matter (rubric, quiz, interview, etc).	1. An explanation of when the cooperative activity will take place (warm-up, wrap-up activity, after a particular lesson). 2. An explanation of where the cooperative activity will take place (classroom, computer lab, playground, other). 3. An explanation of why this choice for a cooperative activity is appropriate (for the age group or topic). 4. An explanation of how the instructor will know that the students have learned the subject matter (rubric, quiz, interview, etc).	explanation of when the cooperative activity will take place (warm-up, wrap-up activity, after a particular lesson). 2. An explanation of where the cooperative activity will take place (classroom, computer lab, playground, other). 3. An explanation of why this choice for a cooperative activity is appropriate (for the age group or topic). 4. An explanation of how the instructor will know that the students have learned the subject matter (rubric, quiz, interview, etc).	explanation of when the cooperative activity will take place (warm-up, wrap-up activity, after a particular lesson). 2. An explanation of where the cooperative activity will take place (classroom, computer lab, playground, other). 3. An explanation of why this choice for a cooperative activity is appropriate (for the age group or topic). 4. An explanation of how the instructor will know that the students have learned the subject matter (rubric, quiz, interview, etc).

	Does Not Meet Criteria	**Incomplete** (1 pt)	**Partially Proficient** (3 pts)	**Proficient** (4 pts)	**Exemplary** (5 pts)
Technology Integration (1, 16%)	Unacceptable performance is evidenced by none of the following criteria met: 1. A description of what type of technology will be integrated into the cooperative lesson. 2. An explanation of when technology will be integrated into the lesson. 3. An explanation where the technology integration will take place. 4. An explanation of why technology is being integrated into the lesson (use at least one of the 5 Es: Engage, Explore, Explain, Elaborate,	Incomplete performance is evidenced by only 1 of the following criteria met: 1. A description of what type of technology will be integrated into the cooperative lesson. 2. An explanation of when technology will be integrated into the lesson. 3. An explanation where the technology integration will take place. 4. An explanation of why technology is being integrated into the lesson (use at least one of the 5 Es: Engage, Explore, Explain, Elaborate, Evaluate).	Partially proficient performance is evidenced by 2 of the following criteria met: 1. A description of what type of technology will be integrated into the cooperative lesson. 2. An explanation of when technology will be integrated into the lesson. 3. An explanation where the technology integration will take place. 4. An explanation of why technology is being integrated into the lesson (use at least one of the 5 Es: Engage, Explore, Explain, Elaborate, Evaluate).	Proficient performance is evidenced by 3 of the following criteria met: 1. A description of what type of technology will be integrated into the cooperative lesson. 2. An explanation of when technology will be integrated into the lesson. 3. An explanation where the technology integration will take place. 4. An explanation of why technology is being integrated into the lesson (use at least one of the 5 Es: Engage, Explore, Explain, Elaborate, Evaluate).	Exemplary performance is evidenced by the following criteria met: 1. A description of what type of technology will be integrated into the cooperative lesson. 2. An explanation of when technology will be integrated into the lesson. 3. An explanation where the technology integration will take place. 4. An explanation of why technology is being integrated into the lesson (use at least one of the 5 Es: Engage, Explore, Explain, Elaborate, Evaluate).

	Does Not Meet Criteria	**Incomplete** (1 pt)	**Partially Proficient** (3 pts)	**Proficient** (4 pts)	**Exemplary** (5 pts)
	Evaluate).				
Participation (1, 16%)	Unacceptable performance is evidenced by no knowledge and research evident from provided readings. Participant's role is not complete due to lacking in the following areas during the group chat or discussion board activity: content, substance, frequency.	Incomplete performance is evidenced by a lack of basic knowledge evident from provided readings. Participant's role is not complete due to lacking in 2 of the following areas during the group chat or discussion board activity: content, substance, or frequency.	Partially Proficient performance is evidenced by basic knowledge evident from provided readings. Participant's role is not complete due to lacking in 1 of the following areas during the group chat or discussion board activity: content, substance, or frequency.	Proficient performance is evidenced by demonstrating knowledge from provided readings. Participant's role is fulfilled by the following criteria shown in the group chat or discussion board activity: content, substance, and frequency.	Exemplary performance is evidenced by demonstrating *knowledge and research* from provided readings. Participant's role is fulfilled by the following criteria shown in the group chat or discussion board activity: content, substance, and frequency.

Appendix E: Quiz Questions and Blueprint

Quiz for Problem-based & Cooperative Learning Module (worth 15 points)

This quiz is to be completed after the Electronic Discussions about Problem Based Learning & Cooperative Learning. Dates of availability are on the Course Schedule. You will have 30 minutes to complete the quiz. You may only attempt the quiz once.

1. Match the following science test questions with their level on the Bloom's Taxonomy of Cognitive Skills. *(worth 1 point)*

a. Define an ecosystem	c. Applying
b. List the different parts of the ecosystem and explain what they do.	d. Analyzing
c. Using a diagram, show how the water cycle operates in an ecosystem.	b. Understanding
d. Differentiate between the natural water cycle and the one used by our community.	a. Remembering

Feedback for Incorrect Answers

To "define an ecosystem" is considered to be at the "Remembering" level of Bloom's Taxonomy because a learner can memorize the definition.

To "list the different parts of the ecosystem and explain what they do", a learner must have general *understanding* of what the different parts are and what they do.

When a learner is asked to use a diagram and "show how the water cycle operates in an ecosystem", they are *applying* the content they have learned.

In order to "differentiate between the natural water cycle and the one used by our community", a learner must *analyze* different types of content.

2. Which is the <u>least effective</u> way of creating a student-centered classroom? *(worth 1 point)*

   a. Giving students a choice on what they want to study.
   b. Designing lessons based on what the teacher thinks is relevant.
   c. Engaging students through games and internet inquiries.
   d. Asking students to work together to create an artifact based on what they've learned.

Feedback for Incorrect

While the teacher's beliefs about the relevance of content are important, a student-centered classroom is one that takes into account what is relevant to the

Answers students.

3. Which of the following are the benefits of cooperative learning? *(worth 1 point)*
   a. Students' levels of achievement increase
   b. Students' communication skills are enhanced
   c. Students are motivated to do better than other students
   d. Both A and B

Feedback for Incorrect Answers Both achievement levels and communication skills have been found to increase after cooperative learning activities. Answer c, "Students are motivated to do better than other students", would be competitive and is not an attribute of cooperative learning.

4. Choose the description that best fits with the associated elements of cooperative learning. *(worth 2 points)*

Match Question Items	Answer Items
e. - a. Promotive Interaction	a. Students need to take the time to reflect on how well they are functioning as a group.
d. - b. Positive Interdependence	b. Students need to practice working with others in order to work effectively in a team.
c. - c. Individual Accountability	c. Students must take personal responsibility for the group's mastery of the material.
b. - d. Teamwork Skills	d. Students must work together to complete the group task; they sink or swim together.
a. - e. Group Processing	e. Active learning through team discussion and peer clarification.

5. Which of the following is the most important element in structuring cooperative learning? *(worth 1 point)*
   a. Scaffolding
   b. Positive interdependence
   c. Social skills
   d. Group Processing

Feedback for Incorrect Answers Positive interdependence is considered the most important element of cooperative learning because without positive interdependence (where students have the same goals for learning/completing a task), students could not rely on one another and may choose to work alone.

6. Why are positive interdependence and individual accountability necessary for successful cooperative learning? *(worth 1 point)*
    a. Because they both require students to work together harmoniously.
    b. Because they both require students to actively compete against other teams.
    c. Because they require individuals to rely on others while being responsible for their own share of the work.
    d. Because they allow students to learn valuable social skills necessary for the working world.

7. What is the main difference between cooperative and collaborative learning? *(worth 1 point)*
    a. Cooperative learning is meant for completing projects while collaborative learning is meant for debates.
    b. Cooperative learning is more structured, including assigning specific roles, while collaborative learning is less structured.
    c. Collaborative learning is more structured, including assigning specific roles, while cooperative learning is less structured.
    d. Collaborative learning is meant for completing projects while cooperative learning is meant for debates.

I Feedback for Incorrect Answers Cooperative learning includes using assigned roles and is therefore more structured. Collaborative learning activities do not rely on assigned roles, but instead expect groups to negotiation the solution to a task together (without splitting up tasks).

8. Mr. Jones' 6th grade class will be learning about the Civil War. At the beginning of the learning unit he creates a cooperative learning activity in which students will write a front page headline and article based on a major event in the Civil War. Students can choose whether they will write from the perspective of the Northern or Southern states. Students are divided into small groups of four and assigned the roles of Leader, Checker, Writer and

Prober. The roles are explained in detail and students are given guidance on how to work in a group. Students work together for a week and seem to enjoy the activity, but the project results do not reflect that they have learned anything above the knowledge of some basic facts. *(worth 1 point)*

What do you think happened?

a. Students were not assigned the right roles and were not shown how to work together.
b. Students were not required to be positively interdependent and individually accountable.
c. Students were not taught teamwork skills.
d. Student learning was not scaffolded with resources and expectations.

Feedback for Incorrect Answers	Students were assigned roles, and the evidence does not show that they were assigned the wrong roles. The assigning of roles shows that the students were required to be positively interdependent and individually accountable. Additionally, students were given guidance on how to work in a group. Therefore, the likely problem is that students were not given appropriate scaffolding of what was expected of them and how to find resources.

9. Which of the following best describes the attributes of project-based learning? *(worth 1 point)*
   a. The project is central to the lesson, highlights basic foundational knowledge, and forces students to learn.
   b. The project is not central to the lesson but encourages collaboration and product development.
   c. The project is not central to the lesson but requires technology integration and collaboration.
   d. The project is central to the lesson, recognizes students drive to learn, and encourages authentic inquiry.

10. Your 5th grade science class is learning about the food chain, and you feel that this would be an excellent place to create a group project. However, up until now you have not assigned any group work, and are unsure how your students will react. You create lab groups of 4 students each and have the students move their desks together as each student takes notes about 3 assigned animals that include the animal's habitat, prey, food, and enemies. After gathering the data, each student will then identify each organism as a producer, consumer, carnivore, herbivore, or omnivore. The student will also need to identify where the organism

is on the food pyramid. Individual students have resources from the library and websites that are bookmarked for this project. In addition, a rubric will be provided for grading, so each student can make sure he or she is including all important content in his/her project. You set aside 30 minutes every other day for students to move their desks into a group formation. Students may also work on the project during free time. When everyone in the group is finished, each student will hand in their project separately. *(worth 5 points)*

a. Given the information provided, which elements of cooperative learning and project-based learning are present? *Type "yes" if the element is present, "no" if the element is not present.*

   Promotive interaction **[no]**
   Positive Role Interdependence (e.g. assigned roles) **[no]**
   Building Teamwork Skills **[no]**
   Group Processing (reflecting on how the group is doing) **[no]**

b. Given the elements that are present and missing for CL and PBL, determine whether this lesson will be a success as a cooperative, project-based activity. *HINT: Are the most important elements for CL and PBL present?*

   Do you think this lesson will be a success as a cooperative, project-based activity? *Type "yes" or "no"* **[no]**

Feedback for Incorrect Answers

- Promotive interaction is not evident because, although students are working in the same area, they are really working independently. Students are not encouraged to share resources or help one another.
- Positive Role Interdependence is not evident because students are not assigned specific roles in the groups. Furthermore, students are mostly working on the project by themselves, and are not working on particular sections that will then be combined with other group members' work.
- Additionally, there is no evidence that teamwork skills are being taught.
- Group processing is not evident because group members are not encouraged to reflect on how well they are working together.
- Although students are sitting in the same grouping of desks, they are generally working on their own. Therefore, this activity cannot be considered a cooperative project.

Blueprint for Quiz and Group Project

Note: This blueprint utilizes the Cognitive Process Dimension of Krathwohl's revised version of Bloom's Taxonomy (Krathwohl, 2002) and does not take the Knowledge Dimension into account.

Terminal Learning Objectives	*Enabling Learning Objectives*	*Remembering*	*Understanding*	*Applying*	*Analyzing*	*Evaluating*	*Creating*
Given resources on student-centered learning, identify effective ways to create a student-centered classroom.	ELO – Identify effective and ineffective ways to create a student-centered classroom.		X Which is the <u>least effective</u> way of creating a student-centered classroom?				
TLO 1: Given resources on cooperative learning, identify the key elements and identify contexts in which cooperative learning is most appropriate.	ELO 1.1 – Define cooperative learning (Identify the basic elements of cooperative learning, as described by theorists such as Johnson & Johnson)		X Matching question X Which of the following is the most important element in structuring cooperative learning? X Why are positive interdependence and individual accountability necessary for successful				

			cooperative learning?				
	Identify potential benefits of cooperative learning	X Which of the following are the benefits of cooperative learning?					
	Differentiate between cooperative and collaborative learning		X What is the main difference between cooperative and collaborative learning?				
	Distinguish between the different levels of Bloom's Taxonomy		X Matching question				
	Identify ways in which scaffolding will benefit student learning		X Civil War question				
	ELO 1.2 – Define project-based learning (Identify the basic elements of project-based learning)		X Which of the following best describes the attributes of project-based learning?				

	Identify how Learning Styles may play a part in cooperative and project-based learning.						
TLO 2: Given resources on cooperative learning and project-based learning, student groups will create a lesson plan summary utilizing the basic elements of cooperative learning, project-based learning and technology integration. (Basic elements include grouping strategies, duration of project, roles given to group members, driving question or problem)	ELO 2.1 – Identify ways that technology can be integrated into cooperative and project-based learning.			X			
	ELO 2.2 – Evaluate their chosen subject matter for content that can be successfully learned via cooperative and project-based learning			X		X	
	ELO 2.3 – Construct a lesson plan summary that utilizes CL and Pbl concepts such as grouping strategies, duration of project, specific Pbl techniques used, group member roles, driving questions, and assessment plan						X
	ELO 2.4 - Reflect on and defend choices based on information gathered by student					X	
	ELO 3.1 – Describe why a cooperative learning approach is appropriate for the				X	X	X

	chosen subject matter (on the 5W/5E lesson template).						

Appendix F: Experimental Instruments

Value of Collaboration Instrument

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
1	2	3	4	5

1. I value a feeling of connectedness to others in my classes.
2. If given the choice I would prefer to work with others to solve complex problems.
3. I have the potential to achieve more academically by collaborating with others.

Process Satisfaction (Green & Tabor, 1980)

How would you describe your group's problem-solving process?

1.	Inefficient				Efficient
	1	2	3	4	5
2.	Uncoordinated				Coordinated
	1	2	3	4	5
3.	Unfair				Fair
	1	2	3	4	5
4.	Confusing				Understandable
	1	2	3	4	5
5.	Unsatisfying				Satisfying
	1	2	3	4	5

Solution Satisfaction (Green & Tabor, 1980)

1. How satisfied or dissatisfied were you with the quality of your group's solutions?

Very Dissatisfied				Very Satisfied
1	2	3	4	5

The following questions use this response scale:

Not at all	Little extent	Some extent	Great extent	Very Great extent
1	2	3	4	5

2. To what extent do you feel personally responsible for the correctness of the group's solutions?
3. To what extent does the group's final solution reflect your inputs?
4. To what extent are you confident that the group's solutions are correct?
5. To what extent do you feel committed to the group's solution?

Community of Inquiry Survey Instrument

Developed by Ben Arbaugh, Marti Cleveland-Innes, Sebastian Diaz, Randy Garrison, Phil Ice, Jennifer Richardson, Peter Shea & Karen Swan

Adapted for cooperative/collaborative group project

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

Teaching Presence

Design & Organization

1. The instructor clearly communicated important module and project topics.

2. The instructor clearly communicated important module and group goals.

3. The instructor provided clear instructions on how to participate in module learning activities.

4. The instructor clearly communicated important due dates/time frames for module learning activities.

Facilitation

5. The instructor was helpful in identifying areas of agreement and disagreement on module topics that helped me to learn.

6. The instructor was helpful in guiding the group towards understanding module topics in a way that helped me clarify my thinking.

7. The instructor helped to keep group members engaged and participating in productive dialogue.

8. The instructor helped keep the group members on task in a way that helped me to learn.

9. The instructor encouraged group members to explore new concepts in this module.

10. Instructor actions reinforced the development of a sense of community among group members.

Direct Instruction

11. The instructor helped to focus discussion on relevant issues in a way that helped me to learn.

12. The instructor provided feedback that helped me understand my strengths and weaknesses.

13. The instructor provided feedback in a timely fashion.

Social Presence

Affective expression

14. Getting to know other group members gave me a sense of belonging in the course.

15. I was able to form distinct impressions of some group members.

16. Online or web-based communication is an excellent medium for social interaction.

Open communication

17. I felt comfortable conversing through the online medium.

18. I felt comfortable participating in the group discussions.

19. I felt comfortable interacting with other group members.

Group cohesion

20. I felt comfortable disagreeing with other group members while still maintaining a sense of trust.

21. I felt that my point of view was acknowledged by other group members.

22. Online discussions help me to develop a sense of collaboration.

Cognitive Presence

Triggering event

23. The problem posed increased my interest in course issues.

24. Module activities piqued my curiosity.

25. I felt motivated to explore content related questions.

Exploration

26. I utilized a variety of information sources to explore problems posed in this module.

27. Brainstorming and finding relevant information helped me resolve content related questions.

28. Online discussions were valuable in helping me appreciate different perspectives.

Integration

29. Combining new information helped me answer questions raised in the module group activity.

30. The group learning activity helped me construct explanations/solutions.

31. Reflection on the content and discussions helped me understand fundamental concepts in this module.

Resolution

32. I can describe ways to test and apply the knowledge created in this module.

33. I have developed solutions to module problems that can be applied in practice.

34. I can apply the knowledge created in this module to my work or other non-class related activities.

Student Perceptions of Group Structure

1. Did each of your group members take on a specific role or task in this activity?
   - Yes
   - No

2. Was your group more likely to work on the whole project together or divide the work up among individual group members?
   - More likely to work on the whole project together
   - More likely to divide the work up among member

Appendix G: Pre-treatment and Post-treatment Surveys

Pre-Treatment Survey

Demographic Information

Thank you for taking the time to participate in this survey. Your responses will help us in our continuing research, which will lead to more effective teaching/learning strategies in this course.

All of your responses are kept confidential. Your demographic information will only be used for matching survey responses. **Your instructor will not have access to any specific answers you provide on this survey.**

Thank you,
Christine Nickel
Instructional Design & Technology

First Name **Middle Initial** **Last Name**

School Email Address

Age

- ○ 20 or under
- ○ 21 to 25
- ○ 26 to 30
- ○ 31 to 35
- ○ 36 to 40
- ○ 41 to 50
- ○ 51 or over

Gender

- ○ Female
- ○ Male

Ethnic Background

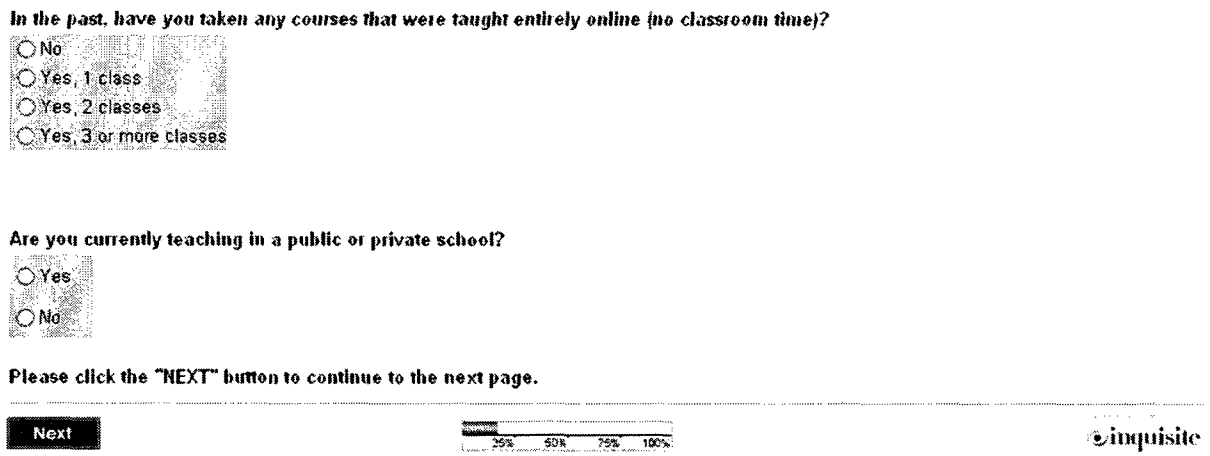
- ○ Black, not Hispanic
- ○ Hispanic
- ○ American Indian / Alaskan Native
- ○ Asian, Pacific Islanders
- ○ White, not Hispanic
- ○ Other
- ○ I choose not to answer this question

Academic Level

Instructor

Course Delivery Method

- ○ The entire course is online
- ○ The course includes traditional classroom sessions



Survey branch question (this question is for those who chose "Yes" to the question "Are you currently teaching in a public or private school?")

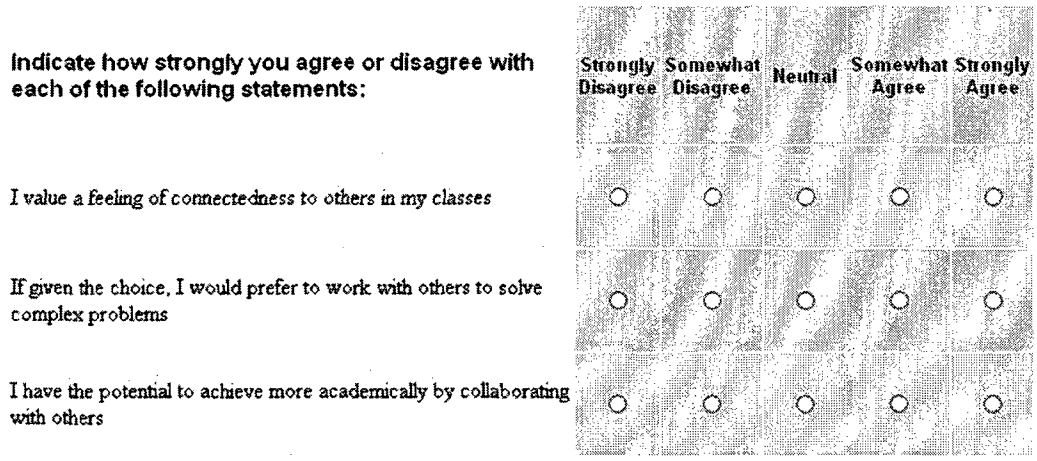
In what type of school do you currently teach?

- Urban
- Suburban
- Rural

This survey continues on the next page.

Please click "next" below

Please answer the following three questions with regard to <u>your classes in general:</u>



Please click "finish" below

Back Finish

25% 50% 75% 100%

Post-Treatment Survey

This is the second portion of the survey that you completed at the beginning of this course.

All of your responses are kept confidential. Your demographic information will only be used for matching survey responses. **Your instructor will not have access to any specific answers you provide on this survey.**

Thank you,
Chris Nickel
Instructional Design & Technology
cnick003@odu.edu

Demographic Information

First Name | Middle Initial | Last Name

Email Address

Instructor

Course Delivery Method

- ○ The entire course is online
- ○ The course includes traditional clasroom sessions

Please answer the following three questions with regard to <u>your classes in general:</u>

Indicate how strongly you agree or disagree with each of the following statements:	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree
I value a feeling of connectedness to others in my classes	○	○	○	○	○
If given the choice, I would prefer to work with others to solve complex problems	○	○	○	○	○
I have the potential to achieve more academically by collaborating with others	○	○	○	○	○

Process Satisfaction (Green & Tabor, 1980)

How would you describe your group's problem-solving process?

1.	Inefficient 1	2	3	4	Efficient 5
2.	Uncoordinated 1	2	3	4	Coordinated 5
3.	Unfair 1	2	3	4	Fair 5
4.	Confusing 1	2	3	4	Understandable 5
5.	Unsatisfying 1	2	3	4	Satisfying 5

Solution Satisfaction (Green & Tabor, 1980)

1. How satisfied or dissatisfied were you with the quality of your group's solutions?

Very Dissatisfied	Somewhat Dissatisfied	Neutral	Somewhat Satisfied	Very Satisfied
1	2	3	4	5

2. To what extent do you feel personally responsible for the correctness of the group's solutions?

Not at all	Little extent	Some extent	Great extent	Very Great extent
1	2	3	4	5

3. To what extent does the group's final solution reflect your inputs?

Not at all	Little extent	Some extent	Great extent	Very Great extent
1	2	3	4	5

4. To what extent are you confident that the group's solutions are correct?

Not at all	Little extent	Some extent	Great extent	Very Great extent
1	2	3	4	5

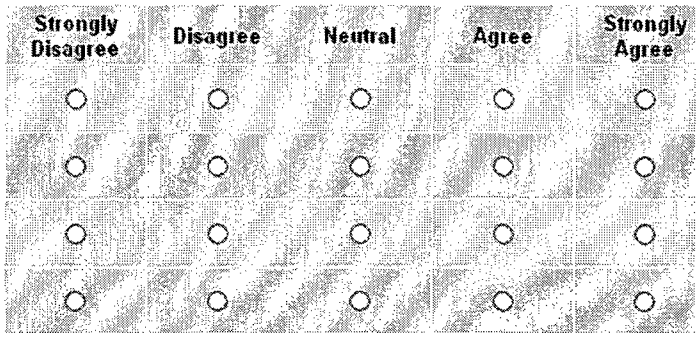
5. To what extent do you feel committed to the group's solution?

Not at all	Little extent	Some extent	Great extent	Very Great extent

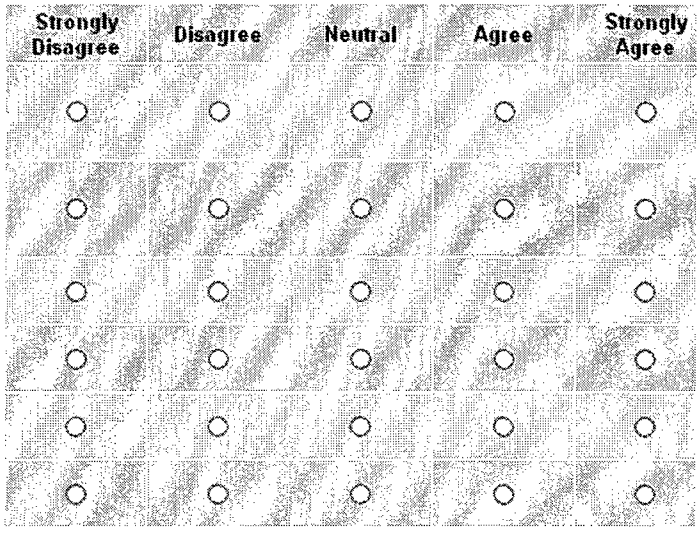
1	2	3	4	5

Community of Inquiry Survey Instrument

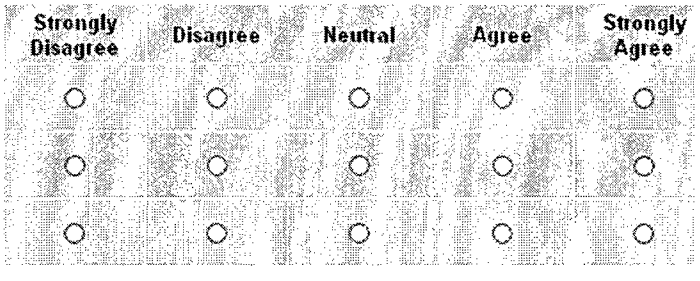
Answer the following questions in regard to your **instructor's actions** during the ***PBL/Cooperative Learning Project.***



1. The instructor clearly communicated important module and project topics.
2. The instructor clearly communicated important module and group goals.
3. The instructor provided clear instructions on how to participate in module learning activities.
4. The instructor clearly communicated important due dates/time frames for module learning activities.

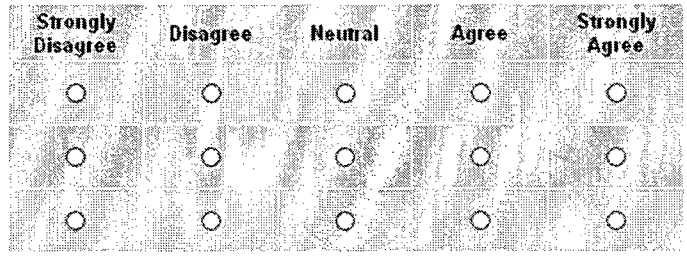


5. The instructor was helpful in identifying areas of agreement and disagreement on module topics that helped me to learn.
6. The instructor was helpful in guiding the group towards understanding module topics in a way that helped me clarify my thinking.
7. The instructor helped to keep group members engaged and participating in productive dialogue.
8. The instructor helped keep the group members on task in a way that helped me to learn.
9. The instructor encouraged group members to explore new concepts in this module.
10. Instructor actions reinforced the development of a sense of community among group members.

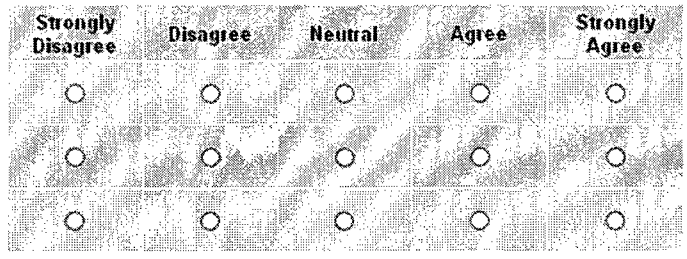


11. The instructor helped to focus discussion on relevant issues in a way that helped me to learn.
12. The instructor provided feedback that helped me understand my strengths and weaknesses.
13. The instructor provided feedback in a timely fashion.

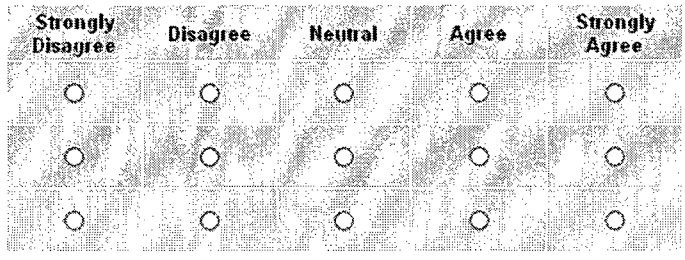
Answering the following questions in regard to your **small group members** during the ***PBL/Cooperative Learning Project.***



14. Getting to know other group members gave me a sense of belonging in the course.
15. I was able to form distinct impressions of some group members.
16. Online or web-based communication is an excellent medium for social interaction.



17. I felt comfortable conversing through the online medium.
18. I felt comfortable participating in the group discussions.
19. I felt comfortable interacting with other group members.



20. I felt comfortable disagreeing with other group members while still maintaining a sense of trust.
21. I felt that my point of view was acknowledged by other group members.
22. Online discussions help me to develop a sense of collaboration.

Please click the "NEXT" button to continue to the next page.

Answering the following questions in regard to **your own learning** during the ***PBL/Cooperative Learning Project.***

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
23. The problem posed increased my interest in course issues.	○	○	○	○	○
24. Module activities piqued my curiosity.	○	○	○	○	○
25. I felt motivated to explore content related questions.	○	○	○	○	○

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
26. I utilized a variety of information sources to explore problems posed in this module.	○	○	○	○	○
27. Brainstorming and finding relevant information helped me resolve content related questions.	○	○	○	○	○
28. Online discussions were valuable in helping me appreciate different perspectives.	○	○	○	○	○

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
29. Combining new information helped me answer questions raised in the module group activity	○	○	○	○	○
30. The group learning activity helped me construct explanations/solutions.	○	○	○	○	○
31. Reflection on the content and discussions helped me understand fundamental concepts in this module.	○	○	○	○	○

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
32. I can describe ways to test and apply the knowledge created in this module.	○	○	○	○	○
33. I have developed solutions to module problems that can be applied in practice.	○	○	○	○	○
34. I can apply the knowledge created in this module to my work or other non-class related activities.	○	○	○	○	○

Student Perceptions of Group Structure

1. Did each of your group members take on a specific role or task in this activity?
   - Yes
   - No

2. Was your group more likely to work on the whole project together or divide the work up among individual group members?
   - More likely to work on the whole project together
   - More likely to divide the work up among member

Appendix H: Course Syllabus and Schedule

ECI 430/530
PK-12 Instructional Technology

COURSE GOALS AND OBJECTIVES:

This course will prepare students to use current technology for classroom management and content-area instruction, in accordance with Commonwealth of Virginia instructional technology mandates. Major emphasis will be placed on using technology to support instruction supporting the achievement goals of the Virginia Standards of Learning. The integration of technology into instruction is based on contemporary learning theories.

Research shows that the use of technology benefits educators from the standpoints of managerial chores and more effective teaching strategies. The purpose of this class is to provide in-service educators with foundational information primarily on productivity computer use in instructional settings based on the (a) Virginia Department of Education's Six Year Educational Technology Plan, (b) the Virginia Standards of Learning (SOL), (c) the Standards of Technology for Instructional Personnel (TSIP), (d) ISTE Nets-T standards, and (e) current research. The course focus is two-fold. The first is to develop a personal model of learning grounded in contemporary learning theory, cognitive models and instructional design. The second is to develop computer application skills including (a) learning and utilizing integrated software including word processing, spreadsheets, draw, paint, and presentations applications, and (c) global communications.

Upon completion, students will possess adequate technological skills and a conceptual foundation that supports (a) continued life-long professional development, (b) potential technological leadership among peers, (c) appreciation of the research and (d) new instructional technology perspectives.

Objectives: Upon successful completion of this course, students should be able to:

Assignment Product	ISTE (NETS-T)	TSIP	Competencies
Technology Portfolio (Technology Knowledge), Digital Media	I-A	A, B	Students demonstrate a sound understanding of the nature and operation of technology systems. List and define important terms used in computer technology.
Technology Portfolio (Technology Discussions), Webquest	VI- A, B, C, D	H	Students understand the social, ethical, legal, and human issues surrounding the use of technology in PK-12 schools and apply those principles in practice. Teachers: model and teach legal and ethical practice related to technology use. apply technology resources to enable and empower learners with diverse backgrounds, characteristics, and abilities. identify and use technology resources that affirm diversity promote safe and healthy use of technology resources.
Technology Portfolio (Technology Integration), Digital Media, Software Tools, Webquest	III-A, B, C, D	C, E, F, G	Students demonstrate methods and strategies for applying technology to maximize student learning. facilitate technology-enhanced experiences that address content standards and student technology standards. use technology to support learner-centered strategies that address the diverse needs of students. apply technology to develop students' higher order skills and creativity. manage student learning in a technology-enhanced environment.
Technology Portfolio (Technology Discussions), Webquest, Software Tools	V-D	D	Students use technology to communicate and collaborate with peers and develop ideas to communicate and collaborate with parents and the larger community in order to nurture student learning.

Webquest, Software Tools, Digital Media	II- A, B, C, D	C, E, F, G, H	Students plan and design effective learning environments and experiences supported by technology. Students: design developmentally appropriate learning opportunities that apply technology-enhanced instructional strategies to support the diverse needs of learners. apply current research on teaching and learning with technology when planning learning environments and experiences. identify and locate technology resources and evaluate them for accuracy and suitability. plan for the management of technology resources within the context of learning activities.
Literature Review-GRADUATE Coursework	I- B		Create documents conforming to APA style and format guidelines. (ECI 530)

Instructional Approach:
One of the unique features of this course is the project-based approach. A project-based environment is student-driven and fosters flexibility and meaningful content due to self-selection of certain aspects of the major projects.

Discussion Board (threaded discussion):
This is located in Blackboard's Communication area. Each threaded discussion is called a forum. Only the instructor can create forums, but students may reply to any forum posted. Typically, each project will have its own Discussion Forum. With some projects, students will post observations and critiques to readings, in other projects students will attach documents for critiquing by other students and the instructor. Carefully read each project for directions about how to use the discussion board.

Collaboration (Chat)
Again, located in Blackboard's Communication area, this tool is called Collaboration. Chat is a synchronous (real time) tool. Blackboard also has a "Group" area where only those members of the group may gain access (and the instructor of course). Each chat session will have clear directions for topics to be discussed and "roles" for everyone involved. One thing to always double check, you MUST turn on the chat archive when the chat begins to have a record for the instructor – don't forget! There is an excellent Blackboard tutorial for students on the CLT website.

Instructor Responsibilities:
It is the instructor's responsibility to help students grow and learn. This means that the instructor will try to provide clear instructions for all projects, answer questions about the

assignments, identify additional resources if necessary, provide review questions and study guides for assessments, and provide rubrics and other criteria for evaluation of projects. This is never a "static" course - referenced readings, software versions and hardware specifications can change quickly. In this environment, the instructor is always evaluating, revising and clarifying questions and problems.

Student Responsibilities:

This course will have several "threads" of work occurring simultaneously, therefore it is imperative that students enrolled in this course continually monitor their learning, evaluating their own efforts, and actively seek help when needed in a timely manner. Students should participate, turn in assignments on time, and adhere to the honor code of ODU. To successfully complete ECI 430/530, you will need to assume an active role in the learning process.

Course Pre-requisites

Completion of a general education technology course (OTS 251D suggested) as outlined by the university or equivalent. All students should have functional competency using productivity software (generic applications used in any discipline/grade level [Word, Excel, PowerPoint, Inspiration]) and file management (ability to save, move and copy files to various locations). Students should also be comfortable using the Internet and with the basic operation of the PC including installing software and browser plug-ins.

Course Requirements

Graduate Students will be asked to complete research on a relevant topic using current literature dealing with Instructional Technology. Students must support their ideas with a minimum of **three** literature sources. Sources may include ERIC documents, Internet articles, personal observations and experiences, newspaper and magazine articles, and interviews. Include a variety of sources in your references.

Computer Literacy:

The Computer Literacy Survey will help you assess your computer literacy skills. If more than half your replies are in the "basic" column in any part you will need extra help when we use that tool. You may find the following tutorials helpful.
Microsoft Office Online Tutorials
Office 2007 Tutorials

The following software is ***required*** for this course:
Purchase and register LIVETEXT (The purchase and/or use of LiveText (Approved Web-based Portfolio Assessment system) is required for this course.) from the Livetext website (**http://c1.livetext.com**). If you have to use financial aid you will need to purchase LiveText Subscription through the ODU Bookstore. When the bookstore sends you your LiveText, they are sending you a code. You need to purchase this as your "textbook".

Make sure you do the following:

- Proceed to the website provided with your purchase and register your account with ODU and create your username. Make sure it is something you will not forget.
  - Please use your official first and last name that matches ODU and your UIN when completing the registration.
  - You DO NOT need the subscription with DE/Unitedstreaming- just the 3 year student subscription
- Microsoft Office (version 2003 or later; with Excel, Word, and PowerPoint. contact Inspiration (see Software Tools assignment for free trial download info, don't attempt to download too early – it is only a 30 day download.)
- Adobe Acrobat Reader (http://www.adobe.com/products/acrobat/readstep.html
- You will be using Windows Movie Maker and Microsoft Paint. These normally come with your Windows or Mac Operating System.

Course Projects

Projects will be submitted in LiveText and/or Blackboard either through the appropriate assignments link or in the discussion board. Students are expected to verify their own Blackboard and LiveText assignments by returning to the appropriate place in Blackboard or LiveText after the work has been submitted to check. Students should be able to see their work submitted, and verify the file's integrity by opening the document.

Class Schedule/Due Dates: Students will complete the following projects by the specified due dates* found in the class's Blackboard section. See Course Materials – Course Schedule document with mandatory class dates and due dates of projects.

Specific requirements for each project are spelled out in the project section of the course content found in Blackboard.

Topic	Estimated Time
First Things First	3-4 hours
LiveText	3-5 hours
Technology Knowledge and Integration into Teaching and Learning	9-12 hours
Digital Media	12-15 hours
Project-Based Learning Cooperative Learning	9-12 hours
Software Tools: Templates, Presentation, Concept Mapping & Spreadsheet	12-15 hours
The Internet	9-12 hours

WebQuest	30-40 hours
Portfolios	2-3 hours
Literature Review Paper (For GRADUATE Students ONLY who registered for ECI 530)	5-10 hours

Grading Criteria:
Project Grading: Each project is worth a specified amount of points. There are no weights on the Project grades. To compute your "grade" for a project or your final grade take the total points earned / total possible points. Then match the percentage to the scale below. Pluses and minuses are given at the discretion of the instructor for undergraduate.

Undergraduate Grading Scale-

90–100	A
80-89	B
70-79	C
60-69	D
59 & below	F

Graduate Grading Scale-

94–100	A
92-93	A-
90-91	B+
83-89	B
81-82	B-
79-80	C+
72-78	C
70-71	C-
68 & below	F

COURSE POLICIES

Students with Special Needs

In compliance with PL94-142 and more recent federal legislation affirming the rights of disabled individuals, provisions will be made for students with special needs on an individual basis. The student must have been identified, as "special needs" by the university and an appropriate letter(s) must be provided to the course instructor. Provision will be made based upon written guidelines from the university "special needs students" resource office. All students are expected to fulfill all course requirements.

Honor Pledge:

"I pledge to support the honor system of Old Dominion University. I will refrain from any form of academic dishonesty or deception, such as cheating or plagiarism. I am aware that as a member of the academic community, it is my responsibility to turn in all suspected violators of the honor system. I will report to Honor Council hearings if summoned."

By attending Old Dominion University you have accepted the responsibility to abide by this code. This is an institutional policy approved by the Board of Visitors.

Old Dominion University Library copyright/plagiarism site

Plagiarism:
No plagiarism will be tolerated under any circumstances. As faculty, I am bound to report any instances of plagiarism. All cases are heard before the honor council. If found guilty, the student automatically receives a failing grade in the course, and a notice is entered into the permanent record for a period of time

Late Work Policy:

Projects and discussions are due on specific dates (this is NOT a correspondence course to be completed when convenient). 10% per day of the total points available are deducted from a student's project grade when it is received after the specified due date and time Work will not be accepted more than 3 days late without a doctor's note or prior approval of the instructor. Students who are unable to complete the work during the semester are eligible for an Incomplete only if the reason fits the University's guidelines for an incomplete. If an Incomplete is granted, it will automatically convert to the grade of F if the work is not completed by the end of the following semester (summer excluded).

Withdrawal Policy:

A syllabus is a contract between the student and the course instructor. Participation in this course indicates that you accept its teaching focus, requirements, and policies. Please review the syllabus and the course requirements as soon as possible. If you believe that the nature of this course does not meet your interests, needs or expectations; if you are not prepared for the amount of work involved; submitting the projects by the due dates for projects, or following the course policies will create unacceptable problems or hardships for you, you should drop the class by the drop/add deadline which is located in the ODU Schedule of Classes.

Course Disclaimer:

Every attempt is made to provide a syllabus that is complete and that provides an accurate overview of the courses. However, circumstances and events may make it necessary for the instructor to modify the syllabus during the semester. This may depend, in part, on the progress, needs, and experiences of the students.

Appendix I: Curriculum Vitae

Christine E. Nickel
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Norfolk, VA 23505
(757) 377-4255
Email: cnickel@regent.edu

EDUCATION

Ph.D. (Instructional Design & Technology)
2010 Old Dominion University Norfolk, VA

M.S. Ed. (Instructional Design & Technology)
2005 Old Dominion University Norfolk, VA
- Summa Cum Laude

B.S. (Communications Media)
1993 SUNY College at Fredonia Fredonia, NY
- Summa Cum Laude

PROFESSIONAL EXPERIENCE (INSTRUCTIONAL DESIGN)

2008 - Present Center for Teaching & Learning Virginia Beach, VA
Regent University
Instructional Designer

- Develop and teach faculty workshops related to integrating technology and pedagogy
  - Courses include Cooperative & Collaborative Learning, Experiential Learning, Content Analysis, Wikis in the University, SACS accreditation report seminar, iTunes University, Learning Theories, and Teaching, Learning & Technology. Courses were developed and implemented using Blackboard and/or Wimba Live Classroom.
  - Co-designed and taught a seminar on Experiential Learning that was featured on the *Wimba Live Classroom Distinguished Lecture Series.* One hundred twenty-eight people participated from the U.S., United Kingdom, and Singapore.
- Work with faculty to analyze course content, objectives and assignments in preparation for transfer to an engaging, learner-centered online course environment
- Consult faculty on pedagogical issues related to online learning
- Assisted writing and editing compliance reports for SACS re-accreditation
- Promote Center for Teaching and Learning activities via the monthly e-newsletter

2004 - 2007 Center for Learning Technologies Norfolk, VA
Old Dominion University
Instructional Designers' Assistant/Graduate Assistant

- Navy Course Design and Development - Co-designed and developed a 40 hour cultural competency course for the U.S. Navy. Analyzed and re-wrote learning objectives;

worked with subject matter experts on content development; co-developed instructor guide, student guide and classroom presentations; assessed pilot course and redesigned course elements; re-designed content for online course.

- Online course development - Analyzed traditional course content, objectives and assignments in preparation for transfer to a fully online course; Rewrote learning objectives as needed; Evaluated proposed course activities for level of learning (using Bloom's Taxonomy) and made recommendations for improvement; worked with subject matter expert on organization and presentation of content
- Online orientation development - Assisted in developing online orientation web sites for faculty and students; included planning, researching and writing web page content
- Curriculum Map Developer - Researched and organized content for a potential curriculum mapping project

2004 - 2006 Old Dominion University Norfolk, VA

Graduate Assistant (Education Curriculum and Instruction)

- Assist professors and students in school computer lab. Instructed students on the use of various software and helped to maintain department website.
- Helped organize, develop and promote the new Ph.D. in Education.

Co-Teacher/Teacher's Assistant

- Co-taught a graduate level Education/Digital Media course.
- Developed syllabus and instructional materials, taught about the principles of graphic design, demonstrated various software programs, evaluated student performances, evaluated content and activities at the end of course for future improvement.

Graduate Assistant (Education Leadership and Counseling)

- Assisted professor with graduate level course provided via distance education, communicated with students, updated Blackboard learning management system for course.
- Created electronic newsletters, assisted in updating program website.

2001-2004 Empire State College New York

Evaluator

- Evaluated student projects and experience (in regards to communications, broadcasting, computer graphics and web development) for college credit.

2003 Old Dominion University Norfolk, VA

Graduate Assistant (Military Career Transition Program)

- Corrected quizzes, kept track of grades and communicated with over 100 students.

PUBLICATIONS

SCHOLARLY ARTICLES:

Duggan, M. H., Adcock, A. B., Nelson, E., & **Nickel, C.** (2007). Creating a web-based environment to enhance helping skills. *Human Service Education, 26*(1), 82-98.

Adcock, A.B., Duggan, M. Nelson, E. & **Nickel, C.** (2007). Teaching effective helping skills at a distance: The development of Project CATHIE. *Quarterly Review Of Distance Education, Winter* 7(4), 349-360.

TECHNICAL REPORTS:

Nickel, C. (2010). RU Global Roundtable 2010: Survey and focus group report. Regent University

Nickel, C. (2009). RU Global Roundtable 2009: Survey and focus group report. Regent University

Nickel, C. (2008). A Blackboard Makeover for Models of Biblical Discipleship. Available online at http://www.regent.edu/admin/ctl/newsletter/2008/special_edition4.htm

PRESENTATIONS

Overbaugh, R. & **Nickel, C.** (2010, May). A comparison of student satisfaction and value of academic community between blended and online sections of a university-level educational foundations course. Presented at the Annual Conference of the American Educational Research Association, Denver, CO.

Nickel, C. (2010, February). The effects of cooperative and collaborative strategies on student achievement and satisfaction in blended and online environments. Presented at the Annual Conference of the Eastern Educational Research Association, Savannah, GA.

Nickel, C. & Nickel, R. (2009, June). Promoting critical thinking through student- created podcasts/vodcasts. Presented at the Sloan-C International Symposium on Emerging Technology Applications for Online Learning, San Francisco, California.

Nickel, C. & Nickel R. (2007, November). Saturday Morning Art Classes: Examples from a short-term field experience & results of a study of pre-service teacher self-efficacy & collaboration. Presented at the annual conference of the Virginia Art Education Association, Williamsburg, Virginia.

Cooley, N., Ehrmann, S, **Nickel, C.,** & Overbaugh, R. (2007, February). Scholarship in the Net Generation: Teaching/learning models, pitfalls, and response. Presented at the 36th annual Conference of Southern Graduate Schools: Building Bridges to the Ne(x)t Generation, Chattanooga, Tennessee.

Nickel, C. E. & Nickel, R. (2007, February). Self-efficacy and sense of community of preservice art teachers involved in a collaborative authentic teaching experience. Presented at the Annual Conference of the Eastern Educational Research Association, Clearwater Beach, Florida.

Overbaugh, R. C., & **Nickel, C. E.** (2007, February). Examining relationships and predictions of student satisfaction in a university-level educational foundations course. Presented at the Annual Conference of the Eastern Educational Research Association, Clearwater Beach, Florida.

Overbaugh, R.C., **Nickel, C.E.** & Brown, H.M. (2006, February). Student characteristics in a

university-level foundations course: An examination of orientation toward learning and the role of academic community. Paper presented at the Eastern Educational Research Association Annual Conference, Hilton Head, SC.

NATIONAL & INTERNATIONAL WEBINARS

Nickel, C. (2009, March). *Wimba Live Classroom Brown Bag Seminar Series.*

Fitkin, R. & Nickel, C. (2008, July). Experiential Learning. *Wimba Live Classroom Distinguished Lecture Series.*

OTHER PROFESSIONAL EXPERIENCE

2002-2003 Academic Television Services Norfolk, VA
Old Dominion University

Media Specialist

- Ran the control room for individual classes broadcast live to community colleges and military sites across the United States. Position required simultaneous operation of video switcher, audio board, camera control unit, video tape recorders, and character generator.

2001-2002 Dutton's Valley Gallery Valley City, ND

Photographer's Assistant/Graphic Designer

- Created and manipulated images using Photoshop and related applications; Designed promotional posters for photographer's products; Maintained company website.

1993-2001 WOKR-TV (Now WHAM-TV) Rochester, NY

Director, Technical Director, Chyron Supervisor, Editor

- Weekend and Fill-in Director: Created OTS and pre-production graphics, Worked with producer to script newscasts, Directed and "switched" newscasts
- Chyron Supervisor: Responsibilities included managing Chyron fonts and directories, creating templates and making full-screen graphics for on-air newscasts and special events, and training Chyron operators
- AVID editor: Edited commercials, Created segments for award-winning community affairs program
- Other experience: Videotape Editor, Camera Operator, Production Grip

1994-1995 Post Central Rochester, NY

Videotape Duplicator

- Duplicated commercials using D2, Digital Beta, DVC Pro, 8mm, Beta, 1-inch, and NTSC and PAL 1/2-inch videotape
- Tended to clients' needs, answered phones and helped organize project paperwork and tapes

1993-1994 WXXI-TV Rochester, NY

Broadcast Engineer

- Master Control Operator: Supervised On-Air Quality, Managed On-Air Log, Inserted

commercial slides and audio tags

- Videotape Operator; Camera Iris Control Operator; Audio Operator

AWARDS RECEIVED

Group Awards:

- Edward R. Murrow Award - Best Newscast in the Nation (1997, 2000, 2001);
- Edward R. Murrow Award - Overall Excellence (2000);
- Edward R. Murrow Regional Awards (1997-2001)

Educational Award: Third Place in the Rosa Parks Essay Contest (Fredonia, NY 1990)

PROFESSIONAL SKILLS

Computer Skills

- Adobe Photoshop, Adobe Dreamweaver, Outstart Evolution, Adobe Flash, Camtasia, Video Editing Software (such as iMovie, Avid Media Composer and Final Cut Express), Microsoft Suite; Blackboard; Experience creating and maintaining websites.