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The Effect of Pre-collaborative Activity Instruction on Self-efficacy

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THE EFFECT OF PRE-COLLABORATIVE ACTIVITY INSTRUCTION ON SELF-EFFICACY

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A dissertation submitted in partial fulfillment of the requirements for the

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ABSTRACT

The Effect of Pre-Collaborative Activity Instruction on Self-Efficacy

by

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Collaborative learning is increasing in popularity in education. This collaborative pedagogy is based on a significant body of research that shows positive learning gains. Additionally, given the nature of much of the information-age work, it is thought that such collaborative activity in school helps develop knowledge, skills and attitudes that will be beneficial to students in their post-college lives.

In spite of collaborative learning’s increasing use and popularity, there is only limited research on how students feel about such methods and their level of confidence in their collaborative knowledge, skills and attitudes. Based on the current theories about self-efficacy, delineated by Bandura (e.g. 1982, 1997), and as shown by experimental evidence, a person’s attitude about his or her competency in regards to an activity or task has a significant effect on his or her willingness to perform that activity, persevere and achieve at a high level. Self-efficacy is thought to be dependent to a large degree on prior experiences with an activity or within a domain (Bandura, 1982).

This study investigated the level of self-efficacy students report about collaborative work within a classroom context. The participants were 73 college students enrolled in 4 sections (two face-to-face and two online) of a teacher preparation class
focused on instructional technology. As part of the students’ normal class work, they participated in a small-group (2 to 4 students) activity spanning approximately 4 weeks to investigate an assigned “new” instructional technology and then to build a wiki web-page to inform others in the class about that technology. The student groups were divided into control and treatment groups in which the treatment-group participants were given computer-based training related to collaborative learning skills, knowledge and attitudes prior to the activity. At the same time, the control group received activity-relevant, but non-collaborative-related, training. All students, prior to and after the activity, were assessed on a number of collaborative self-efficacy and related measures through the use of a new online-based survey instrument developed for this purpose.

The factor analysis of the survey instrument revealed two orthogonal factors related to collaboration. These factors are collaborative self-efficacy and liking-valuing disposition. The results, from these factored-composite measures, showed that the pre-service teachers, in general, had a fairly high level of collaborative self-efficacy; on average, they liked and thought they could perform well in collaborative learning groups. Collaborative self-efficacy did not differ significantly from the pre-training-activity to the post-activity; however, generally the self-efficacy values did increase from pre-training-activity to post-training and activity. It was also found that the students in the face-to-face classes reported significantly higher liking-valuing dispositions toward collaborative learning activities than distance education students both prior to and after the activity. These findings provide some indication that offering brief training focused on collaborative-group skills might be beneficial to students’ collaborative self-efficacy and liking-valuing disposition.
The variability of participants’ rating of collaborative self-efficacy showed, in some cases, large positive and negative swings between pre and post assessments. These fluctuations in collaborative self-efficacy suggest that immediate prior experiences may have a stronger effect on such measures than more distant experiences. This hypothesis was termed the Theory of Last Experience.
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At an age when many of my friends and contemporaries have retired to the golf course or such, the undertaking of a PhD program and dissertation is definitely unusual and personally challenging. Beyond the “accomplishing” of such a goal, one of the things that my years and experiences have taught me is that “who we are” and what we “accomplish” is always the product of, and only made possible through, the support and help of many other people. I will always look upon this degree as a having been a “collaborative” learning project.

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CHAPTER 1: INTRODUCTION

Collaboration can be defined as people working together to achieve a common goal (Webster, 1984). Collaborative learning and its synonym, cooperative learning, are terms commonly used to describe an educational technique featuring the use of groups of pupils who work together while involved in some educational activity for the purpose of achieving educational learning goals (Johnson & Johnson, 1996a & 1999; Johnson, Johnson & Holubec, 1991; John-Steiner, 2000). Collaborative learning has become an increasingly popular and important pedagogical technique primarily because it is thought by its proponents to increase student learning (Antil, Jenkins, Wayne, & Vadas, 1998; Johnson & Johnson, 1999). Some go so far, in their advocacy, to say: “it is clear from the research that classrooms should be dominated by cooperation among students” (Johnson, Johnson and Holubec, 1991). However, simply putting students together to work on some academic activity does not automatically result in the benefits theoretically attributed to collaborative learning. In fact, a great deal of research has focused on trying to parse out the aspects critical to successful collaborative learning. With this goal in mind, many techniques, tools and approaches have been used and tested as instructional scaffolding to support collaboration and learning. Instructional scaffolding, used in this broad sense, means any support provided in an educational context that will improve collaborative learning processes and outcomes. One aspect identified as of critical importance in collaborative learning is that students need the appropriate knowledge, skills and attitudes about collaboration and collaborative learning to be successful (Johnson & Johnson, 1987). Most importantly, for purposes of this current study, experts, such as Johnson & Johnson (1987), point out that most students do not possess
the required knowledge and skills for successful collaborative learning; rather they need additional focused training.

Another aspect of collaborative learning that has received little attention is: “what is the level of competency that students feel toward collaborative learning activities?” More specifically, what collaborative self-efficacy do students possess? Self-efficacy is defined as a person’s belief about whether they can successfully do or succeed at some activity or task in a specific situation (Bandura, 1997). It follows that collaborative self-efficacy can be defined as the level of a student’s belief about whether she or he can be successful in a collaborative learning activity or task. A person’s self-efficacy in regard to some activity, task or situation has been shown to be an important predictor of student success in many types of academic activities (e.g. Bandura, 1997; Zimmermann, 2000). Some limited research was found that has looked at the self-efficacy that students, in general, and college students in particular, possess towards collaborative learning activities (e.g. Wang, Poole, Harris, & Wangemann, 2001; Ryan, Bordoloi, & Harrison, 2000; Gardner & Korth, 1998). Intriguingly, neither self-efficacy theory nor its research-related findings support the question of whether increasing a person’s knowledge about a particular activity or domain alone will result in increased self-efficacy. The current study tests the hypothesis that increasing a student’s collaboration/collaborative learning knowledge, by means of training before the activity (instructional scaffolding), should have the effect of increasing a person’s collaborative self-efficacy at the end of the activity. In this current study, collaborative learning converged with the concepts of instructional scaffolding and collaborative self-efficacy. Specifically, this study looked at developing a measure for collaborative self-efficacy; in other words, college students’
self-efficacy toward collaborative learning. In addition, the current study asked whether instructional scaffolding in the form of pre-activity training of collaborative skills and knowledge would increase collaborative self-efficacy after participating in a collaborative group project. Further, the current study asks, what relationship, if any, did the type of class, face-to-face or online, have on these hypotheses? In this introduction, each of these topics is dealt with briefly; leading to a more complete description of the research questions. The current research is be situated within the convergence of the three major concepts: collaborative learning, collaborative self-efficacy and instructional scaffolding as depicted in Figure 1.

![Diagram of the current research’s conceptual framework.](image)

**Figure 1: Venn diagram of the current research’s conceptual framework.**

**Humans’ Collaborative Nature**

Collaborative learning might be said to have sprung from the very nature of humans, for without collaboration our species would not have survived, prospered and spread to the far reaches of this planet and beyond. From the time of written records and stretching back through the archeological record, the human story is one of grouping
together and collaborating. Whether looking at the pyramids of Egypt or the migrations of humankind from Africa to cover the world, it is hard to imagine our long history without a great deal of collaboration. Evidence, from so-called primitive hunter-gatherer cultures, shows that collaboration was the norm of behavior and necessary for survival (Bronowski, 1974; Fromkin, 1998). One could surmise therefore that collaboration has been with us for thousands of millennia as an essential part of survival and life. More recently, contemporary scholars suggest that people who accomplish notable things attribute much of their success to cooperative efforts (Kouzes & Posner, 1987).

Additional research shows that cooperative/collaborative behavior results in greater success in academic and other fields (Helmreich, Beane, Lucker, & Spence, 1978). Thus, collaboration, in spite of having been a part of humans’ activity seemingly forever, is not a completely natural or innate skill. The research for this study rested on the belief that students’ collaborative skills cannot be assumed and that they require training and knowledge-skill building.

**Collaborative Learning in Education**

The idea that humans have collaborated seemingly “forever” seems axiomatic. However, exploring the long history of collaboration in education raises the question of whether collaboration is a normal and natural way to learn. We know that humans require a long period of experiential training, learning and development after birth before a person can become a fully-functioning adult and societal member. Consequently, the concept of education or more fundamentally, the idea of a more-knowledgeable person teaching a less-knowledgeable person, has surely been in existence for at least a few dozen millennia. Thus from what we know of antiquities and what we know about
education today, it naturally follows that education in its most traditional forms has always involved, at times, some form of collaboration between some type of teacher and a student. Yet, today, how common is teaching/learning done through the use of student-focused collaboration? One obvious answer is, that much of the education over the last few centuries of the western world tradition, at least, has been dominated by an individualized and competitive structure and pedagogy, rather than collaborative methods. In spite of the dominance of individualistic and competitive formal education pedagogies, given humans’ collaborative and social nature, one might assume that students have “always” informally collaborated in their educational activities. Thus it is somewhat surprising that some have suggested that collaboration between students for the purpose of learning, at least in formal educational settings, is a new phenomenon (Slavin, 1983 & 1987). Others have pointed to collaborative learning as being “an old idea” (Johnson, Johnson & Holubec, 1991). They have pointed to such historical evidence as the Talmud’s argument that learning requires a learning partner; Johann Amos Comenius’ sixteenth-century admonition that students benefit from teaching other students and learning from them and Colonel Francis Parkers’ nineteenth century advocacy of cooperative learning and finally, John Dewey’s collaboratively-based project method of instruction (Johnson, Johnson & Holubec, 1991). Whether formal or informal, it is probably impossible to definitively determine the beginning of collaboration in educational contexts. Nevertheless, in the waning years of the twentieth and continuing into the beginning of the twenty-first century, there continues to be an increasing focus, interest and popularity in education circles about teaching-learning techniques based on collaborative learning.
One of the reasons cited by supporters of collaborative learning for their advocacy is the substantial evidence existing pointing to the effect it has on increasing student learning. The positive academic performance value of collaborative learning has been reviewed many times (e.g. Slavin, 1995; Slavin, 1996). A meta-analysis, reviewing studies in which undergraduates were involved in academic activities, concluded that those students who had some type of group-learning activity had higher academic achievement than those who experienced no group activity (Springer, Stanne, & Donovan, 1999). Similarly, an earlier meta-analysis reviewing 37 studies found that 68% of the studies reported better outcomes with cooperative learning approaches than with more traditional instruction (Newmann & Thompson, 1987). In addition to collaborative learning proponents focusing on collaborative learning’s academic goals, some educators also emphasize the important role that collaborative learning plays in developing essential social skills (Johnson, Johnson & Holubec, 1991a). For example Johnson, Johnson and Holubec (1991) argue that “peer relationships are a critical element in the development and socialization of children and adolescents (Hartup, 1976; Johnson, 1980).” Additionally, with the advent of curricular goals emphasizing 21st century skills, collaboration-oriented pedagogy is thought to be a primary way that students develop the “new” fundamental and essential collaborative skills (Schank, 1997; Rogoff, 1990; Collins & Halverson, 2009). Similarly, a number of sources suggest that the post-schooling world is looking for people with collaborative skills (e.g. Gardner & Korth, 1997). Thus the generally the need for and positive effect of collaboration in educational and non-educational settings seems well established.
Educational Theory and Collaborative Learning

As with many new pedagogical movements, this interest and use of collaborative learning techniques did not happen in a vacuum. Somewhat concurrent with, and to a significant extent driving, the interest in collaborative learning theory and techniques has been the development and rising popularity of socio-cultural, social-cognitive and constructivist educational-learning theories (Vygotsky, 1978; Bandura, 1997; von Glaserfeld, 1995). These learning-pedagogical theories have placed far greater emphasis on the social nature and social construction of learning and knowledge. Socio-cultural theory, for example, places a much higher focus and stress on the social nature of learning (Wink & Putney, 2002). This places increased emphasis on the belief that most learning should be within some type of group, albeit even a two-person (dyad) group. The fundamental socio-cultural idea is that teaching-learning is social in nature and generally takes place when a “more-knowledgeable” person… provides teaching and scaffolding to a less-knowledgeable person (Vygotsky, 1978; Wink & Putney, 2002). This idea in turn has led directly to the concept that students can and, more significantly, should learn from other students. Add to this a social-cognitive theory tenet that people learn a great deal of what they know by observing others (Bandura, 1997) and you have the theoretical foundation of collaborative learning.

In addition to the central role assigned to the social nature of learning, constructivist theory centers on the individual’s “construction” of knowledge. A primary constructivist learning theory concept is that knowledge is not transmittable but must be constructed by each individual from his or her unique experience (Von Glaserfeld, 1995). Many educators (e.g. Wink and Putney, 2002; Von Glaserfeld, 1995; Duffy &
Cunningham, 1996) have interpreted this concept as support for emphasizing experiential learning, which has lead directly, or indirectly, to groups working on open-ended discovery-learning tasks.

These social learning models have placed great emphasis on learning within social situations including focused-learning groups. A question could be raised about the implicit assumption in these commonly used theoretical models that learners have the social and group skills to make socially-based learning succeed. Although it could be argued that much of the time the assumption is that students have all the collaborative skills to be successful, there are any number of teachers and researchers which would argue that they do not, as illustrated in the following quote:

Students are not born with the project management, time management, conflict resolution, and communication skills required for high performance teamwork. If team assignments are to be given, explicit steps should be taken to help students learn those skills and to equip them to deal effectively with the logistical and interpersonal problems that commonly arise in collaborative efforts (Oakley, Felder, Brent & Elhajj, 2004, p. 9).

Additionally, the most popular collaborative learning literature provides supports the idea that just putting students in groups is not adequate to achieve either successful collaborative processes or learning (Johnson, Johnson, & Holubec, 1990, 1991; Johnson & Johnson, 1987a). More significant than the recognition of the limited collaboration skills students possess is the fact that “educators systematically fail to train students in the basic social skills necessary for interacting effectively with peers” (Johnson, Johnson, & Holubec, 1991, p. 3:4). The collaborative skills necessary to function well in
collaborative learning must be taught with the same vigor, skill and importance as reading and math skills (Johnson, Johnson, & Holubec, 1991). Unfortunately there is little evidence that this skills training is systematically being done. One might translate this problem with students having a lack of collaborative knowledge and skills as calling for some type of pre-activity instructional scaffolding. This study was based on the idea that some type of pre-activity instructional scaffolding training is needed to address this lack of collaborative knowledge and skills. Whether collaborative learners possess the required knowledge and skills was a key query underlying this current study’s work. The question is what type of scaffolding is needed?

**Scaffolding Collaborative Learning**

Thus, as presented above, simply assigning students to work together does not result in either well-functioning collaborative learning groups or performance gains (Johnson & Johnson, 1987a, 1989). In fact, much evidence exists that supports the idea that students’ collaborative efforts are far from optimal and many times detrimental to collaboration and learning (e.g. Dembo & McAuliffe, 1987; Salomon & Globerson, 1989; Hogan, Nastasi, & Pressley, 2000; Barron, 2003). Many means of *instructional scaffolding* have been employed with the intent to improve the functioning and resultant benefits of collaborative learning. The term instructional scaffolding, as used here, can be thought of as any information, technique, activity or behavior used by an instructor to increase the success of an educational activity. The term *scaffolding*, as opposed to instructional scaffolding, has commonly been used in describing Vygotsky’s learning theory; wherein it is the assistance given by a more knowledgeable teacher or peer that allows the student to do something they could not do without the help (scaffolding)
Instructional scaffolds that have been employed in support of collaborative learning include such things as group selection method, group organization, role assignment, scripts, and grading schemes; to name only a few. Many of these instructional scaffolds have focused on the structure of the groups’ activity; and thus could be considered “concurrent with the activity” in nature. Many teachers also seem to assume that students have all the knowledge, skills and attitudes necessary to utilize whatever collaborative structure and task is assigned.

Measuring the Effect of Instructional Scaffolding on Collaborative Self-Efficacy

How might having more training in collaborative knowledge and skills impact collaborative learning? As with almost any aspect of human learning or functioning, there are many ways to measure the impact of an intervention. An obvious way to measure the impact of any training is to assess if the student has learned the desired material. Although this study does use a measure of student learning, it is not the primary focus. Rather this study proposed to use collaborative self-efficacy as the primary dependent variable. The term self-efficacy describes the beliefs that a person has about whether he or she can successfully function in a particular situation or doing a specific activity (Bandura, 1982, 1997). Thus the construct collaborative self-efficacy describes the beliefs that a person has about whether he or she can successfully function in a collaborative learning activity. This study focused on students’ perceptions about collaborative learning activities and working in groups (collaborative self-efficacy); then the study asked what effect pre-collaborative training might have on those perceptions.

Advocates of collaborative learning point to its many positive academic and social benefits (Slavin, 1995; Johnson & Johnson, 1999a); and give the impression that
everyone, participating in collaborative learning activities, has positive attitudes or dispositions toward such activities. Some research has focuses on how students perceive working in collaborative learning groups (Yazici, 2004; Chapman, Meuter, Toy & Wright, 2010). Yazici found that business majors felt comfortable working in groups (4.75 on a 5 point scale). Chapman et al. found in a large survey (n = 583) of undergraduate business major students that they responded at an average rating of 5.4 (on a scale of 1 to 7) to the statement “enjoyed working in groups” (p. 44). They further reported that these same students rated the statement “desire to work with group again” at an average 3.1 on a 1 to 4 scale. Contradictorily, a recent study, found in surveying teacher educators (120) and student teachers (369) that “students do not prefer to collaborate themselves during the learning process” (Ruys, Van Keer & Aelterman, 2010, p. 537). At the same time, work done with students similar to this current study’s participants reported imprecise qualitative findings that some students enjoyed the experience (Addis, 2009). A study of older (mean age 37 years) graduate students majoring in human resource development found that they rated “I enjoy participating in group work” at 3.71 on a 5 point scale (Gardner & Korth, 1998, p. 29). Additionally, mention is made in Millar, Seth, & Sharma (1999) that students preferred working in groups within a first-year physics course. Taking a different slant, there has been one study of secondary students that attempted to identify the factors that make up a person’s preference for group or individual work (Cantwell & Andrews, 2002). Unfortunately, although these studies provide some data about students’ attitudes toward collaborative learning, they seem to come to contradictory conclusions and none of this research focused directly on students’ collaborative self-efficacy.
Why is it important to know a student’s perceived self-efficacy about an academic activity such as collaborative learning? A large body of research focused around the construct of self-efficacy sheds light on one approach to this question (Bandura, 1997; Slavin, 1995). Self-efficacy research provides substantial evidence that a person’s self-efficacy plays an important role in their positive motivation and successful performance in most human activities, including academic situations or tasks (Bandura, 1997; Zimmernmann, 2000). Additionally, there is considerable research indicating that a person’s self-efficacy belief, of whether he or she can successfully perform within a particular educational situation or on an academic task, is equal in importance to that of the prior knowledge and skills one brings to bear (Bandura, 1982, 1997; Zimmerman, 1995, 2000; Bouffard-Bouchard, 1990; Pajares, 1996; Schunk 1991). All this evidence suggests that a student’s collaborative self-efficacy may have an important impact on whether, and how well, the student performs the activity.

From where does a person’s self-efficacy about something arise? Bandura (1982, 1997) bases his explanation of the genesis and development of self-efficacy beliefs primarily on “prior experiences.” He argues that if a person has successful experiences with a situation, task or goal then it is thought that positive self-efficacy is developed. Likewise if a person has negative prior experiences then self-efficacy should be low. The logic, as developed by Bandura, is that self-efficacy increases by having more positive experiences (1982). He also developed a theory of learning based on modeling and observational learning (1986). The idea that we learn from direct experience and observing others, Bandura believed to be a primary method by which we acquire a great amount of our knowledge, both in and out of the classroom. It is noteworthy that
Bandura’s more general triadic reciprocity learning theory does provide for the importance of the environment, along with behavior and personal factors, as one of the key determinates of behavior (1986). In this triadic reciprocity theory, the definition of the term “environment” is so broad that it could include direct instruction but he does not delineate it as such. Further, in earlier writings, he states that “expectations of personal efficacy are derived from four principal sources of information: performance accomplishments, vicarious experience, verbal persuasion, and physiological states” (Bandura, 1977, p. 191). Clearly Bandura believes that some type of prior and/or direct experience, and/or verbal persuasion plays a key role in human cognition, including self-efficacy. It is not clear however from his writings that either verbal persuasion or prior experiences would equate to direct instruction or, as this study proposed, pre-activity training. Recently his writings about the large-scale mass health campaigns would imply that self-efficacy is open to manipulation through instruction although the emphasis is on television-video means, soap-opera novellas and observational learning (Bandura, 2004). Finally, Bandura cautions: “there is a marked difference between possessing knowledge and skills and being able to use them well…” (1993, p. 119). In spite of Bandura’s position, it is clear that an argument could be made that much of the research in the area of self-efficacy has not actually looked at how and whether one might directly influence a person’s self-efficacy (e.g. Pajares, 1996, 2002; Kitsantas, Zimmerman & Cleary, 2000).

Thus, for the purposes of this current study, a fundamental hypothesis was that self-reported collaborative self-efficacy can be increased by collaboration-oriented training taken prior to a group-learning activity. In support of this hypothesis, it has been shown that self-efficacy, about using a computer-aided software engineering (CASE)
tool, increased when users had knowledge and skill training prior to utilizing the tool (Cheung, Li, & Yee, 2003). It can be posited that at the heart of Bandura’s “past experiences” and vicarious experiences is increased knowledge. In other words, it seems logical to suppose that increasing knowledge and skills is a part of increasing self-efficacy.

**Research Questions**

The current study was situated in four sections of an existing university class for pre-service teachers’ focused on preparing them to use educational technology. As part of the normal sequence in this class, students are expected to participate in a group collaborative learning project titled “Innovations Mini-Teach.” Each designated group is assigned to collaborate on the development of a wiki page that communicates their findings about their particular educational technology topic (i.e. interactive whiteboards, podcasting, etc.) to others in the class. In this study, students in some groups (the treatment groups) experienced a computer-delivered training module focused on collaborative-learning knowledge and skills. Students in other groups (the control groups) experienced a “filler” computer-delivered training module focused on instruction design/learning theory. It was thought that this training intervention would generate some new information about how well one can scaffold students’ collaborative skills and attitudes using computer-based pre-training. Since two of the classes were taught face-to-face and two online, this experiment also compared the effect of the instructional scaffolding on both face-to-face and online collaboration groups. The comparison of those students who received collaborative-skills training with those who received
learning-theory training provided information and insights (see research questions below) into how such an intervention can affect collaborative skills, knowledge and self-efficacy. The main research questions addressed in this study are enumerated below.

**Question 1:** What is the level of collaborative self-efficacy of students enrolled in a college class for pre-service teachers? Secondly, does collaborative self-efficacy differ depending on whether the students are taking the class as a face-to-face class or as a distance-education class?

**Question 2:** Will the collaborative self-efficacy increase in students after taking part in a collaborative learning activity if they first experience an instructional scaffolding in the form of a computer-based training focused on key collaborative knowledge, skills and attitudes over another group that does not receive this scaffolding?

**Question 3:** Does the computer-based collaboration training have a differential effect on collaborative self-efficacy depending on whether the students are participating in a face-to-face class versus a distance-education class? Secondly, what is the effect based on the future grade-level teaching goal of the student? Thirdly, does the instructor-type have a differential effect on the impact of training?

**Question 4:** Do students, who get training on collaborative knowledge, skills and attitudes, differ from those not receiving this training in their use of, or frequency of words, or descriptions when asked open-ended questions about the collaborative activity?

**Significance of the Study**

The current study provides valuable information about the nature of students’ (pre-service teachers) self-efficacy toward collaborative learning activities. The increasing popularity of collaborative learning techniques makes understanding the level
of students’ perceive self-efficacy about such activities a valuable addition to the information base in this area. This study is also important because although earlier work suggests that students have a positive attitude toward collaboration (Addis, 2009); little detailed quantitative-based research has measured students’ collaborative self-efficacy. The survey instrument used for this study provides quantitative measures of students’ self-efficacy regarding a number of aspects of collaborative learning. The design of this study also provides insights into whether self-efficacy is amenable to manipulation through instructional intervention. The logic that the teacher or tutor will instruct the student in how to better do something, and thereby increase the student’s ability and willingness to do it, is the bedrock of educational pedagogy. The question of whether such instructional interventions affect self-efficacy has surprisingly not received a lot of attention in the research literature. A liberal reading of Bandura’s writings about self-efficacy could infer that his “past experience” includes the direct training/instruction of the person. Similarly the leading advocates of collaborative learning, Johnson & Johnson (1987a) have provided some guidelines on the training necessary for better collaboration. Nevertheless this area seems to have received by far the least attention in the collaborative learning research literature and even less in the end user/learner genre.

The actual practice of collaborative learning activities is subject to great variation. The literature indicates that many features are necessary to maximize the educational benefits from such activities (Johnson & Johnson, 1999a; Zimmerman 2000). One way to look at these collaborative activities is to think of them as something planned and outlined by the teacher that the students “simply” do or complete. In this view the students are considered to have all of the knowledge about collaboration, interpersonal
communication and group dynamics necessary to perform the group activity. Although no data appears to exist that definitely indicates whether this is the dominant view of how collaborative learning works, everyday observation would suggest that, at the collegiate level, it is the prevalent view. This study provides evidence about whether students might benefit from some instruction in collaborative techniques; a supposition supported by the following quote:

“Children are not born instinctively knowing how to interact effectively with others. Interpersonal and group skills do not magically appear when they are needed. Students must be taught these skills and motivated to learn them”

(Johnson, Johnson and Holubec, 1991, p. 5:2).

The word “children” in the prior quotation might make one question whether this same argument also applies to older students. There is a sense, in reviewing the literature of not only collaborative learning but, possibly even more significantly, business management, that suggests that many adults have much to learn in terms of the knowledge, skills and attitudes needed for successful collaboration (Johnson & Johnson, 1987a; Knapp & Miller, 1994). The current study attempts to provide evidence supporting the idea that more emphasis needs to be directed at providing these skills to students of all ages within our educational system.
CHAPTER 2: REVIEW OF THE LITERATURE

This review of the literature is divided based on the three conceptual ideas on which this research is grounded: collaborative learning, collaborative self-efficacy and instructional scaffolding. Each topic is dealt with in turn, and then a final summary provides a synthesis of the three concepts. The literature reviewed here is supportive of the questions of this study as outlined in chapter 1.

Collaborative Learning

To understand collaborative learning in a manner that synthesizes with collaborative self-efficacy and instructional scaffolding and their meaning in the research, one must look at research and ideas engendered from socially-based and constructivist learning theories, collaborative learning pedagogy and research on group dynamics/interpersonal communications, and, because of the new online world, computer-supported collaborative learning. Each topic is reviewed in order; with a summary section at the end.

Collaborative learning is briefly addressed in chapter 1. Collaborative learning is commonly thought of as involving a small group, usually two to five members, who work together to accomplish one or more educationally-related goals (Johnson and Johnson, 1987a). Collaborative learning takes numerous forms, for example, some of the more well-known terms used to describe this class of educationally-focused human interaction include: cooperative learning (Johnson, Johnson and Holubeck, 1990), team learning (Senge, 1990, 1994), peer learning (O’Donnell, 2006) and teamwork. Collaborative learning is the term generally used in this document.
Socially-based and constructivist learning theories.

Understanding socially-based and constructivist learning theories provides essential background for understanding the genesis of collaborative learning. Vygotsky (1978) provides a theoretical basis for educational collaboration (also see Von Glaserfeld, 1995; Wink & Putney, 2002). Vygotsky’s socio-cultural theory places emphasis on the social nature of almost all learning. He maintains that much of our cognition is first modeled for us by people in our social environment, including school. Similarly, Bandura’s social-cognitive theory also places emphasis on modeling and observational learning (1977, 2001). As presented in the introduction, according to Vygotsky (1962, 1978), a student, with the help of a more-knowledgeable person, is assisted in learning how to do something the student could not do previously. This assistance (commonly translated as “scaffolding”) is gradually removed as students become able to do and, more significantly, think in a manner previously unknown to them. Based on this socio-cultural theory, collaborative learning is thought to be a valuable educational approach that fosters learning from others’ knowledge and skills beyond what individual students could achieve alone (Stahl, 2002; Slavin, 1996).

Whereas socially-based theories posit that we learn most of what we know from others, a key concept of constructivist theory suggests that learners do not simply absorb the information as taught by a more knowledgeable person (Von Glaserfeld, 1995, Vygotsky, 1978; Piaget & Inhelder, 1969). Constructivist learning theory has two main tenets; the first is that learners actively “construct” their own unique version of knowledge based on their previous experience, personality and point of view (Duffy and Cunningham, 1996; Jonassen et al., 1999). A second important constructivist tenet is that
“instruction” is more about supporting individual knowledge construction from first-hand experience than from the transmission of knowledge from teacher to student. Some have also suggested that learning is best when students are thinking in “meaningful” ways and that collaborative learning environments can support this type of thinking (i.e. Jonassen, 1996). Both socially-based and constructivist learning theory have special relevance to collaborative learning and, more recently, computer-supported environments because these two theories often utilize experiential activities within collaborative learning groups.

**Collaborative learning pedagogy and tools.**

Early collaborative learning theory is often attributed to Herbert Thelen (1954, 1960 as cited in Mandel, 2003). Vygotsky (1978), discussed earlier, provided a fundamental dyadic model. Since those earlier conceptions, there have been quite a number of theoretical and applied models developed around the general concept of collaborative learning. Some concepts are focused more on educational environments while others encompass a more general idea of collaboration. The following discussion describes the more prominent collaborative models briefly and the Johnson, Johnson and Holubec (1990) model in more depth.

*Think, pair, share.*

The think-pair-share model of collaborative learning is a relatively simple technique. It is designed to be used in the standard classroom as a didactic pedagogical approach (Sharan & Sharan, 1992). Basically the idea is that rather than pure lecturing, a class should be broken up into a sequence of mini-lectures interspersed with small collaborations involving thinking about what was said, pairing-up and sharing one’s
thoughts with a partner. The theory and hope is that by requiring the students in the
dyads to articulate their thoughts and listen to others’ thoughts about a subject, they will
better understand the material and increased learning will occur. Thus with this model
improved student learning is the measuring rod used.

Others have used this model in a college economics class where the sharing is
done after class in an online discussion forum (Chizmar & Walbert, 1999). In this
economics class, the students think about the day’s lecture, pair-up and share something
online about what they learned during the lecture or share something they find confusing.
Chizmar and Walbert believe that the formality of thinking caused by the students
sharing his or her thoughts with another person and the fact that the postings are
ultimately available for reading by the entire class will result in the students being more
careful in their thinking and writing.

Knowledge-building communities.

There are a number of related models that have in common the idea that
collaborative learning is about the development, support and functioning of a community
of learners (Jonassen, Peck, & Wilson, 1999). One of the first, and probably the most
well recognized instantiation of this knowledge-building community concept, is that
developed by Scardamalia and Bereiter (1996a, 1996b). Their internet-based software
called Knowledge Forum (once called CSILE) is built around students developing
questions, hypotheses and conclusions that they enter into an online knowledge-
community database. Its basic technique is described in the company’s literature as
follows:
In Knowledge Forum, students are expected to pose questions, define their own learning goals, acquire and build a knowledge base, and collaborate with one another. Built-in scaffolds ‘cue’ students to the thinking strategies that characterize ‘expert learners’ while the structure of the database with its communal views necessitates sharing of information. Students contribute public notes, "build-on" to others’ ideas, and "reference" the work of peers. The ongoing practice of these advanced operations, combined with teacher support and coaching, helps students acquire the sorts of learning strategies that characterize expert learners (Scardamalia & Bereiter, 2007; Knowledge Forum Website, product research page).

This collaborative learning model and the supporting software for Knowledge Forum are built on a constructivist philosophy. Together they scaffold each student’s individual knowledge development. The success measures of this model are increased student achievement, increased higher-level thinking skills and evidence of more sophisticated interpersonal skills for use in collaborative learning groups.

Team learning-learning organization.

In the general vein of knowledge building communities Senge (1990, Senge, Cmbron-McCabe, Lucas, Smith, Dutton & Kleiner, 2000) advocate team learning as a key component in their concept of a learning organization. At the heart of team-learning are the concepts of dialogue and alignment. Dialogue is a sustained inquiry where people learn how to “think together” (p. 75). It is described (Senge et al., 2000) as follows:

During the dialogue process, people learn how to think together—not just in the sense [of] analyzing a shared problem or creating new pieces of shared knowledge
but in the sense of occupying a collective sensibility, in which the thoughts, emotions, and resulting action belong not to one individual, but to all together (p. 75).

This description of dialogue would seem to set a high standard for judging a “true” interaction. Senge et al. (2000) assert that this type of dialogue seems to flourish in today’s work and learning environments. This optimistic view is in contrast to others more pessimistic views (i.e. Burtis & Terman, 2006) who suggest that frequent pitfalls keep too many people and groups from reaping the benefits that can come from good collaboration. The alignment concept is basically the idea that a team should be “orienting… to a common awareness of each other, their purpose, and their current reality” (p. 74). This is similar to a situation found in a classroom’s collaborative learning groups when students are “involved in their common learning endeavor, not just individual learning” (p. 74).

A challenge with the team learning concept and technique is its complexity. There is no simple specification of a set of steps that one should follow to achieve good team learning. Rather this concept is built on a systems thinking model (Banathy & Jenlink, 2004). The systems thinking model recognizes that many factors impact the performance of any system (such as team learning environment) and that each instance is unique. Therefore only by looking at each factor specific to a particular instance can one start to understand which factors are critical and which are less important.

Models of teaching.

Joyce and Weil (2000, as cited in Mandel, 2003) have a model of collaboration that involves six phases (Mandel, 2003, p. 4):
1. Students encounter puzzling situations (planned or unplanned).

2. Students explore reactions to the situation.

3. Students formulate study task and organize for study (problem definitions, roles, etc.).

4. Independent and group study.

5. Students analyze progress and process.

6. Recycle the activity.

Others have used this model successfully (see Sharan, 1994; Sharan et al, 1994 as cited in Mandel, 2003). This approach is very student-centered, in that the topic and depth of effort is in-large-part or wholly-defined by the student. This model also focuses on the social learning process as opposed to focusing on reaching some defined learning objective.

STAD.

Slavin (1987) developed a collaborative learning methodology known as the Student Teams-Achievement Division (STAD). It is similar to Johnson, Johnson and Holubec’s (1990) positive interdependence in that heterogeneous group-members work together to help each other with learning of previously didactically presented material. Individual results, such as improvement measures on tests, translate into group-based points and rewards. The model itself was originally designed within a traditional classroom direct teaching-learning model.
**Brainstorming.**

Osborn (1967) explicates and advocates for brainstorming; a type of collaboration focused on idea generation. Brainstorming is usually related to a specific task or goal. The basic technique involves a period of idea generation with two main rules: a) generate as many ideas as possible and b) no discussion or criticism of any idea generated is allowed. Success or failure is measured primarily by how many ideas a group develops. In brainstorming collaboration the quality of the ideas generated is considered after the quantity metric. Osborn asserted that if the proper brainstorming rules are followed, an average person can generate twice as many ideas in a group as when the person works alone. It would seem that this collaboration model could be utilized as part of a collaborative task in some types of computer-supported environments.

*Johnson, Johnson and Holubec.*

The Johnson, Johnson and Holubec (1990, Johnson & Johnson, 1987a, 1989, 1999b) (JJH) model of collaborative learning is probably the best known and most widely applied. Johnson et al. report that their model was based on the work of Deutsch (1962) and Glasser (1986) and focuses on cooperation among students. This model has been described as being from a social-cohesion perspective (O’Donnell, 2006); meaning that it is dependent on strong social interaction plus mutual caring and concern. Johnson et al. maintain that the primary goal behind this technique/model is academic learning. Thus they argue that the success or failure as a result of using this model should be judged primarily on basis of whether students learn more with this technique compared to more traditional methods of learning. Central to Johnson et al.’s conception of cooperation are five concepts: positive interdependence, face-to-face promotive interaction, interpersonal
and small group skills, individual accountability and group processing. Each of these facets is briefly discussed below.

**Positive Interdependence.**

Positive interdependence means, in the JJH model, that the group’s task, roles and structure must be such that each member is dependent on other group members’ efforts (Lew, Mesch, Johnson, & Johnson, 1987a). In the JJH model of cooperative learning, lessons having positive interdependence mean that each member is held responsible for other members’ learning as well as their own. Thus collaboration is structured so that it is not acceptable for only one person to learn the material; success is when all the group members learn the material. This expectation is thought to encourage supportive and engaged behaviors by each group member. A key to this strategy is that there must be a clear group goal although in contrast to some models it does not require a group artifact or product. Additional interdependence can be encouraged by the use of rewards based on group, as opposed to individual, performance or attainment.

**Face-to-face promotive interaction.**

Cooperative learning according to the JJH model depends on face-to-face interaction. It is emphasized that interaction and verbal interchange are essential to make the positive interdependence work. Obviously, this interaction requirement poses a problem when trying to take this model to an online education environment since in many cases (i.e. pure distance education) there is no face-to-face interaction at all.

**Interpersonal and small group skills.**

The JJH model depends in large part on successful group interaction. In fact in their book (Johnson et al., 1990), there is an entire chapter entitled “Teaching Students
Cooperative Skills.” Thus logically, successful collaboration is dependent on the skill with which each member is able to interact. Further Johnson et al. argue that we are not born with such skills but that they must be taught. They add that teachers generally over-estimate the collaboration skills that students possess. They state that such skills are procedural in nature and should be taught using techniques applicable to such skills. Thus Johnson et al. (1990) suggest that skills should be learned using a five part program (p. 97-98):

1. Learn conceptually what the skill is and when it should be appropriately used.

2. Translate their conceptual understanding into a set of operational procedures (phrases and actions) appropriate for the learners involved.

3. Actually engage in the skill.

4. Eliminate errors by moving through the phases of skill mastery.

5. Attain a routine-use, automated level of mastery.

Johnson et al. also argue that the learning of skills to the point of automaticity requires repeatedly engaging in those skills until mastery is obtained. They specify this iterative loop is made up of: doing the skill, getting feedback and adjusting one’s action based on the feedback. Also it is stressed that such learning and mastery requires partners “willing to trust each other, talk frankly, and observe each other’s performance over a prolonged period of time and help each other identify the errors being made in implementing the skill” (Johnson et al., 1990, p.97-98). It may be obvious that the JJH model was developed for the K-12 classroom environment where the same students and collaborative groups generally have long periods of time together and multiple
opportunities to learn collaborative skills. This requirement for needing collaboration skills is not limited to K-12 students; research on collaboration in distance education environments also has found that college-aged students require training and guidance on group collaboration techniques and interpersonal communication (Johnson, 2001). This requirement for collaborative and communication skill training as well as extended-time groups poses a problem for many collaborative learning activities at the college level. Frequently, and as is true of the collaborative activity that was completed by students in this current dissertation’s study, the collaborative activity in college is a one-shot lesson or project. The single-shot collaborative learning activity at the undergraduate level and above may require special scaffolding to assure satisfactory or better collaborative learning experiences. Thus interpersonal training scaffolding may even be more necessary, if as reported above, college students are also deficient in the desired knowledge and mastery of these skills.

Collaborative processes in an online environment have been studied previously (Xiong, 2009). Using an analysis of interactive discussion logs, the following behaviors were observed: “planning, organizing, contributing, taking the initiative in exchanging resources, seeking and providing feedback, sharing knowledge, monitoring group process, building learning communities, negotiating, and persuading” (Xiong, 2009).

*Individual accountability/Personal responsibility.*

The bottom-line for the JJH model is individual responsibility and accountability. The idea that a group member can get a free-ride and allow others to complete the task is not acceptable. There are a number of ways that this model attempts to encourage everyone do his or her share. One way to encourage individual responsibility is through
the assignment of roles as well as the rotation of roles. Additionally, although group or social goals may be assessed and/or graded, they are secondary to individual educational achievement.

*Group processing.*

Finally, the JJH model places some emphasis on what it calls group processing; which involves the group focusing on and actively accessing the processes that are working or not working for the group. Thus the questions that groups should regularly be discussing are *what are we doing well and what do we need to do differently to reach our group and individual goals?* This activity strives to make the group processes visible, noted, discussed and improved.

*Collaborative-learning skills.*

One issue mentioned directly in the JJH model is the importance of interpersonal communication and group process skills to successful collaborative and learning outcomes. Most other models pay attention, albeit minor, to the importance of these skills. The literature from research on teamwork, interpersonal communication and business-oriented collaboration places greater emphasis on the importance of these knowledge, skills and attitudes (Turner, 2001; Giles & Street, 1994; Senge, 1994; Albrecht, Burleson & Goldsmith, 1994; Scholtes, Joiner, & Streibel, 1996; Bell & Smith, 2011). As has been documented earlier, there is general agreement that many students do not naturally have all the pertinent collaborative knowledge, skills and attitudes necessary for optimal collaborative learning.

While many collaborative learning experts agree that collaboration skills need to be taught; what is less clear is what actual knowledge, skills and attitudes are most
beneficial for students to have. As was noted above, there is a substantial amount of literature on business group process, teamwork and interpersonal communication. There is significantly less literature that focuses on collaborative skills needed by students. In fact, no collaborative learning skills training literature was found that is for direct use by students of any age. The classic work *Becoming a Master Student* (Ellis, 1991), although allocating a little space to *relationships* and interpersonal communication, makes no mention of collaborative learning skills. Also, the book *Communicating in Small Groups* (Beebe and Masterson, 2000), which might be appropriate for college-aged students, has much valuable information on communicating and functioning well in groups; but only a brief one page mention of collaborative learning in groups. So what training focused on collaborative learning that does exist is directed at teachers; to be used in the training of students (e.g. Johnson & Johnson, 1987a; Johnson, Johnson & Holubec, 1991). One conclusion from a review of the extant literature is that there is no single list of knowledge, skills and attitudes that are recognized as necessary by scholars researching and writing about collaborative learning, rather, there appear to be a myriad of ideas. What follows is a non-exhaustive sampling from the literature.

One way to think of the collaborative skills needed by students is to classify the skills as those involving behaviors that are *promotive* versus those that are oppositional (Johnson, Johnson, & Holubec, 1991). Promotive interaction behaviors are those that encourage the achievement and efforts of others. Oppositional interaction behaviors are those that discourage and obstruct others in their efforts to achieve. Thus the collaborative skills and knowledge of the members of a learning group should be focused on encouraging each other through developing an atmosphere of acceptance, trust and
liking (Johnson, Johnson, & Holubec, 1991). Unfortunately this type of atmosphere does not develop naturally simply by putting students together; especially if the timeframe for the group interaction is short, essential interpersonal skills are missing, or both.

Another important component of valuable social skills is the accuracy of perspective taking (Johnson, Johnson, & Holubec, 1991). This skill involves being able to understand how another person views a particular situation. Further it entails being able to have a sense for how the other person is reacting cognitively and emotionally. It might be considered a bed-rock skill on which most other social skills rely. Some would argue that collaborative learning is one of the best ways for students to develop this skill (Johnson & Johnson, 1989).

Still another view of collaborative skills is provided by Johnson, Johnson, & Holubec (1991), who suggest that the essential skills fall into four categories: forming, functioning, formulating and fermenting. Forming-skills focus on the essential knowledge, skills and attitudes that allow the organizing of the group and the establishing of norms of behavior. The following behaviors are included in forming-skills: moving into groups silently, staying with your group, using low-volume voices, taking turns, establishing roles, etc. The term functioning-skills describes essential group-process knowledge, skills and attitudes that are used to manage a group’s efforts in reaching its goals and maintaining an effectively-working group. Some of these skills include: sharing ideas and opinions, asking for opinions, facts and reasoning, providing direction (leadership), providing encouragement for everyone, asking for clarifications, providing motivation, etc. Formulating-skills are those that allow each participant to maximize learning and deep processing of the knowledge being generated by the group. These
formulating skills include explicit verbal summarization of what has been seen, read or discussed; a seeking and support of accuracy; encouraging elaboration; helping the group to remember; planning out loud; etc. And finally fermenting-skills are similar to formulating skills but with a dialectic twist. These skills involve being able to criticize ideas without angering people, differentiating ideas expressed, integrating ideas, seeking justifications, probing for more depth and quality of thinking and answers, etc.

But there is still another view of group collaboration knowledge, skills and attitudes that comes from the interpersonal communication literature (Beebe & Masterson, 2000). The perspective that Beebe and Masterson takes is epitomized by the following: “a group cannot function without words: communication is the vehicle that allows a group to move towards its goals” (p. 37). Their list of important task and relationship competencies are:

Task-focused

1. Define the problem
2. Analyze the problem
3. Identify criteria
4. Generate solutions
5. Evaluate solutions
6. Maintain task focus

Relationship-focused

1. Manage conflict
2. Maintain climate
3. Manage interactions
This Beebe and Masterson book spends whole chapters describing the extensive knowledge and sub-skills that make up each of these competencies.

Another book “Learning Team Skills” presents a non-academic view of collaboration skills (Bell & Smith, 2011). Although not every approach or issue is directly applicable to collaborative learning, many skills and issues presented do seem directly transferable. The skills focused on include:

1. Assessment of participants’ skills and knowledge
2. Building a well-balanced team
3. Team membership
4. Leadership skills
5. Recognizing and resolving problems
6. Motivating team members (eight motivators of productive teams)
7. Problems to avoid, pitfalls
8. Understanding the steps in the collaborative process
9. Dealing with cultural differences

This Bell and Smith book is rare in that it purports to teach people who are going to be collaborating about the knowledge, skills and attitudes that are important to doing it well. It is interesting to note the items dealing with leadership skills and cultural differences. Leadership, as an important skill, gets scant to no mention in the education literature about collaborative skills. It would seem that this skill is an important one for all collaborative learning groups; but especially for older students where collaborative tasks and directions seem to be much less structured than for younger students. The issue of
cultural differences is also not included in most of the classic collaborative learning skills literature. This issue raises the potentiality that collaborative learning has gotten more complex.

A key point from this and other models of needed skills (i.e. Senge, 1990, 1994; Hackman, 1990; Johnson & Johnson, 1987a, 1987b) is how long and non-trivial the suggested list is, of knowledge, skills and attitudes, required by competent group participants and collaborative learners. When viewed from this long and daunting perspective one can only hypothesize that most groups, learning-focused and otherwise, have many members who lack these skills and therefore these groups must function at far below their potential. Finally, as discussed in chapter 3, this seemingly ever expanding list of collaborative knowledge, skills and attitudes that would seem to be important to collaborative learners created a conundrum in designing the computer-based intervention used in the current study.

**Is all group learning collaborative learning?**

Some scholars would answer no to this question (i.e. Haythornthwaite, 2006). Haythornthwaite, for example, believes one important distinction needs to be made. She asserts that there is a difference between collaborative learning and what she calls *coordinated learning*. She maintains that a coordinated learning group is one in which the students limit their interactions to: coordinating their work (division of labor), doing individually-identifiable piecework and then assembling it into a group work total. Collaborative learning generally implies a more stringent definition where there is “joint work on tasks, creation of shared definitions, pooling and sharing of knowledge, and creation of emergent outcomes” (p. 6). Further, she argues that the feature that
distinguishes collaboration from other types of group activities is whether there is a desire on the part of the group to create new group knowledge. Key to Haythornthwaite’s definition is the idea that when the goal involves constructing knowledge, learning educationally-focused activity is collaborative because of the uncertainty of the task. This concept seems to be a critical dimension to which a number of the collaborative learning models discussed do not ascribe (i.e. discussion and argumentation, think-pair-share). One could argue that although some benefits do accrue from participating in Haythornthwaite’s coordinated learning, they are significantly less than the more stringent collaborative learning model. This is an important issue that will be revisited a number of times: namely the nature of the collaborative task, the directions for the task, and the means of assessing participation and interaction.

**Assessing collaborative learning.**

As discussed in chapter 1, assessing success or failure of collaborative learning efforts has predominately been done by measuring individual learning and group learning or performance (Slavin, 1996); while other studies have focused on measuring increases in social skills, collaborative skills or processes, or both (Kumar, Gress, Hadwin, & Winne, 2007). These are not the only measures that have been studied in relation to collaborative learning. Two other measures have received considerable attention: antecedent causal factors and interaction analysis.

**Antecedent Causal Factors**

Some researchers who have studied collaborative learning have looked at the collaboration activity and participation measures (i.e. Pimentel, Gerosa, Fuks and Pereira de Lucena, 2005). The idea behind their research is that the final learning results are a
function of antecedent collaborative activity. Thus using final learning performance as a measure may be leaving out the actual factors that are the causes of these learning results. Pimentel et al. (2005) looked at participation in an online course discussion forum using a grade-dependent measure that was the product of the number of comments multiplied by the quality-grade of each posting. In their multiple-year comparison they concluded that giving a grade and feedback resulted in better discussion comments. At the same time they found that including a quantity component in the discussion grade resulted in more comments without a decrease in quality under their system. A limitation of this study was that they did not correlate this increased discussion against any learning measure. For purposes of this study, a series of open-ended questions in the post activity survey was intended to provide information about such things as: either positive or negative references to participation, group dynamics and other members’ behaviors.

Interaction analysis.

Collaboration learning has also been studied by focusing on the interaction of the participants. The interaction measures include analysis of the semantic exchanges (verbal or written) as well as simply looking at the number and direction of the exchanges. One example of semantic analysis is the work of Pata, Sarapuu and Archee (2005). They analyzed the conversations (“discourse acts”) in synchronous chat rooms while groups were engaged in “dilemma-solving” problems. From this analysis, they argued that the participants and/or discussion tutor can provide positive (“scaffolding”) support that enhances collaborative discourse or, conversely, verbal actions that have a negative effect. They posit that we need to “develop a new understanding of multi-actor scaffolding for collaborative situations” (p. 492).
This interaction research supports the system view of the complexity of collaborative activity and interactions (Kumar, Gress, Hadwin & Winne, 2007). The current dissertation’s study involving pre-activity training attempted to influence the group interaction in positive ways; however, because collaborative interaction was not the focus of the current study, no intra-group communication semantic analysis or numeric interaction analysis was done.

_Missing Assessment Piece?_

As discussed in chapter 1, some research was found that focuses on students’ attitudes toward collaborative learning group work but it was of a limited nature (Addis, 2009; Cantwell & Andrews, 2002; Millar, Seth, & Sharma, 1999). What is significant for the current study is that of the small amount previous research on attitudes only a small portion of it has focused on assessing a student’s self-efficacy toward collaborative group work.

**Computer-supported collaborative learning.**

With the advent of the internet, there has evolved technology, pedagogy and research to support collaborative learning in online education. All the topics about collaborative learning discussed above have relevance to computer-supported collaborative learning (CSCL). CSCL encompasses a broad area of work focused on the application of collaborative learning in an online environment (e.g. Jonassen, Peck & Wilson, 1999; Koschman, Hall, & Miyake, 2001). Research about online group processes (Burtis & Turman, 2006) and more recently with wikis (Cunningham, 2004; Raman, Ryan & Olfman, 2005; Xiao, Baker, Shea & Allen, 2007) indicate that a number of elements including such things as learner attitudes, task characteristics and
collaborative skills have a strong influence on the success or failure of maximizing CSCL educational benefits. These important elements are also those that are important in face-to-face collaborative learning. Clearly moving collaborative learning to the internet is not a simple cut-and-paste exercise. The large body of research about distance education shows there are many pedagogical challenges in “simply” moving a class to the internet. If one adds to these fundamental challenges those imposed by collaborative learning then this clearly adds even more complexities.

**Collaborative learning summary.**

Collaborative learning has been shown to be a very valuable and versatile technique for improving learning and academic performance (Slavin, 1991). Collaborative learning and, its online-sibling, computer-supported collaborative learning have been found to have many challenges as evidenced by the increasing body of research focused on improving students’ behavior, learning and other outcomes related to these activities; for example, to name just a few: rush to superficial consensus and agreements (Weinberger, Ertl, Fischer, & Mandl, 2005, Nussbaum, 1998) and lack of attribution of partner’s contributions (Hewitt, 2005). What can one conclude about collaborative learning so far? First, the theories and techniques span quite a broad spectrum (Koschmann, 1996; Lehtinen, Hakkarainen, Lipponen, Rahikainen, & Muukkonen, 1999). It would be wrong to suggest that there is one “collaborative learning” theory or technique. Second, as will be outlined later, when one contemplates the scaffolds that can affect collaborative learning that the picture gets even more complex.
Self-Efficacy

Research on collaborative learning, as just discussed, generally involves assessing the achievement differences under different treatments (Springer, Stanne, & Donovan, 1999; Newmann & Thompson, 1987). Far less research has been found that looks at how a construct such as self-efficacy might affect or be affected by those same treatments. The construct self-efficacy provides the basis for the primary survey measurement tool used for the current study’s research. It is the initial self-efficacy measurement and change in this measurement that is key to the current research’s main questions. This section looks at a definition of self-efficacy, why it is thought to be an important construct, how it differs from other similar constructs, how self-efficacy is measured, problems with self-efficacy and finally, how it ties to collaboration and instructional scaffolding.

Self-efficacy defined.

Self-efficacy can be defined as a person’s belief about his or her ability to successfully function within a particular situation (Bandura, 1982, 1997; Pajares, 1996). By this definition self-efficacy could range from having very low self-efficacy, meaning a belief of little or no ability, to high self-efficacy, meaning having a strong positive belief in one’s ability. Self-efficacy, it is argued, is a primary component of our motivation (Bandura, 1982, Pintrich & Schunk, 2002). A key point to note is that self-efficacy is specifically focused on a belief about a particular task, goal or activity and not a general belief or attitude.
How self-efficacy differs from other similar constructs.

Attitudes might be considered the super-class for concept self-efficacy. A classic definition of attitude is that given by Allport: “An attitude is a mental and neural state of readiness, organized through experience, exerting a directive or dynamic influence upon the individual’s response to all objects and situations with which it is related” (1935, p. 810). The definition of self-efficacy advocated over many years by Bandura (1982, 1997) as described earlier, although simpler and narrower in a sense, would seem to easily fall within the broader conceptual class of attitudes. This connection is important because it allows the literature, theory and research findings related to general attitude change to be considered in regards to this study’s experimental intervention.

Attitudes, although of importance in most aspects of living, have, along with the related construct motivation, received much less attention from educators and educational psychology researchers than constructs seemingly more directly related to cognition and learning. Consequently, less work in the past has focused on how one goes about directly influencing attitudes and, by my theoretical argument, self-efficacy. In part this lack of research emphasis may stem from what some would argue is the belief that attitudes are somehow incidentally acquired in the course of more direct learning and experience (Gagné, 1985). Nevertheless, there has always (e.g. within recorded times) been some attempt to directly teach attitudes as part of a child’s education. This is evident in ancient religious writing, Greek and Chinese literature. A century ago, the “McGuffey Reader” (Westerhoff, 1982) had moral lessons that could be construed to be the teaching of attitudes toward God, parents, patriotism, etc. In more recent times, schools have taken over the role of attitudinal teaching about gender, diversity, bullying, etc. These more
recent attitudinal curricular goals have sometimes been considered to fall under something called the *affective domain* (Gagné, 1985; Krawthwohl, Bloom & Masia, 1964). The affective domain is thought to be that realm of teaching and learning dealing with emotions and internal attitude states.

There has been, at times, disagreement and even controversy about what and, even whether, attitude-related goals should be included in modern educational curricula (Gagné, 1985). However today it is more generally accepted that attitudes, and by logical extension from earlier discussion, self-efficacy, are something to be included in our curricula, either directly or indirectly. Martin and Reigeluth forcefully express the importance of emotions by stating “…modern theories of psychology and philosophy recognize more than ever the interrelationships among thoughts and feelings. Purposeful action is based on attention to both affect and cognition…” (Martin & Reigeluth, 1999, p. 488). Martin and Reigeluth also focus on what is called affective education. This group of theories and strategies emphasize emotional growth and well-being as desired curricular outcomes.

One conceptual view of attitudes, and by extension self-efficacy, considers them having three interacting components; those being cognitive, affective and behavioral (Gagné, 1985). The cognitive component would focus on the understanding or knowledge aspects of an attitude. Thus a person might have knowledge of how to do a study plan for a collaborative learning group, why it is important, challenges with doing one, etc. The affective component would relate to how one feels emotionally about some situation, goal or activity. An attitude such as self-efficacy would be measured on a continuum of negative-to-positive or weak-to-strong depending on the instrument being used.
used. Thus, continuing the group study plan, one might express a strong sentiment that a plan needs to be done or, conversely, that it is a waste of time. Finally the behavioral component relates to experience with and readiness or disposition to act. Thus one could have knowledge of the plan, and have generally a good attitude toward the plan, but might have no disposition to do one because one feels a plan in this situation would not be productive.

Another characteristic typology for attitudes/self-efficacy focuses on a number of key attributes; 1) latent character, 2) focused object 3) affective component 4) behavioral component 5) cognitive component and 6) stability/enduring (Bednar and Levie, 1993). Cognitive, behavioral and affective attributes were discussed previously; what follows is a discussion of the three attributes unique to this topology. Latent character describes the fact that attitudes such as self-efficacy “are not directly observable but rather are inferred from behavior” (p. 285). Attitudes/self-efficacy has something on which the belief is “focused;” it is not just a general emotion. Finally, attitudes are thought to be “stable and enduring” (p. 285); they do not change from day-to-day and are not easily manipulated or changed.

The affective taxonomy.

It has been argued above that self-efficacy is a type of attitude. Similarly, self-efficacy has many features in common with the affect domain or emotional component of cognition. By far the most well-known and used taxonomy of the affective domain is that developed by Krathwohl, Bloom and Masia in 1964. This affective taxonomy focused on an "internalization" principle in which an attitude or feeling becomes part of a person’s affective-cognitive configuration. This hierarchical taxonomy's five major categories are
receiving, responding, valuing, organization and characterization. At the time, a prime reason for this taxonomy’s development was to help in the writing of behavioral objectives encompassing the affective component of learning, cognition and behavior. A number of other affective taxonomies have been developed (i.e. Martin & Briggs, 1986; Brandhorst, 1976). Self-efficacy clearly has an emotional component in that it is a belief that can be strong or weak. The concept of levels of development of an affect, by the levels outlined (i.e. receiving, responding, etc.), suggests that self-efficacy may follow a similar pattern. Following this logic, one could argue that the first step in forming or modifying any affect and self-efficacy is the receiving of information or experience, responding to it and developing some level of value about it.

Brandhorst (1976) extends the classic Bloom et al.’s taxonomy in the cognitive domain and Krathwohl, Bloom and Masia's (1964) taxonomy in the affective domain to include one in the relational domain. He proposes six categories: conceptualization, evaluation, leadership, followership, role exchange-yielding, and role exchange-following. Brandhorst (1976) argues that "task oriented group activity requires leadership” (p. 4). He suggests leadership may be exercised through power-oriented sanctions, social persuasion and/or social influence. It is interesting to note that Brandhorst espouses that leadership skills are not natural and can be learned. It follows that he argues that these relational-domain skills should be included in our curriculum.

For purposes of this discussion, all these models of attitudes and affects seem to apply in the current research’s training intervention aimed at affecting the treatment group’s self-efficacy regarding group work by increasing their knowledge of collaboration skills/techniques and ways of looking at group activity. It was hoped that
this pre-scaffolding intervention, along with the opportunity to apply this information, would positively influence the motivational component as measured by the collaborative self-efficacy assessment instrument.

**The importance of self-efficacy.**

Bandura (2001) argues that what a person believes has a major impact on what they can achieve. If a person does not believe they can do something then they will have little incentive to even attempt it. He says:

To make their way successfully through a complex world full of challenges and hazards, people have to make good judgments about their capabilities, anticipate the probable effects of different events and courses of action, size up socio-cultural opportunities and constraints, and regulate their behavior accordingly. These belief systems are a working model of the world that enables people to achieve desired outcomes and avoid untoward ones. Forethoughtful, generative, and reflective capabilities are, therefore, vital for survival and human progress (Bandura, 2001, p. 3).

Bandura (1997) argues that humans vary in their competencies; each person is only skilled at some things. It follows from this limited competency argument that each human would have differing degrees of belief about his or her ability to act successfully in a particular situation. Thus a person who knows nothing about brain surgery would probably doubt that the surgery they are asked to perform on someone tomorrow would be successful. Conversely, the average person would have a high level of confidence that he or she can get back home at the end of the day successfully. Bandura's construct of self-efficacy is posited to be specific to a particular activity or situation as opposed to a
general attitude. He writes: "self-efficacy theory acknowledges the diversity of human capabilities. Thus he treats the efficacy belief system not as an omnibus trait but as a differentiated set of self-beliefs linked to distinct realms of functioning" (Bandura, p. 36, 1997). However, he does acknowledge that a person's perceived self-efficacy can be affected by a more general attitude. In other words, having high confidence in one's ability in academic learning situations may influence a high self-efficacy about success or failure in a particular class or academic activity. For this proposal self-efficacy provides a means of assessing the participant’s attitude toward collaborative learning activities.

Problems with the self-efficacy constructs.

Though there is a large body of research that positively correlates a person’s self-efficacy to performance (Bandura, 1997; Zimmerman, 1995, 2000), there is other research that tends to show how expressed attitudes do not correlate well with actual behavior (Triandis, 1971). One explanation put forth for this disconnect is that attitudes and behaviors are just not the same thing. Thus a person may say “I will not eat such-and-such,” but given the right situation the person eats that food willingly. The paper’s author expressed such a negative attitude toward cheese all through his childhood until he started dating a girl in high school who liked pizza; at that point, he started eating cheese willingly.

Other people point to further limitations of the self-efficacy construct (Bong, 1996; Heggestad & Kanfer, 2005). For example, Bong (1996) would argue that the extent to which self-efficacy influences motivation and ultimately academic learning, effort and achievement is somewhat hampered by the limitations inherent in the lack of a comprehensive motivation model. She critiques that there is a jumble of motivational
concepts that lead to confusion on how to measure motivation. She also criticizes the over reliance on self-reporting questionnaires. She states "We now have a number of reasonable, although far from complete, explanations of why two people may display drastically different reactions to seemingly identical experiences" (Bong, 1996, p. 149). She suggests viewing the motivation caused by self-efficacy as a dynamic process that varies over the course of an activity. She contrasts this with what appears to be snapshot-like measurement techniques employed in motivation/self-efficacy research (Bong, 1996).

Additionally, some have focused on the challenges of measuring self-efficacy because many times the person being queried does not really have much information about the task in question (Bong, 1996, 2006; Bong & Skaalvik, 2003). In measuring self-efficacy, Bong and Skaalvik (2003) argue that “if students are to report their likelihood of success on some impending tasks that are yet to be performed, they need to consider all the available information regarding these tasks. Otherwise, their judgments cannot be accurate because their performance on these tasks could well be determined by the situational affordances and constraints” (p. 25).

The classic book by Robert M. Gagné, *The Conditions of Learning and Theory of Instruction* (1985) contains an entire chapter on how attitudes and, by extension, self-efficacy are affected by instructional situations and events. Gagné argues that the “indirect (or complex) relation that attitudes have with human action means that their attainment and their modification pose difficulties” (p. 219). Further, he points out that because of the indirect nature of attitudes (i.e. self-efficacy), their assessment or measurement is difficult.
Another reason given for the attitude-to-action discrepancy is that the questions often asked are about other people or people in general (Gagné, 1985). The problem with this type of measurement is that people appear to come up with all types of thoughts, images and reasoning when asked questions that are too general. Gagné argues that questions should be phrased in terms of specific personal choices or attitudes. This seems in agreement with the previous section’s description of the means of measurement of self-efficacy; where it has been found that the question phrasing should be focused in a present or proximal future-tense and in as specific a description of the activity or situation as possible (Bandura, 2006).

Although the criticisms of the self-efficacy discussed above and the measurement issues discussed in the next section need to be kept in mind, the abundant evidence showing that measurement of self-efficacy correlates with and predicts performance of behavior and academics makes a strong case for its use in educational research (Bandura, 1997; Zimmermann, 1995, 2000).

The genesis of self-efficacy.

A key issue with the construct of self-efficacy regards it antecedent causes. In other words, what brings about high self-efficacy or, conversely, what causes low self-efficacy. Bandura (1997) lists four sources for the development of self-efficacy: mastery experiences, vicarious observation, social persuasion and affective-physiological state feedback. Although arguing for the value of mastery experience, Bandura seems to discount the effect of just acquiring more knowledge or skills in a domain. His emphasis avoids the simple concept that if you learn about something or how to do something you did not know to do previously that this is an antecedent to self-efficacy. Bandura’s
emphasis is on having had a successful mastery experience which is described in very active situated-behavioral terms. Thus, by this logic, you must have succeeded in applying some knowledge and have cognitively processed and reflected on this success for there to be a heightened self-efficacy. Bandura’s view is one of a complex, active, experiential, domain-situated view of experience. He views knowledge and skills, along with sufficient self-efficacy to apply them, as only a precursor to experience. It is the mastery of this experience that raises self-efficacy.

Some experimental evidence exists showing a moderate correlation between improved mastery of a skill-domain and increased self-efficacy. (Brannick, Miles & Kisamore, 2005). An experiment found that there was a .33 correlation between a mastery measurement before instruction and .49 correlation after a term-long learning experience. The authors argue that instruction facilitates self-efficacy as well as content mastery. Additionally, they suggest that more mastery experiences a person has in a domain, the better one’s calibration of the level of both mastery and self-efficacy. It is interesting to note that the pre and post-test correlation of self-efficacy was only .30. This implies that there was not a consistency in peoples’ self-efficacy over the course of the class.

In contrast to a small to moderate correlation between improved mastery and self-efficacy, Bandura (1982) cites evidence (Bandura, Reese & Adams, 1982) showing a high linear correlation between self-efficacy and performance. He argues that this is a bi-directional causation where high performance begets high self-efficacy and high self-efficacy begets high performance. This type of causal logic, although it may have some
truth, seems to be less than convincing in terms of other factors which come into play and affect both performance and self-efficacy.

A review of the literature leads to the conclusion that the genesis and means of effecting self-efficacy is multi-faceted, complex and far from well understood. See the section later in this chapter on training and self-efficacy for evidence that just learning more about a domain may also have a positive effect on self-efficacy.

Measuring self-efficacy.

Generally self-efficacy is measured through the use of some type of self-reporting questionnaire or scale (Bandura, 2006). Because self-efficacy is conceived of as context-specific and not a overall feeling of general competence, the questions used on such questionnaires must be crafted to the specific context or situation being measured (Bandura, 2006, Bong & Hocevar, 2002). Bandura states: "scales of perceived self-efficacy must be tailored to the particular domain of functioning that is the object of interest" (Bandura, 2006, p. 307-308). Bandura (2006) further specifies that questions measuring self-efficacy should focus on aspects that are within the control of the person. Thus one should not be asking about prior happenings, background experiences or personality characteristics. Additionally measurement should try to include questions covering as many of the controllable aspects as possible; because it is the composite of such aspects that comprises self-efficacy.

However, although it is easy to understand that general self-efficacy measures are not useful, finding the correct level of measurement specificity is not necessarily simple. First, Bandura (1997) delineates the importance of narrowing the domain activity in measuring self-efficacy. For example, he reports that asking a student about their
perceived general academic competence is too broad because students can differ on this measure between subjects (i.e. mathematics, sciences, literature, etc.). His argument is that students may have much different perceived self-efficacy about math and literature; so asking them their self-efficacy about succeeding at school may not be predictive of how they feel about, and therefore perform at, a particular subject. He states that “general items linked to major activity domains are an improvement over omnibus measures that are disassociated from clearly defined activities” (p. 48). Later he seems to contradictorily state: “self-efficacy is commonly misconstrued as being concerned solely with ‘specific behaviors in specific situations.’ This is an erroneous characterization” (p. 49). In what applies more to the current study’s research, he says:

> In many situations, self-efficacy theory seeks to explain certain classes of performance within generic or prototypic classes of settings. For this purpose, people judge their efficacy across the full range of task demands within a given domain of functioning with items cast at an intermediate level of generality (Bandura, 1997, p. 49).

Within the current research it is important to try to define those “range of task demands” as defined by Bandura in the preceding quote. As Bandura suggests: “self-efficacy for a specified domain of functioning is usually assessed at the intermediate level of generality...” (Bandura, 1997, p. 49). Therefore, increasing the specificity of the self-efficacy assessment may lead to a more accurate prediction of performance in that specific situation; however, as mentioned earlier, overly specific assessment may result in a measure of self-efficacy for a domain that is not representative of the more general cases of activity within a domain. In other words, getting some measure of a person’s
self-efficacy about working with a particular group of people on a particular common task, which has been done before, may not be giving an accurate measurement of how a person feels about working on a future general collaborative learning activity for which less is known. Since the students in this study had not worked together with their assigned group-mates before and had not worked before on a project with the characteristics of the mini-teach lesson, it would make little sense to ask them to assess their self-efficacy at too detailed a level. Also, since the goal of this study was not to predict behavior, as is common in some types of self-efficacy studies, but rather to assess initial values and changes in self-efficacy attitudes, a more intermediate level of specificity would seem to be in order. One challenge in this current study was that the concept of collaborative self-efficacy has not received a lot of research attention. Thus in trying to define the self-efficacy-related sub-activities encompassed within a collaborative learning activity, it is necessary to try to combine the knowledge, skills and attitudes that come from the literature on group work with the much smaller literature available from the collaborative learning field.

Additionally measurement should try to include questions covering as many of the controllable aspects as possible; because it is the composite of such that comprises self-efficacy. Further, perceived efficacy "items should be phrased in terms of can do rather than will do. Can is a judgment of capability; will is a statement of intention" (Bandura, 2006, p. 308).

**The Specificity of Collaborative Self-efficacy.**

The previous discussion on self-efficacy may leave the reader with the impression that this construct is the same as general attitude, self-esteem or self-concept. This, in
turn, might lead to a false assumption that a person who is usually regarded as a “positive” person will generally remain positive in other situations; thus implying that a person’s self-efficacy about one situation, activity or challenges will be similarly highly correlated to the person’s self-efficacy about other situations, activities or challenges. This has not generally been thought to be theoretically or found experimentally to be the case (Brockner, 1989; Bandura, 1997). Bandura argues that self-efficacy is a specific feeling of competency related to a specific situation. Thus, for example in this current research, the self-efficacy of one of the participants might have about his or her use of a computer technology like a spreadsheet (i.e. Excel) would not be expected have any correlation to the person’s self-efficacy about functioning in collaborative learning groups.

**How self-efficacy relates to collaboration and instructional scaffolding.**

There is ample evidence of the important role self-efficacy beliefs play in human behavior and academic performance (Bandura, 2006; Pajares, 1995). What has received little attention and remains unclear is what level of collaborative self-efficacy is held by college-level students. Further, as indicated in the discussion above on self-efficacy, it is unclear whether increased knowledge about collaboration will increase a person’s self-efficacy. The list of instructional interventions that affect academic self-efficacy is large. For example, instructors can provide pre-activity process goals along with feedback on progress (Schunk and Swartz, 1993). Teachers can set proximal versus distal goals for students (Schunk, 1983). Much research on self-efficacy has the intervention occurring during the learning activity; however, some of the treatments occur before the activity (Cheung, Li, & Yee, 2003). The research on pre-activity scaffolding is sparse although
that which is available would seem to indicate that self-efficacy is not only about what happened on past activities but also what is happening in relation to the current situation. Additionally, classic works on collaborative learning provide emphasis on the importance of training of students in collaborative knowledge and skills prior to collaborative learning activity (Johnson & Johnson, 1987a, 1989, 1999a, 1999b). It is a natural synthesis to raise the question of how pre-activity collaborative skills training might affect learners’ self-efficacy.

**Instructional Scaffolding**

*Instructional scaffolding* or, as sometimes used in education, just the word *scaffolding* is, in a broad sense, a term used to describe any help provided to a student to increase learning or to enable them to do something they would not be able to do or to do as well without the instructional scaffolding. The term instructional scaffolding is somewhat of a *tautology* (Liska, 1969) in that if some educational technique, action, resource or object helps the learner/student do or learn something, it can be considered as representing a scaffold; if it does not help, then it might not be considered a scaffold. Scaffolding is commonly associated with social-cultural theory as outlined in, and derived from, the writings of Vygotsky (1962, 1978) focused around the concept of the zone of proximal development [ZPD]; although others attribute the first explicit use of the scaffolding metaphor and term, in an education sense, to an article written by Wood, Bruner, and Ross in 1976 (e.g. Dennen, 2004). The parallels between these two concepts have been noted and acknowledged for many decades (Rogoff & Wertsch, 1984; Hogan & Pressley, 1997).
In the beginning Wood, Bruner and Ross (1976) delineated six steps to take when scaffolding learning: arouse a child's interest in the learning task; introduce the task at the student's level; help the learner stay on task; make critical aspects explicit; encourage autonomy by the student; and demonstrate or provide examples. Three trends have taken place since the term was initially introduced into education. First, the scaffolding concept has become a primary component of a student-centered, one-to-one, constructivist pedagogy (e.g. Hogan & Pressley, 1997). A second trend has been a broadening of the term instructional scaffolding to encompass any type of help; this is the stance emphasized within the current study (Puntambecker & Hubscher, 2005). This usage is in keeping with the more broadly defined use of the term, for example: "scaffolds, according to their original meaning within educational psychology, include all devices or strategies that support students' learning (Rosenshine & Meister, 1992)." (van Merrienboer, Kirschner & Kester, 2003, p. 5). The third trend is characterized by some having suggested that the term has become too broad and that it should be returned to its more narrow original definition (e.g. Stone, 1998; Palincsar, 1998). Pea supports this view by saying: “I am perhaps not the only one who feels that the concept of scaffolding has become so broad in its meanings in the field of educational research and the learning sciences that it has become unclear in its significance” (Pea, 2004).

Instructional scaffolding for collaborative learning, as defined in the broad sense, can be of numerous types. As two researchers in the field put it: “Scaffolding is no longer restricted to interactions between individuals – artifacts, resources and environments are also being used as scaffolds” (Puntambekar & Hubscher, 2005). Many scaffolds on this now expanded list can be applied conceptually and practically to either a
single student or a collaborative group, while some are most applicable to only individuals. In fact, many of the collaborative learning pedagogies and CSCL tools and software can really be considered some form of scaffolding. The discussion of instructional scaffolding is particularly relevant to this current study’s questions because reviews of research in collaborative learning suggest that many of the scaffolds discussed below can affect a group’s educational and group-process outcomes (Cohen, 1994). Similarly, by influencing the outcomes, these scaffolds should, by extension, affect a collaborative learning participant’s “experience,” thus ultimately influencing his or her collaborative self-efficacy.

**Scaffolding typology.**

Instructional scaffolding can be grouped in several ways. One grouping is related to whether the scaffolding is focused on the group or individual. Another way to look at scaffolding is the timing of the scaffolding in relation to the collaborative activity: pre, concurrent, post. Still another way to organize types of instructional scaffolding is to determine whether it is focused on the task or activity, on technology or on training. The following diagram (Figure 2) gives a visual representation of some of the common ways to categorize instructional scaffolding.
<table>
<thead>
<tr>
<th>Type of Scaffolding</th>
<th>Activity / Task / Structure</th>
<th>Technology-Based</th>
<th>Training-Based</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timing</td>
<td>Pre-Activity</td>
<td></td>
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<tr>
<td></td>
<td>Concurrent</td>
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<tr>
<td></td>
<td>Post (i.e. feedback)</td>
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</tbody>
</table>

Group or Individually Oriented/Focused Scaffolding

Face-to-face or Distance-Based

Figure 2: Typology of scaffolding collaborative learning.

It should be noted that the above typology of instructional scaffolding is not nearly this neatly represented in actual practice. Many collaborative learning situations involve scaffolds of multiple types and timing. Following is a discussion of some of the most common types of scaffolding used in collaborative learning.

*Task-goal-directions scaffolding.*

The collaborative task, goal and directions form a type of scaffold, in that these all influence other possible scaffolds and factors. If the task or goal is too simple, then few or no scaffolds will be needed. If the task or goal is too complex then an extreme number of other scaffolds may not be enough to insure a successful learning experience for the students.

In collaborative learning the task or goal is commonly in the realm of project-based, case-based, problem-based or inquiry-based pedagogy (Sternberg, 1996). All of
these types of learning tasks can be characterized as being complex, ill-defined and/or open-ended (Osada & Miyake, 2005). Additionally some would suggest that the underlying goal of these types of tasks is collaborative knowledge building (Hewett, 2001; Stahl, 2001). In spite of this goal, Hewitt suggests that merely providing one of the “-based” tasks (i.e. project-based, case-based, etc.) does not necessarily result in knowledge building but rather many times it results in a much less desirable educational process that he terms “knowledge-telling” or “copy-delete” (p. 15). Knowledge-telling is a low-level cognitive function where a person simply tells something they already know. Copy-delete is a technique that looks like summarization but is really just cut-and-paste used extensively with little or no cognitive process such as rephrasing, analysis, synthesis or evaluation added.

What and how a student is directed to do a task can have a big impact on what is done and learned (Eggen & Kauchak, 2007). More specifically, one scaffold that has been shown to affect online argumentation collaboration involves manipulating the directions or goals set for the student (Nussbaum, 2005). The research evidence would also support the task goal (directions) in CSCL as being important in the resultant collaborative processes and products (Cohen, 1994). Bandura (1986) argues that a person’s self-efficacy combines with his or her goals to significantly affect motivation to engage in a learned behavior. Further the goal’s characteristics clarity, appropriate level of challenge, temporal proximity affect the level of motivation (Bandura, 1997). Thus too few or incomplete directions result in the student not having a clear understanding of what is expected, which can cause uncertainty, frustration, and lack of effort with its resultant poor learning outcomes.
Directions are also very important in a complex and sometimes ill-structured task such as those used in many collaborative learning activities. In such collaborative learning situations the directions given to the group will have an impact on how the students behave (Johnson, Johnson, & Holubec, 1990). What is emphasized in instructions will focus most students on that aspect of a group task. Likewise, aspects of a task that are not emphasized may get less effort. Also, if students are confused by directions, they may have a tendency to hesitate or do very little. The key point of the tasks, goals and directions used as scaffolds to increase learning is that they must be structured to encourage the student to higher levels of cognitive functioning. These components of a collaborative learning activity are such fundamental scaffolds for learning that they are often overlooked.

The concept of directions had an influence on the design of the current research. The instructional intervention used could, in some ways, serve as a type of implicit directions to the students who experienced it. The intent of the training was to focus the students’ attention on the group-skills aspect of the collaborative activity while they were engaged in it.

**Group rewards.**

Group rewards (Johnson et al., 1990; Slavin, 1983) have been shown to have a significant effect on collaboration. If a student has the belief that his or her rewards are based solely on individual learning, products or achievements, then there is little incentive to collaborate. There are differing views and research results relating to whether extrinsic rewards should be used in individual educational situations (Eggen &
Kauchak, 2007). A review of the research makes it less clear if rewards play a significant role in collaborative learning situations.

**Individual responsibility.**

Individual responsibility (Johnson et al. 1990; Slavin, 1983) is the counter-force to group rewards in collaborative learning situations. Since individual learning is the major goal of the JJH model, it follows that using appropriate scaffolding related to how a group participant will be individually assessed may be very important to successful collaboration.

**Grouping.**

How groups are chosen is an important factor in the outcome of any collaborative learning situation. The first dimension to consider is size. The smallest group of two people defines the classic dyad that covers collaboration including tutoring. Too large a group can make collaborative learning difficult. Mandel (2003) suggests the following rules about group size: three-person groups tend to be problematic, groups of more than seven are unwieldy, four to six-member groups allow for diversity. He suggests further that even-numbered groups are usually better because they will generally lead to more conflict-generated negotiations; which he views as positive.

Another dimension to group selection is whether they are heterogeneous or homogeneous. There are conflicting research results and theories as to which is better, so it remains an open question. Generally the group composition is affected by the goals of the desired collaborative learning activity. For example, a heterogeneous group may be beneficial in an elementary discovery-learning collaboration but not in a novel reading group. In the former group, the varying degrees of skill and different viewpoints may be
helpful whereas in the latter it may cause difficulty because the skill level required to read a particular novel may not be appropriate for some portion of the group.

**Scripting.**

The term scripting in a scaffolding context refers to various means of prescribing a series of behaviors a person or a group should take in trying to accomplish a particular task (i.e. Schank & Abelson, 1977; O’Donnell, 1996). As with many other types of scaffolds, scripts can be shown to a person before the activity to which the script applies or they can be shown contemporaneously with each step of the activity. The research shows that such scaffolds can be effective in increasing the behaviors, at least in the short term (O’Donnell, 1996; O’Donnell et al., 1990; Weinberger, Ertl, Fischer & Mandl, 2005). Scripting has become a popular means of scaffolding collaboration in the online education (e.g. CSCL) world (Fisher, Kollar, Mandl, & Haake, 2007).

Scripting could be considered a type of direct instruction in the sense that a script tells the person following the script “exactly” what should be said or done. For purposes of the questions, which are the focus of the current study’s research, a scripting approach was not used. However, although not the design intention, one might interpret some of the items in the computer-based pre-activity training as having a rudimentary script-like nature. For example, suggesting how a person should provide feedback could be considered a type of script.

**Simulations.**

Some people have developed simulated environments for teaching complex social skills such as management, diplomacy and selling (Kass, Burke, Blevis, & Williamson, 1993). These people would argue (following Lave & Wenger, 1991) that complex skills
need to be taught in a situational context close to that in which a person is expected to perform the skills. One interesting simulation system is “YELLO” which provides opportunities to learn about and experiment with social tasks (Kass, Burke, Blevis, & Williamson, 1993).

**Training/Prerequisites.**

Training can be considered an instructional scaffolding. For example, Rittle-Johnson and Koedinger (2005) provided pre-activity scaffolds, which they classified as contextual, conceptual, and procedural, to support 6th-grade students learning to do fractions. In this design experiment they concluded that all three types of scaffolding "are promising tools for improving student learning" (p. 313).

Others have written about how to provide “explicit statements adjusted to fit the learners’ emerging understandings about what is being learned (declarative or prepositional knowledge), why and when it is used (conditional or situational knowledge), and how it is used (procedural knowledge)” (Hogan and Pressley, 1997, p. 17). This description would seem to fit with the design of this current experiment’s instructional interventions. The current study’s tutorials provided information that fit all these criteria except for not being individualized to each learner.

Arguments and evidence have been provided previously suggesting that most students of any age have gaps in their collaborative skills and knowledge. In this section two concepts will be advocated. The first concept stresses that pre-activity collaborative skills training is scaffolding and it needs to be considered and used by educators in their collaborative activities. Secondly, scaffolding by training is one means of potentially increasing any student’s collaborative self-efficacy.
One thing a teacher can do to scaffold an increase in learning from collaborative activities is to assess the student’s pre-task collaborative skills and knowledge and, if necessary, provide direct training in those skills (Johnson & Johnson, 1987a, 1999a). This assessment can help to determine if the student has the required pre-requisite skills and knowledge necessary to allow for successful group functioning and for learning to take place (Cohen, 1994; Dick, Carey, & Carey, 2005). The scaffolding provided by collaborative skills pre-training can occur at any level of Bloom’s taxonomy (Bloom et al., 1956) (i.e. knowledge, comprehension, analysis, etc.) that is applicable to the situation. Similarly, assuming that sufficient pre-requisite skills or knowledge is not present then training can be focused on providing the student with that needed knowledge or skill. Additionally, training could be focused on group-interaction skills and strategies by direct instruction, role-playing or videotapes (Fitch & Semb, 1992; King, 1999).

Earlier, in regards to self-efficacy, it was proposed that it was a logical extension to suggest that increased knowledge about a task should generally have the effect of increasing one’s belief in being able to successfully do the task. Somewhat surprisingly, this method of increasing self-efficacy does not seem to play a prominent role in Bandura’s writings about self-efficacy (i.e. 1982, 1997). Nevertheless, one can find models that are focused on changing affect, attitudes and motivation, in which increasing the person’s knowledge plays a key role. Bednar and Levie (1993) state that changing an attitude has a “cognitive component” (p. 285). Further they state that this component is teachable. They, as do others (i.e. Johnson & Johnson, 1987a), point out that many times information is insufficient to bring about attitude adjustment or affect change. Bednar and Levie point to the importance of informational message design in affecting attitudes.
Some attributes considered as having a positive effect on attitudes include: high-credibility sources, well-structured arguments, congruence of message with learner’s goals, explicitness, and repetition. Johnson and Johnson (1987a) in their description of the steps to follow in learning group skills (and by extension teaching them) list the first two as cognitive steps: “understand why the skill is important” and “understand what the skill is and what are the component behaviors” necessary (p. 21). It is on the basis of these models that the current study’s training-treatment intervention rests. The premise is that supplying new information about an activity or skill, when necessary for the activity, would help increase individual self-efficacy about the activity. It is hypothesized that this would occur in two ways; directly and indirectly. The direct way is that if a person knows more about how to do something it should increase self-efficacy. The indirect way is that if a person has increased knowledge about how to do something and then has a chance to apply that new knowledge then the performance and result will be positive. The indirect means tie to Bandura’s concept, discussed earlier, placing prior experiences in a primary-causal role in self-efficacy beliefs. In the current research the participants who received the collaboration training treatment were exposed to new information and therefore, it was hoped, should have increased their knowledge and, at the same time, had a chance to apply this new knowledge in the Mini-teach collaborative activity in which they participated. It was hypothesized that the combination of new knowledge and application of this new knowledge should increase the participant’s post-activity measures of collaborative self-efficacy.
**Research on the Experimental Environment**

The current study’s research was situated within 4 sections of a university class for pre-service teachers titled “Preparing Teachers to Use Technology.” Within these sections the collaborative activity, around which the current research was centered, had the title: “Innovations Mini-Teach” (Grove, Foulger, Wetzel, Archambault, Williams, & Strudler, 2008; Williams, Foulger, & Wetzel, 2009). The same class activity in a previous semester was studied with a focus on differences between the online and face-to-face versions (Addis, 2009). In a qualitative analysis, Addis reported that “face-to-face students reported positive experiences collaborating on the project…” (p. 100) while “online students reported that the collaborative nature of the project was what they enjoyed the least, and, for some online students, this was detrimental to their performance on the project” (p. 100).

**Research on Other Issues**

**Secondary versus elementary teacher characteristics**

The experimental participants used in this study were enrolled in either a class for elementary or secondary teacher candidates. This raises the possibility that these two groups were different for purposes of this study. In order to investigate whether this division could be important, a review of the literature was done addressing the possible differences between these two types of education majors.

A great deal of research has been done on the characteristics and beliefs of pre-service teachers (Brookhart & Freeman, 1992; Pajares, 1992). Brookhart and Freeman’s study lists 30 studies done between 1970 and 1990. In these studies, the most common variables investigated were motivation for teaching, background and beliefs about
teaching. Somewhat surprisingly, no extensive research was found that differentiates or, more specifically, contrasts elementary and secondary pre-service/practicing teachers. Pigge and Marso (1987) did find that students majoring in elementary-education reported significantly higher anxiety about their ability to teach than those majoring in secondary-education.

However, one study did look at the personality differences between elementary and secondary education majors using the Myers-Briggs instrument (Sears, Kennedy & Kaye, 1997). This research found that elementary majors fell mostly in the Myers-Briggs category of Sensing-Feeling-Judgmental category; while secondary majors were predominately in the Intuitive-Thinking group with either the judgmental or perceptive attribute. Additionally, they found that both levels of education majors were predominately classified as extroverts. Sears, Kennedy and Kaye did suggest that one conclusion of their findings was that secondary student teachers had an “intuitive and thinking nature, which inspires them to seek solutions to complex problems, intimates that in contrast to elementary teachers, they possess greater potential to advance educational innovation and reform” (1997, p. 201).

Further research found another characteristic that does differ between elementary and secondary-teacher candidates; their expressed reason to teach (Book & Freeman, 1986). Elementary-teacher candidates’ reasons were described as more child-centered whereas secondary-education candidates were more subject-focused.

Finally, a quote from Pigge and Marco’s research raises doubts on any consistent difference within teachers and therefore groups of teachers: “the data collected in this study clearly support the contention of Fuller and Brown (1975) that despite the
possession of some common attributes, teachers (and prospective teachers) as a group are a ‘heterogeneous lot’” (1987, p. 114). Thus, for purpose of the current study’s research, a tenuous hypothesis is that elementary education majors might be more focused on or sensitive to interpersonal relations and therefore they might have more favorable attitudes toward collaborative learning. However, the scarcity of research and the tenuous nature of the theoretical connection to collaborative learning suggest that no predicative logic is suggested for the current study’s research.

**Nature of students: Face-to-face versus distance-education.**

There were two types of classes involved in the current study: face-to-face and distance-education. One of the experimental questions asked whether the collaborative self-efficacy, as measured in the collaborative self-efficacy survey, would be different between those students taking face-to-face versus those taking distance-education classes. One of the obvious questions one might ask is whether there are differences in any characteristics, besides collaborative self-efficacy, between the students who enroll in distance education over those who enroll in face-to-face classes. A very limited quantity of research focusing on class-type differences was found; however, a great deal of research has looked at student characteristics in an attempt to understand why students drop-out of distance education classes (e.g. Parker, 1999; Rovai, 2003). Somewhat related to the current study “Ross and Powell (1990) reported that females tend to be more successful in online courses than males. Rovai (2001) found similar gender-related differences in an online course and explained them as differences in communication patterns and sense of community” (Rovai, 2003). This might indicate some gender differences related to class-type, but unfortunately no such comparison was done.
Rowntree (1995) hypothesized that those who were successful at distance education have good interpersonal skills but provides no experimental evidence for this conjecture.

Wang and Newlin (2002) provided some interesting experimental data indicating that a student self-efficacy rating about how well they thought they could handle an online class was positively and significantly related to the earned grade and the amount of online interaction in which they participated. Although supportive of the significance of the predictive nature of this type of self-efficacy measure, the study did not compare face-to-face students on this characteristic.

Learning styles were found to be different between students in different class types (Diaz & Cartnal, 1999). There was a significance difference with the distance education student showing a preference for independent over dependent style. At the same time the collaborative component of learning style was not found to be significantly different although they did find the following:

The online students also displayed collaborative qualities related to their need for structure (dependence) and their willingness to participate as good class citizens (participant dimension). Thus, although online students prefer independent learning situations, they are willing and able to participate in collaborative work if they have structure from the teacher to initiate it… in contrast, the traditional class students had collaborative tendencies related to their needs to be competitive, and good class citizens. In other words, they were interested in collaboration to the extent that it helped them to compete favorably in the class and to meet the expectations of their teachers. Thus, collaboration was tied to obtaining the rewards of
the class, not to an inherent interest in collaboration. (Diaz & Cartnal, 1999, p. 133).

The Diaz and Cartnal study is intriguing in that it found some difference between
distance and face-to-face students. The Diaz and Cartnal study’s usefulness is limited
because the measuring instrument (Grasha-Reichmann Student Learning Style Scales;
Hruska-Riechmann & Grasha, 1982) used does not apply well to the current study’s focus
on collaborative self-efficacy measurement of collaborative attitude, skills and
knowledge. In spite of the limitations of the measures used in the Diaz and Cartnal study,
it does suggest that the type of students enrolled in distance as opposed to face-to-face
classes may have some type of different personality or attitude characteristics related to
collaboration and that the current study’s results might find differences in the two class-
types self-efficacy measures.

**Focused Research**

This section contains research that involves at least two of three components of
collaborative learning, self-efficacy and instructional scaffolding (mainly training). It is
hoped that the earlier individual reviews of these three major constructs will make the
following discussion about *focused research* more understandable and more informative
about the current study’s design.

**Positive results from collaboration.**

Neo (2003) presents evidence that a collaborative learning environment provided
benefits for first-year college students including increased critical thinking skills and
problem-solving. In Neo’s experiment, just the act of collaborating was given the credit
for the benefits found; no additional training or scaffolding was used. This technique or
strategy could be referred to as the no-scaffolding model; in other words, just put people together and have them work collaboratively. Key provisions of the collaborations in Neo’s research that were different from most collaborative learning activities included: students formed groups of their own choosing as well as the longer than usual time frame (eight weeks). The impact that being able to choose one’s own group membership is different from the way groups were chosen in the current research’s class environment; where students were assigned to groups by the instructor. In Neo’s study, student attitudes about the collaborative work indicated that the vast majority, 86%, felt that they preferred to work in groups; although somewhat contradictorily, 36% felt that “teamwork kept them from doing their best work” (p. 471). Using the results from Neo’s research findings, it was hoped, might provide a comparison point for this study’s measurement due to a number of similar self-efficacy related questions.

**Self-efficacy and academic performance.**

The relationship between online-learning self-efficacy measures and academic performance in an online learning environment has been found to be complex (Bates and Khasawneh, 2007). Bates and Khasawneh, using a modified computer self-efficacy measure based on Compeau and Higgins (1995), found that self-efficacy correlated significantly with such positive measures of performance as hours spent on assignments, mastery perceptions, etc. Significantly, prior experience was the strongest predictor of performance; thus supporting Bandura’s (1997) model of self-efficacy. In support of their research, they make the statement: “there is a general paucity of research directly examining the antecedents of self-efficacy…” (p. 188). This quote, the research, and associated discussion above, suggests that “prior experience” can involve a number of
components that are supportive of the case being made in this study for the need for increased training prior to collaborative learning activities.

In addition to the issue of complexity is the influence that training has on self-efficacy as reported in a study by Potosky (2002). Potosky found that such things as “computer playfulness, computer knowledge and performance during training” interacted with the training to result in differential changes in self-efficacy.

In spite of the complexity indicated by some research, self-efficacy has been found to be of greater importance than many other variables (i.e. gender, health problems, challenge-threat rating, etc.) as a predictor of academic performance (Chemers, Hu & Garcia, 2001). Chemer et al.’s study involving measurement of academic self-efficacy and seven other variables obtained from entering 1st-year university students, found that self-efficacy had the highest correlation \( r = .51 \) related to self-rated academic performance and the second highest correlation \( r = .35 \) to faculty ratings of academic performance at the end of the first quarter and at the end of the year. Academic expectations had the second highest correlation to self-rated academic performance \( r = .36 \) and high-school GPA had the highest correlation to faculty ratings \( r = .45 \). Self-efficacy was measured using an eight-item measure with a 7-point Likert scale. The self-efficacy questions focused on skills judged to be pertinent to academic achievement. Their research is supportive of this proposal’s contention that self-efficacy is an important factor in academic performance. Additionally, their study’s instrument features are supportive of the current research study’s methods.

Pajares (1996) in his review of “Self-Efficacy Beliefs in Academic Settings” reports on numerous studies supporting the idea that self-efficacy is important in predicting academic performance. Although the evidence is far from unequivocal and many issues remain, the
following quote epitomizes the dominant findings of the many studies he cites: “Pajares and Miller (1994) reported that math self-efficacy had stronger direct effects on mathematics problem solving ($\beta = .545$) than did self-concept, perceived usefulness, or prior experience” (Pajares, 1996, p. 554).

**Collaboration and self-efficacy.**

There have been many studies supportive of the importance of self-efficacy in academic performance. However there are few that combine both collaboration and self-efficacy. A paradoxical study involving both cooperative learning and self-efficacy found that cooperative learning groups did not have increased learning of “database modeling techniques” as compared with students who learned the material individually (Ryan, Bordoloï, & Harrison, 2000). Ryan et al. state that: “experimental data… does not show that [the] cooperative learning approach makes a unique contribution to self-efficacy development” (p. 18). Although, self-efficacy is not learning, this finding runs counter to the majority of the findings that show improved academic learning with collaboration (Springer, Stanne, & Donovan, 1999; Newmann & Thompson, 1987). It is interesting to note that the description of their experiment gave no indication of any positive interdependence being required of the students; such interdependence is considered by some people to be essential for good collaborative learning (Johnson, Johnson & Holubec, 1990). However, their study did find that increased self-efficacy was positively correlated with skill training as assessed by a skill achievement measurement. Ryan et al. summarized their findings by writing: “the data from this experiment showed that self-efficacy is significantly related to acquiring skills in conceptual data modeling” (Ryan, Bordoloï, & Harrison, 2000, p. 18). Their study,
although not supportive of collaborative learning, does support the effect that learning new skills has on self-efficacy; which was a primary hypothesis of this study.

Another study utilized teenagers working cooperatively online to look at a number of before and after attitudes including questions that had a collaborative self-efficacy nature (Wang, Poole, Harris, & Wangemann, 2001). This study involved 27 volunteer students collaborating to develop high-tech related marketing plans, with the help of six onsite and four online adult mentors. The study found that students showed moderately-high confidence (e.g. self-efficacy) in collaborating. For example, they rated “I feel very confident in my ability to work with a team of other youth online in solving a problem or completing a task (p. 208)” at 4.07 (pre) to 4.32 (post) average rating on a 5 point scale. Additionally, these students expressed liking and valuing of collaboration by responding at an average rating of 4.15 (pre) and 4.09 (post) to the question “I really like working in cooperative groups in school (p. 209).” This study would be a good example of Bandura’s idea of self-efficacy being influenced by mastery performance (e.g. hands-on) experience, modeling and persuasion. Part of the time spent on this project, involved the participant receiving a day of on-site training. Additionally all mentors were given training about general collaborative skills such as team-building, communication, problem-solving, etc. and also about the group’s project-focused goals. This study is valuable in that it provides some of the limited quantitative information about both collaborative self-efficacy and the liking-valuing of collaborative activities found in the literature. On the other hand, the nature of the participant age, recruitment, training, extensive mentoring, to name just a few differences, make direct comparison to the current study’s environment difficult.
Collaborative-learning focused training.

A few studies were found that focus on teaching collaborative skills to students and then measuring the effects in their subsequent collaborative groups activities. Gillies and Ashman (1996) studied the effect of a 45-minute training period focused on “behaviors needed to facilitate members’ participation in the group” (p. 189) followed on the second day with a 45-minute period for practicing the behaviors. The training “components discussed included breaking each group activity into smaller components with each group member accepting responsibility for completing that component, encouraging equal participation by everyone, and sharing resources among the group members” (p. 189). The second day of training included practicing of such skills as listening, providing constructive feedback, sharing tasks, clarifying differences of opinion, seeing different perspectives, monitoring and evaluating group processes. The control groups were given time to “discuss how they were going to work together” (p. 190). The groups were then video-taped periodically over a 12-week period. It was reported that for 7 of the 10 positive cooperative behaviors, the trained group was significantly better. "The results showed that the children in the trained condition were consistently more cooperative, responsive to the need[s] of their peers, and provided significantly more explanations to assist each other than their peers in the untrained condition" (p. 198). Additionally, the authors concluded that their study was a “demonstration of how easily small group processes can be developed in real classroom situations, and how effective this is in developing children's social and academic skills" (p. 199). For purposes of the current study, Gillies and Ashman’s study would seem to

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support the idea of pre-activity instructional scaffolding as having the potential to effect on subsequent group behavior.

Rummel and Spada (2005) utilized an “instructional approach to promoting collaborative problem solving” (p. 201). Their research was situated within a computer-mediated environment. Their study consisted of comparing learners in four conditions: 1) those trained with “elaborated worked-out collaboration example[s]” (p.201); 2) those who utilized a concurrent scripted collaboration interaction; 3) those who participated without either training or script; and 4) those who did not get any training, scripting or collaborative experience. In one interesting finding, they noted that on the measure of “quality of problem solving” that pre-training was significantly better than concurrent scripting. They also concluded that pre-activity observation of “worked-out collaboration examples can be a promising way to promote collaborative skills” (p. 235). Additionally, in support of the current study’s research, they state that “complex cognitive skills can be acquired if performance is scaffolded externally in the beginning and the support is later faded out” (p. 235). In another interesting conclusion, the authors noted that while some of their dyads appeared to collaborate successfully without any training or support, “most of the dyads only succeeded with instruction” (p. 236).

Training and self-efficacy.

There have been a number of studies focused on the effect of training on self-efficacy. Various types of training have been used in these studies. For example, research measuring task self-efficacy has used collaborative tutoring, a type of behavior modeling, as the training mode (Day et al., 2007). This research looked at the influence of a more experienced video game (Space Fortress) player-collaborator’s effect on the
self-efficacy of novice players as compared with those playing and practicing individually. In terms of the types of scaffolding described earlier, this collaborative training might be considered a type of concurrent scaffolding. The measure of self-efficacy was the average score on a 12-item Likert scale with choice levels from 1 (strongly disagree) to 5 (strongly agree). Questions were similar to “I can meet the challenges of Space Fortress” and “I am confident that I have what it takes to perform Space Fortress well” (p. 1136). Their research compared individuals who had initially low self-efficacy to those who had initial high self-efficacy. Overall results indicated that collaborative tutoring resulted in better performance and increased self-efficacy for those who started with low self-efficacy. For those with high initial self-efficacy, the collaborative tutoring did not result in significantly better performance or an increase in self-efficacy. Their study suggests that the effect of any type of scaffolding, pre-training or concurrent, may have a differential effect depending on the person’s initial self-efficacy.

Research has also provided evidence of the effect of pre-training scaffolding as opposed to the concurrent scaffolding just discussed. Chou & Wang (2000) studied the “influence of learning style and training method on self-efficacy and learning performance” (p. 455) in a “homepage design” classroom environment. They compared “instruction-based” to “behavior modeling” training given to 10th graders in a three-session format. Each session consisted of one hour of training, followed by a thirty-minute practice period, and finally, a thirty-minute applied-test on developing a web-page design. Computer self-efficacy was measured at the beginning of the experiment and at the end of the last session using a 5-point Likert scale with 32 items. There was a
significant increase in computer self-efficacy between the start and the end of the experiment. They also found that "subjects with various learning styles performed substantially different in some learning tasks" (p. 455). Further, they found that a type of "behavior modeling" training was superior to an "instruction-based" approach (p. 455). This experiment is similar to the current study in that a self-efficacy measure is taken before and after a training and application phase. It differs in that the training is given three times and behavior modeling is used as one of the training methods. Also the measure of computer self-efficacy as used by the experiment does not seem be in agreement with Bandura’s (2006) stricture that self-efficacy assessment should be in a form that is as specific to the task to be performed as possible.

Training also has been shown to increase a student’s self-efficacy about electronic information searching (Ren, 2000). In a non-control group experiment involving college students it was found that a training intervention which consisted of “an 80-minute in-class lecture, online search demonstration, and hands-on practice followed by an after-class library assignment” (p. 325) resulted in a significant increase in electronic information searching self-efficacy. The self-efficacy was measured, prior to and after the intervention, using a thirteen question Likert-style questionnaire; with a 10-point scale. This research demonstrates that a combination of direct instruction and practice can, in certain circumstances, result in increased self-efficacy; and those features and sequence are overtly similar to the current study’s experimental design; but differ in that they were much longer, involved in person training, was a simpler collaborative activity and shorter period between measurements.
Additionally, training was found to significantly increase “Internet self-efficacy” (Torkzadeh & Van Dyke, 2002, p. 479) in an experiment covering the span of time during a university-based introductory course in computers. The assessment was based on a 17-item instrument; that was administered at the beginning and again at the end of the course. Their study also found that those with higher self-efficacy regarding Internet use at the start of the course gained more self-efficacy than those with lower self-efficacy at the beginning.

The research discussed earlier pointed to the complexity of factors affecting self-efficacy. The effect that different types of training have on self-efficacy has also been studied. Hasan (2003) found that eight different types of training have different effects on students’ computer self-efficacy. He found that “experience with computer programming and graphics applications have a strong and significant effect on computer self-efficacy beliefs, whereas experience with spreadsheet and database applications demonstrated weak effects” (p. 443). This research utilized the Compeau and Higgins (1995) scale for measuring computer self-efficacy. This scale utilizes a 10-point Likert scale varying from “1 (not confident at all) to 10 (totally confident)” (p.446). Hasan’s research is supportive of the fact that a training experience may affect a person’s self-efficacy toward some domain or task; but it may not be obvious what training has the most positive effect on self-efficacy. The current research extends Hasan’s findings by providing evidence as to whether a brief computer-based training positively affects collaborative self-efficacy.

Finally, in research that has similarities to current study, Cauble and Thurston (2000) looked at whether interactive multimedia training could affect social-work
students’ *instructional efficacy* in a non-randomized study. Instructional efficacy in this context was meant to measure whether the students felt they could utilize the information in a social work environment. The self-efficacy scale used consisted of 76 statements based on the multimedia training modules and were rated on a five-point Likert scale (1 = very low to 5 = very high). The researchers found a significant increase in self-efficacy for those who experienced the training. Their research is supportive of the concept that computer-based training can positively affect self-efficacy. The study had a limitation in that the training took place over a period of two semesters and many history-effect factors could have influenced the results. Also, unfortunately, no details beyond the descriptor “interactive media training” and the subject areas covered are given; rendering its relationship to this study’s training format difficult to assess.

**Focused research conclusions.**

The above reviewed focused research indicates that the components of collaborative learning, self-efficacy and instructional scaffolding have been employed in one form or another. Most of the studies identified investigate one of the three described components (collaborative learning, self-efficacy and instructional scaffolding) with little consideration of the other two. While some were identified that addressed a combination of two of the components, no studies combine all three in a manner that could provide relevant insights into current learning environments. This significant gap in the research and literature forms the basis for this current research.

**Summary: Review of Literature**

This review of literature provides a background to collaboration and collaborative learning, self-efficacy, and instructional scaffolding. This section presents a summary of
the three key ideas supported by this review that made up the basis for the current study’s research.

**Collaborative learning.**

Collaborative learning is an important pedagogical technique. This technique has been approached and implemented in a wide array of ways. The nature of collaborative learning has become more complex with the addition of the internet, distance education and CSCL. Note that collaborative learning is a combination of human collaboration issues (e.g. interpersonal communication, group dynamics, etc.) combined with pedagogical issues (e.g. curriculum, learning objectives, etc.). This combination means that to be successful in collaborative learning situations, students need to not only understand the learning task and goals, but also be competent in collaboration knowledge, skills and attitudes that allow for successful collaboration.

**Self-efficacy.**

Self-efficacy has been portrayed as an important construct in understanding human motivation and performance (Bandura, 1982, 1997). With high self-efficacy about a task or activity, a person will attempt it and persevere in the face of obstacles. Without positive self-efficacy about a task or activity, a person may avoid even attempting it or, if they do attempt the task or activity, the person will be hindered or stopped from further effort or engagement by any obstacle. The nature of collaborative learning activities and tasks would suggest that this is a complex undertaking. Because of the common use of collaborative learning activities in schools starting at a very early age, it would follow that students of all ages will have self-efficacy beliefs about their ability to work in a group toward some learning goal utilizing a collaborative learning
model. The research record is unclear as to both how sophisticated students’ grasp of collaborative learning knowledge, skills and attitudes are and what their self-efficacy is for collaborative learning.

Other issues were important to the consideration of the current study’s research. First, general self-efficacy measurement tools are not available because they need to be customized to a specific activity domain. No readily available instruments exist that focus on a person’s self-efficacy about collaboration or collaborative learning. Our knowledge about student’s self-efficacy in doing collaborative learning activities is very limited. Additionally, the literature about the development of an individual’s self-efficacy is quite general. To say that past experience is a key component of self-efficacy is at the very least a broad statement. This study’s research was based on the concept that when a person knows more about some activity that this increased knowledge can increase the person’s self-efficacy. Conversely, it was based on the idea that when someone asks a person to do something for which the person only has limited knowledge and experience that the person’s self-efficacy will generally not be high. If the person asking provides more information, ideas, directions, rubrics, etc. then the person being asked will, in many situations, have a rising self-efficacy. Of course this reaction will only occur if all the added information causes the person being asked to become more confident that what is being asked falls within his or her capabilities.

**Instructional scaffolding.**

Instructional scaffolding, as a general concept reviewed here, has been shown to be multi-faceted. The majority of the scaffolding in support of collaborative learning has been done through structuring the task, the groups or rewards. In the CSCL realm, the
scaffolding has been focused on tools that provide for communication (email, chat, instant messaging, discussion forums, etc.), collaborative editing of documents or scripts. Some research reviewed earlier has shown that some types of training can result in increased self-efficacy. However there is limited research that attempts to scaffold collaborative learning by increasing each participant’s knowledge, skills and attitudes about collaboration in general and collaborative learning in particular. This oversight may stem from a lack of knowledge on the part of the people in education as to the need for, and complexities of, interpersonal communication, group dynamics, and collaboration skills in general. As has been shown, some of the experts in the field clearly know that collaborative knowledge, skills and attitudes are not innate but must be learned. The current study’s research focuses on expanding our knowledge-base by measuring collaborative self-efficacy, increasing some of the participant’s knowledge about collaboration through direct instruction and measuring whether such instruction combined with a collaborative experience would result in a change in the participant’s collaborative self-efficacy.

**Research Questions Revisited**

The research questions delineated in chapter 1 are reiterated here along with some comments as to the reasoning behind each question.

**Question 1:** What is the level of collaborative self-efficacy of students enrolled in a college class for pre-service teachers? Secondly, does collaborative self-efficacy differ depending on whether the students are taking the class as a face-to-face class or as a distance-education class?
The research literature found provides scant empirical data about this question. Self-efficacy theory would suggest that the collaborative self-efficacy of students would be an important factor in determining their performance in collaborative learning activities. The fact that little is known about students’ collaborative self-efficacy would suggest that getting some measure of this concept may be helpful to educators. Secondly, does collaborative self-efficacy differ depending on whether the students are taking the class as a face-to-face class or as a distance-education class? There is some literature and research suggesting that “online-students” are “different” than face-to-face students. The data from this research will provide some needed information about this question.

**Question 2:** Will the collaborative self-efficacy increase in students after taking part in a collaborative learning activity if they first are given an instructional scaffolding in the form of a computer-based training focused on key collaborative knowledge, skills and attitudes over another group that does not receive this scaffolding? The prediction is that it will. This question is founded on the logic that positive self-efficacy is based on a feeling of competence in a particular domain or activity and that increasing the knowledge about some domain or activity should increase a person’s feeling of competence in that area. There seems to be conflicting opinions and evidence as to whether increased knowledge will increase self-efficacy. Bandura, as noted earlier in this chapter, does not cite this as a cause of increased self-efficacy. However, some research shows that increased mastery correlates with increased self-efficacy (Brannick, Miles, & Kisamore, 2005). This research may provide some new information on the nature of self-efficacy and its causes.
**Question 3:** Does the computer-based collaboration training have a differential effect on collaborative self-efficacy depending on whether the students are participating in a face-to-face class versus a distance-education class? Secondly, what is the effect based on the future grade-level teaching goal of the student? Thirdly, does the instructor-type have a differential effect on the impact of training?

This question combines aspects of question one and two; in that, if students in distance education classes are different from those in face-to-face classes, then one might assume that knowledge and skills training may have a differential effect. The second part of this question, suggested by the research literature, and discussed in this chapter, found some characteristics differ between those wishing to teach in K-6 and those whose preference is high school teaching. The differences, between these two groups, noted in prior research, do not directly lead to a prediction as to what results might be expected in this study. The second part of this question asks whether differences can be discerned between the two instructors. There is no deductive logic, coming from a particular body of research, for this question other than the commonsense understanding that no two teachers will handle that same curriculum in the same way due to personality, experience and other factors.

**Question 4:** Do students, who get training on collaborative knowledge, skills and attitudes, differ from those not receiving this training in their use of, or frequency of words, or descriptions when asked open-ended questions about the collaborative activity? Since the main focus of this research is on changes in collaborative self-efficacy as an indirect result of training and not the adequacy of the training as such, this question
focuses on whether an effect of the training can be measured directly or indirectly after the training and collaborative activity has been completed.
CHAPTER 3: METHOD

Experimental Setting

This research was situated within four sections of a college class normally taken by pre-service teachers titled: “Preparing Teachers to Use Technology.” The purpose of the class was to provide future teachers with skills for integrating technology into the K-12 classroom (ISTE-NETS, 2008). There were two instructors; each taught a face-to-face and a distance-education section of the class. One instructor’s classes were designated for, and filled with, students expressing the goal to teach in elementary grades. The other instructor’s two classes were for, and filled with, students expressing the goal of teaching at the high school level. The instructors utilized the same syllabi for all classes; although allowances were made for some activities in the two sections that were taught online; and some of the examples used were more focused for the grade-level teaching goal of that particular section. Part of the normal course work in these classes was a group-oriented collaborative project titled “Innovations Mini-teach” (Addis, 2009; Grove, Foulger, Wetzel, Archambault, Williams, & Strudler, 2008; Williams, Foulger, & Wetzel, 2009). A number of weeks before the mini-teach activity, the students filled out a brief questionnaire in which they indicated their interest in a list of technologies (wikis, electronic white-boards, podcasting, etc.). Based on these surveys, the instructors assigned the students to groups with different educationally-oriented technology topics. Their assignment was to research their assigned topic as a group and produce a wiki-page to be used by the other class members to learn about their group’s particular assigned technology. The face-to-face class groups also had a requirement to give a 10-15 minute presentation to the class after the completion date for their group’s wiki-page. Grades
were assigned based on a rubric. Each student in a group got the same grade under normal circumstances. For purposes of this study, all students had completed the post-activity instrument-survey before they received their grades.

**Overall Experimental Approach**

The experimental design for this study was basically a quantitative experimental design as outlined by Creswell (1994, 1998). Although the post-activity instrument had some open-ended questions, Creswell considers such fixed-questions as not constituting a qualitative method. The experimental design group-selections could be described as quasi-random convenience sample because the classes’ team-groupings were chosen by the instructor based on the pre-activity interest survey that each student completed prior to the planned collaborative mini-teach activity. The researcher assigned these instructor-formed groups to either experimental or control groups in a manner such that the instructors did not know whether any particular group was in the experimental or control group.

This experiment could be described in the X and O nomenclature (Campbell & Stanley, 1963) modified here to provide additional clarity as:

\[
\begin{align*}
\text{Opre} & \quad \text{Xe} \quad \text{Mini-Teach Collaboration Activity} \quad \text{Opost} \\
\text{Opre} & \quad \text{Xc} \quad \text{Mini-Teach Collaboration Activity} \quad \text{Opost}
\end{align*}
\]

The “Opre” and “Opost” observations represent survey-type instruments for measuring self-efficacy attitudes toward selected aspects of collaboration and collaborative learning. The pre- and the post-survey instruments (described below) differ in that the post survey has four additional Likert-style questions and four free-form questions that asked about collaboration issues, problems and knowledge learned during the mini-teach activity.
The experiment’s computer-based scaffolding-training-treatment “Xe” differs in content from the control computer-based training-treatment “Xc.” The instructional scaffolding training content treatment consisted of collaborative knowledge, skills and attitude training while the control groups received placebo training focused on instructional design. Thus both types of groups had a computer-based training experience of approximately the same amount of time and interactivity; but only the training-treatment groups’ training was focused on collaborative learning skills.

**Experimental Timeline**

1. Shortly after the start of the class, the students completed an “Introductory Computer-Skills Survey” (see Table 20 in Appendix D) which provided a measure of technical competence that can be compared with measures of collaborative self-efficacy.

2. Approximately four weeks after the start of the semester, after the mini-teach activity groups were assigned by the instructors; the researcher assigned each to either the treatment or the control group. The intent was to have as balanced numbers of participants, in each type of group within each class section, as was practical.

3. Prior to knowing either their group members or their topic, each student took the pre-activity self-efficacy survey (Table 18 in Appendix A) and completed the online training assigned to all members of his or her group. This computer-based training (lasting about 10 minutes) was either about collaboration for the treatment groups (see Appendix B) or about learning
and instructional message design theory (Fleming & Levie, 1993) for the control groups (see Appendix C).

4. Participants then completed the Innovations Mini-Teach class assignment. This activity took approximately 3 weeks.

5. The participants then completed the post-activity self-efficacy survey (Appendix A). This post-activity survey’s first portion was identical to the pre-activity self-efficacy survey. The post-activity survey also had some additional open-ended questions that were intended to provide data about the two group’s thinking about the collaborative experience.

Participants

There were a total of 73 participants in the study. A total of 77 students were enrolled in the four classes at the time period of this study. All students participated in the collaborative activity, including pre-training and the pre- and post- survey, but only those students who agreed to participate in the research (73 of the 77) have their answers included in the research analysis and findings. For this class activity, the groups consisted of approximately 3 students; but because of classroom necessity and occurrences (dropping, uneven numbers, etc.), groups ranged from 2 to 4 students.

Treatment and Control Training Materials

The training materials used in this research consisted of the following:

1. Treatment group: a brief computer-based training (series of slides) that stressed some key concepts that the literature shows (see discussion in chapter 2) are important in successful group work (see Appendix B).
2. Control group: a brief computer-based training (series of slides) that presented some key concepts about designing and presenting information for learners. Note that the designed intent was to have this training be similar in length and level of difficulty to the treatment groups’ training (see Appendix C).

As was discussed in the chapter 2, the number of conceptions of the knowledge, skills and attitudes that are deemed important for collaboration and collaborative learning is quite large and varied within each source reviewed (i.e. Bosworth, 1994; Johnson, Johnson & Holubec, 1991; Schmuck & Schmuck, 1997; Friend & Cook, 2003). No single source was found that provided a delineation of the knowledge, skills and attitudes information in a format that fit the audience, space and time constraints required for the training slides. Rather a composite and distillation of concepts found in a number of sources was used in the development of the collaborative learning training slides. One of the sources was “Joining Together: Group Theory and Group Skills” (Johnson and Johnson, 1987) (see page 9 and table 1.1 on page 11. The text “Communicating in Groups: Application and Skills (Adams & Galanes, 2003) provided key concepts on group communication. The book “Cooperation in the Classroom” (Johnson, Johnson, Holubec, 1991) provided, among other things, part of the framework for needed skills by classifying them in four categories: forming, functioning, formulating and fermenting. Although these groups, except for “forming,” were not used directly; they did provide a basis for approaching the training in terms of categories of skills. Another source, “500 Tips on Group Learning” (Race, 2000), was used as a cross check on the information drafted into the slides for the treatment group’s collaboration training. The draft of the
slides was reviewed, edited and approved by the two instructors of the class as being important points and relevant to the problems they have seen in prior classes. See Appendix B for the slides used in the computer-based training of the treatment groups.

The slides (Appendix C) for the control group’s computer-based training were developed from general learning theory and from selected issues inspired by some of the “rules” presented in the book “Instructional Message Design” (Fleming and Levie, 1993). The intention of these slides was to provide something of value for performing the Mini-teach assignment equivalent to the treatment groups training, yet not be directly applicable to the collaboration aspects. Only reasonableness and general value of the content was used in judging the appropriateness of this control group “design” training.

**Variables and Measures**

The independent variables in this study are training-type: collaboration skills versus teaching principles; and class-type: face-to-face versus online. The primary quantitative dependent variable is pre- and post-activity measures of collaborative self-efficacy.

**Self-efficacy.**

The literature on how self-efficacy is measured was discussed in chapter 2. The key points from that discussion are:

1. self-efficacy self-report measures need to be specific to the activity/skill/goal being assessed;

2. a question assessing self-efficacy is best written in as personal a fashion as possible. (i.e. I am confident that I can… );
3. a Likert scale is required that allows the participant to indicate a level of perceived confidence;

4. in spite of the research done on self-efficacy, many facets of its nature are yet to be discovered.

In line with the discussion in chapter 2 regarding self-efficacy specificity, this current study attempted to balance between being specific to group-collaborative domain activity and to strike the balance in line with the thought quoted earlier that: “[assessment items should be] cast at an intermediate level of generality” (Bandura, 1997, p. 49).

A goal of this study was to get the best measure of the construct collaborative self-efficacy as possible. In order to accomplish this goal a three-pronged approach was taken. The first was to ask a single question focused directly on assessing the participant’s self-efficacy about collaborative group learning. This goal was addressed by question number 1 of the 24-item pre and post survey (Table 18 in Appendix A). Question number 1 asked the participant to rate the following statement: “I am confident in my ability to do group work in classes.” Then a broader measure of likely components of collaborative self-efficacy was obtained by asking the participants to rate an additional 23 statements related to collaborative activities (Table 18 in Appendix A). These additional question-statements varied from the simple omnibus-type question-statement number one described above to a series of questions that attempted to gauge self-efficacy and attitudes toward sub-aspects of collaboration and collaborative learning activities.

The following categories of these questions were:

1. Overall Collaborative Self-efficacy

2. Overall Worth/Value of Collaborative Learning
3. Planning
4. Communications
5. Goal Accomplishment
6. Roles
7. Learning
8. Functioning

All questions were answered on the basis of a seven-point Likert scale, a sample of which is shown in Figure 3.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>No answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am confident in my ability to do group work in classes.</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
</tbody>
</table>

Figure 3: Sample Likert scale used on pre & post 24 item self-efficacy instrument.

See Appendix A for a list of the questions, each question’s category and whether the question was reverse-coded. Also see Appendix A for an example of how these questions were presented to the participants. No existing instrument was found that measures collaborative self-efficacy or its components. Additionally, as noted in the following quote, the literature does not provide any concise guide to skills, knowledge and attitudes of collaboration/teamwork:

An instructor attempting to find a concise guide on how to work with teams in the classroom may find it difficult to gain a toehold in the literature. Many papers contain useful ideas on some specific aspect of teamwork, such as team evaluation or assigning team roles to students, but they describe only part of what
an instructor needs to know to create an effective class-room team structure.

(Oakley, Felder, Brent & Elhajj, 2004, p. 9).

This lack of a concise guide also extends to developing an assessment instrument focused on collaborative self-efficacy. Therefore the categories and questions were identified by reviewing the literature on collaboration, teamwork and collaborative-learning skills for areas that were identified to be aspects of skilled and successful collaboration and collaborative learning (Bosworth, 1994; Hackman, 1990; Johnson & Johnson, 1987a, 1987b, 1999b; Johnson and Johnson and Holubec, 1990; Race, 2000; Senge, 1990, 1994; Beebe and Masterson, 2000; Faidley, Evenson, Salisbury-Glennon, Glenn, & Hmelo, 2000; Michaelsen & Sweet, 2008). These questions were then worded in keeping with the self-efficacy phrasing (Bandura, 2006). These questions were reviewed by an educational technology researcher and the two instructors (experienced educational technology teachers) and, based on their feedback, were revised to their final form. Several items were reverse-coded to verify that respondents were engaging appropriately with the survey. As was indicated in chapter 2, some of the questions were similar to those used by Neo, 2003; although Neo’s 14 questions covered many more topics specific to that research’s specific activity and were given only at the conclusion of the eight-week class experiment.

Factor analysis was used to analyze the resulting 24-item responses (see chapter 4). It was anticipated that at least two factors would emerge from this factor analysis: first a factor of general collaborative self-efficacy and one or more additional factors related to aspects collaboration other than collaborative self-efficacy. If no factors were
evident after the factor analysis then a composite of the entire 24-items would be used as a composite collaborative self-efficacy measure.

**Additional questions on the post-activity survey.**

In addition to the 24 Likert-style questions, there were eight additional questions asked of each participant on the post-activity survey. See Appendix A Table 19 for a list and format of these questions. The intention of adding these questions was to do a series of things:

1. Questions 1 and 2 asked for information regarding how participants viewed the communication and collaboration in their group.
2. Questions 3 and 4 collected information regarding strategies or techniques from tutorials.
3. Questions 5 and 6 provided additional information regarding overall attitude toward collaboration.
4. Question 7 and 8 was meant to be a means of comparing the participants’ answers about goal accomplishment and overall collaboration with each other and the self-efficacy and other factors derived from the 1-24 questions.

**Data Analysis**

The planned data analysis consisted of the following:

1. A Cronbach’s Alpha on Scale SE Question Instrument (where applicable) (Cronbach & Meehl, 1955).
2. A factor analysis on the 24 Likert-style questions to establish sub-groupings of these items comprising a collaborative self-efficacy factor (SE-factor) and, if possible, other factors for use in the experimental analysis.
3. Compute a SE-factor measure and, if appropriate, other composite factor measures from subsets of items 1-24 of the pre- and post-survey instrument. Using SE-factor and other derived factors measures as dependent variables: perform 2 X 2 X 2 repeated-measures MANOVA with the independent factors being distance versus face-to-face; collaborative skills training versus learning design training; and elementary vs. secondary teaching preferences all with pre-activity and post-activity timing as the repeated measures. Based on the MANOVA, if called for, perform follow-up individual repeated measures ANOVAs for SE-factor and other derived factors.

4. Correlate the answers in additional post-activity questions 7 and 8 (see Appendix C) with the derived self-efficacy factor and other factor measures obtained in step 2.

5. It was anticipated that the experimental questions would be mainly answered by the MANOVA and follow-up ANOVAs described in step 3. However, in addition, review the open-ended post-activity questions and develop a strategy for 1) possibly assessing themes or qualitative differences between treatment and location groupings and, 2) any indication that the two treatment groups differ in their description of problems or issues. Depending on this review, utilize appropriate follow-up analyses.

Validity Review

This section contains a review of various types of validity in regards to this research design. These reviews are based on validity measures described in Research
Methods in Psychology (Breakwell, Hammond & Fife-Schaw, 2000) unless otherwise noted.

**Content validity.**

Content validity is concerned with whether the measure being used is relevant to the construct being measured. As discussed, the 24 self-efficacy survey questions (see Table 18) and the logic as to how they were developed, would suggest that these questions and additional open-ended questions are focused on issues and attitudes applicable to measuring collaborative self-efficacy and related attitudes about collaboration in general. One method for assessing content validity is to ask an “expert” about the questions. An educational technology researcher and the instructors of the courses reviewed the instrument’s questions. The reviewers found them applicable to collaborative self-efficacy and other attitude areas applicable to collaborative learning activities.

**Construct validity.**

Construct validity is concerned with whether a measurement is assessing a single construct (e.g. self-efficacy). As operationalized within this study, the collaborative self-efficacy score could be the answer to question number 1, of the 24 Likert-style pre- and post-survey questions which were worded in a manner similar to that described by Bandura (2006). In addition, a factor analysis will be done on the 24 questions to see if what factors emerge and how this relate to collaborative learning. There is no magic means to predetermine what question or questions can be asked to obtain the most accurate measure of a construct such as collaborative self-efficacy. It is anticipated that a factor analysis of the questions will not result in a single collaborative self-efficacy factor
because by design some of the questions focus on areas lying conceptually outside the realm of collaborative self-efficacy.
CHAPTER 4: RESULTS AND ANALYSIS

Introduction

This chapter is focused on the presentation of the data collected and the results of the analysis. It is broadly divided into a quantitative data section and a qualitative perspective section. Within the quantitative section, the results of the factor analysis of the survey instrument are reported first, followed by a section dealing with the four research questions along with their supporting data analysis, and concludes with a report on other quantitative findings, not specifically related to the four main research questions. The qualitative perspective section of this chapter reports on the results of explorations and observations of a qualitative nature. The research plan for how and when this data was collected and the planned analysis is described in chapter 3. Chapter 5 presents a discussion of the implications of the results, limitations and suggestions for future research.

Quantitative Data

Self-efficacy instrument: adequacy, factor analysis and findings.

Since the primary instrument (see Appendix A: Pre and Post Activity Survey) utilized in this research was created specifically for this study, the first quantitative results’ section focuses on this instrument and the resulting factor-analysis-derived measurements. The analysis of the primary survey instrument focused on the first 24 question/items with the goal of deriving a composite collaborative self-efficacy factor to be used in answering this study’s main research questions. The primary analysis technique for obtaining a collaborative self-efficacy factor utilized an exploratory factor
analysis to develop question-item grouping factors from the 24 questions. Finally, a judgment was made and described below as to whether any of the derived factors from factor analysis would provide a better, or additional way, to approach and/or analyze the construct of collaborative self-efficacy.

Assessment of instrument.

The primary instrument used in answering this study’s main research questions, the Pre and Post Activity Survey, was subjected to a Cronbach’s Alpha analysis to assess the tool’s internal reliability and consistency. The Cronbach’s Alpha for the pre and post collaborative self-efficacy 1-24 question instrument ranged from .909 for the pre-activity survey to .925 for the post-activity survey (Table 1). These alpha values indicate that these questions also have a high internal consistency. The follow-up exploratory factor analysis was used to see if the implied consistency was indicative of a single factor or multiple factors. The correlation between pre and post-administered versions of the survey was \( r (71) = .53, p < .01 \).

Table 1: Collaborative self-efficacy questions (1-24) Cronbach’s Alphas.

<table>
<thead>
<tr>
<th>Sample</th>
<th># of Items</th>
<th># of Cases</th>
<th>Cronbach’s Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Training &amp; Collab. Activity</td>
<td>24</td>
<td>73</td>
<td>.909</td>
</tr>
<tr>
<td>Post-Collaborative Activity</td>
<td>24</td>
<td>73</td>
<td>.925</td>
</tr>
</tbody>
</table>

Factor analysis and collaborative self-efficacy measure determination.

An exploratory factor analysis using PASW (formerly SPSS) version 18 was performed on the pre-activity 24 survey items (Table 2). As indicated earlier, this factor analysis was done to explore whether the participants’ responses to the items grouped into latent factors related to collaborative self-efficacy and/or other related constructs.
The Kaiser-Meyer-Olkin measure of sampling adequacy was .807 indicating a good fit for factor analysis. Bartlett’s test of sphericity was significant (Chi-Square = 3051.013, df = 36, p < .000) indicating that this is not an identity matrix and is appropriate for factor analysis. This preliminary factor analysis before the removal of any items is shown in Table 2.

Table 2: Principle component factor analysis collaborative self-efficacy survey before removal of any items.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Loadings</th>
<th>Question on pre &amp; post SE survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loadings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LV-factor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>“Like/Value Group Work”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>.878</td>
<td>Group work in classes is enjoyable.</td>
</tr>
<tr>
<td>7*</td>
<td>.847</td>
<td>Group work in classes is not fun.</td>
</tr>
<tr>
<td>12*</td>
<td>.840</td>
<td>I learn more working by myself than when working in a group.</td>
</tr>
<tr>
<td>19*</td>
<td>.829</td>
<td>I avoid working in groups in classes when I can.</td>
</tr>
<tr>
<td>24</td>
<td>.759</td>
<td>I learn more working on group-learning projects than when studying by myself.</td>
</tr>
<tr>
<td>18*</td>
<td>.757</td>
<td>The time I spend working on group projects is better spent studying by myself.</td>
</tr>
<tr>
<td>16*</td>
<td>.711</td>
<td>Group products and outcomes are worse than I could have done by myself.</td>
</tr>
<tr>
<td>SE-factor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>“Collab. Self-Efficacy”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>.087</td>
<td>I am confident that I know the roles that need to be filled in cooperative groups.</td>
</tr>
<tr>
<td>22</td>
<td>.008</td>
<td>I know how to assure that groups accomplish their goals.</td>
</tr>
<tr>
<td>10</td>
<td>.163</td>
<td>Groups I am on... accomplish the group's goal or assignments.</td>
</tr>
<tr>
<td>4</td>
<td>.066</td>
<td>Groups I am on... always produce the best results.</td>
</tr>
<tr>
<td>3</td>
<td>.126</td>
<td>In groups I will communicate to make sure my views and concerns are heard.</td>
</tr>
<tr>
<td>20</td>
<td>-.051</td>
<td>I have the ability to influence others to plan what my class-related groups are going to do.</td>
</tr>
<tr>
<td>21</td>
<td>-.056</td>
<td>I understand the problems that can arise in group communication and how to avoid or remedy them.</td>
</tr>
<tr>
<td>Not used in revised factor analysis See Table 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>.607</td>
<td>The time I spend working in learning group is valuable.</td>
</tr>
<tr>
<td>9*</td>
<td>.520</td>
<td>Groups I participate in... will have comm. problems.</td>
</tr>
<tr>
<td>11*</td>
<td>.466</td>
<td>Groups I participate in have uneven contributions and efforts from members.</td>
</tr>
<tr>
<td>14*</td>
<td>.426</td>
<td>Groups I participate in have a hard time filling all needed team roles.</td>
</tr>
<tr>
<td>15</td>
<td>.446</td>
<td>Groups I participate in... communicate well.</td>
</tr>
<tr>
<td>8</td>
<td>.396</td>
<td>Groups I participate in plan effectively so as to accomplish goals.</td>
</tr>
<tr>
<td></td>
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<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>1</td>
<td>.332</td>
<td>.533</td>
</tr>
<tr>
<td>2*</td>
<td>.134</td>
<td>.425</td>
</tr>
<tr>
<td>5*</td>
<td>.248</td>
<td>.279</td>
</tr>
<tr>
<td>17</td>
<td>.613</td>
<td>.335</td>
</tr>
<tr>
<td>6</td>
<td>.607</td>
<td>.362</td>
</tr>
</tbody>
</table>


The number of factors used in the final extraction was arrived at by considering a combination of the scree-plot (Figure 17 in Appendix E) line-break, the incremental percentage of variance explained by each added factor, factors having an eigenvalue greater than one, and construct clarity of the possible factors (Ford, MacCallum & Tait, 1986). These methods suggested that either 2 or 3 factors might be appropriate. A three-factor analysis was considered; but it resulted in the third factor only having one item (number 5) and only a very slight increase in the variance explained, 61% as compared to the final two-factor model of 60%. This third single-item factor was deemed to not be a distinct new construct since its meaning is similar to items found one of the other two factors (SE-factor). In the preliminary two-factor model (Table 2), items, after rotation, with cross-loadings greater than .30 or a primary loading less than .50, were removed from the initial results and the factor analysis and varimax-rotation was repeated and is shown in Table 3.

It is interesting to note that the item number one in the original survey, “I am confident in my ability to do group work/classes,” was not included in the final SE-factor items. This is of note, because some self-efficacy theorists would argue that an overall global statement about an activity is what self-efficacy assessment should utilize (Bandura, 2006). The fact that this item cross-loads on the LV-factor as shown in the
original factoring (Table 2), implies that it may invoke multiple attitudinal issues in a person when asked to rate such an item.

Table 3: Pre-activity collaborative self-efficacy survey re-factored after item removal.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Item</th>
<th>1</th>
<th>2</th>
<th>Items on pre &amp; post collaboration survey</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LVfactor</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>“Like/Value Group Work”</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Group work in classes is enjoyable.</td>
<td>.883</td>
<td>.085</td>
<td></td>
</tr>
<tr>
<td>7*</td>
<td>Group work in classes is not fun.</td>
<td>.844</td>
<td>-.046</td>
<td></td>
</tr>
<tr>
<td>12*</td>
<td>I learn more working by myself than when working in a group.</td>
<td>.886</td>
<td>-.020</td>
<td></td>
</tr>
<tr>
<td>19*</td>
<td>I avoid working in groups in classes when I can.</td>
<td>.848</td>
<td>.164</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>I learn more working on group-learning projects than when studying by myself.</td>
<td>.783</td>
<td>.062</td>
<td></td>
</tr>
<tr>
<td>16*</td>
<td>Group products and outcomes are worse than I could have done by myself.</td>
<td>.714</td>
<td>.059</td>
<td></td>
</tr>
<tr>
<td><strong>SEfactor</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>“Collab. Self-Efficacy”</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>I know how to assure that groups accomplish their goals.</td>
<td>.007</td>
<td>.835</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>I am confident that I know the roles that need to be filled in cooperative groups.</td>
<td>.088</td>
<td>.828</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Groups I am on... accomplish the group's goal or assignments.</td>
<td>.162</td>
<td>.725</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Groups I am on... always produce the best results.</td>
<td>.049</td>
<td>.635</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>In groups I will communicate to make sure my views and concerns are heard.</td>
<td>.144</td>
<td>.581</td>
<td></td>
</tr>
<tr>
<td>2*</td>
<td>I am NOT sure how to organize a collaborative learning-group.</td>
<td>.020</td>
<td>.665</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>I understand the problems that can arise in group communication and how to avoid or remedy them.</td>
<td>-.060</td>
<td>.626</td>
<td></td>
</tr>
</tbody>
</table>


*Derived collaborative learning-related factors.*

A review of the text of the survey items associated with each of the derived factor groupings suggests two orthogonal, but in a sense still related, factors dealing with collaborative learning activities (Table 3). These two factors are named SE-factor and LV-factor; each is described in turn in the following two paragraphs.
The most salient derived factor, in terms of this study’s research questions, is the “SE-factor.” It is the most salient because it is the factor that best encompasses the construct of collaborative self-efficacy. The type of items that group in the factor analysis for the SE-factor include sentences such as: “I am confident that I know the roles that need to be filled in cooperative groups,” “Groups I am on... accomplish the group's goal or assignments,” and “I am confident in my ability to do group work in classes.” The type of statements in the SE-factor grouping speaks to the confidence, in other words collaborative self-efficacy, that a person has regarding successfully participating in learning groups (Bandura, 2006; Wang, Poole, Harris, & Wangeman, 2001; Gist & Mitchell, 1992).

The second derived factor is the “LV-factor,” which can logically be thought of as measuring aspects of a person’s disposition about liking/valuing of collaborative learning. This LV-factor varies from the collaborative self-efficacy construct (SE-factor) in that someone can value or like some activity without feeling very confident about his or her ability to successfully participate in the activity. A common example illustrating this situation is the attitude of the many golfers (i.e. “duffers”) who love playing golf but average 2 or 3 strokes over par for every hole; they like golf but would not express much self-efficacy about their ability to play it well. In the case of the survey instrument, the derived LV-factor is epitomized by items such as: “Group work in classes is enjoyable” and the reverse-coded item “I avoid working in groups in classes when I can.”

It was concluded that the SE-factor was an excellent candidate for use as a multi-question composite measure of collaborative self-efficacy for purposes of analyzing this study’s first three research questions. Therefore, it seemed reasonable to replace the
“composite of all the questions” measure as originally proposed with factor analysis derived SE-factor in the analyses. Significantly, the complete set of 24 questions also contained items combined into the LV-factor (Table 3), which were not indicative of attitudes directly aligned with the primary collaborative self-efficacy focus of this study. The LV-factor is analyzed in the “Other Quantitative Findings” section later in this chapter.

*Single-item collaborative self-efficacy measure.* In addition to the original planned utilization of the 24-question composite collaborative self-efficacy value, it was also originally thought that the question-item number one of the survey would be a simple, single question measure of the collaborative self-efficacy of the participants. The original intent was to use this single question (“I am confident in my ability to do group work in classes”) as one of the primary dependent variables. However, because this single question-item, as a dependent variable, has a ceiling effect for responses as shown in Figure 4 and because its information is included in the derived SE-factor measure; for purposes of the analyses to follow, this single question self-efficacy measure will not be used in further analysis; rather it will be replaced with the SE-factor.
Figure 4: Pre and post survey item #1 boxplot by training-type (T-group).

Figure 5: Boxplot comparison of SE-factor and LV-factor. Both are shown pre and post training; by training type. “Collab Training” refers to training-treatment group receiving collaborative-focused training versus “Design Training” which refers to the training-control group who received website/instructional design training.

Introductory Survey. For the Introductory Computer-Skills Survey (see Appendix D, Table 21), the Cronbach’s Alpha is .915. This value indicates a high internal
consistency for this measure. A review of the effect of individual items suggests that all items could be retained in using this instrument.

**Data analysis: Questions 1-3.**

The primary statistical analysis for questions 1 thru 3 was based on a three-way (2 X 2 X 2) mixed-subjects repeated-measures multivariate analysis of variance (MANOVA) conducted to determine the effect that the three independent dichotomous variables had on the two dependent variables (SE-factor and LV-factor) with time (pre and post training/activity) serving as the repeated measure factor (Field, 2005). The three dichotomous independent variables were 1) treatment training-type (T-group: Collab, Design), 2) class-type (FtoF, DisEd) and 3) planned teaching level (ElHiGoal: ElemSch, HiSch) with time (pre-training/activity = 1, post-activity = 2) as the repeated measure within-group variable. The statistical analysis utilized version 18 of PASW (formerly SPSS) for a general linear model (GLM) with repeated measures.

Preliminary tests were performed on the data to validate the use of the MANOVA. The Box’s M statistical measure was not significant; thereby providing evidence that the homogeneity of variance-covariance matrix assumption was not violated. Additionally, no univariate or multivariate outliers exceeding two-standard deviations were evident. A .05 critical alpha level was used to judge statistical significance for all statistical tests.

The MANOVA showed significant main effects and interactions, as described below, therefore follow-up ANOVAs were performed for each of the two dependent measures; SE-factor and LV-factor. The ANOVAs were required to ascertain which of the two independent variables are statistically significant because the MANOVA used a
combined vector of the two dependent variables to test main and interaction effects. Thus, the MANOVA output from PASW did not indicate whether one or both of the dependent variables was responsible for any significant differences. Only the SE-factor was used in answering this study’s first three research questions. The results of the analysis for the LV-factor is shown in a later section of this chapter titled “Other Quantitative Findings.”

*Unequal cell sizes.*

The selection of the treatment group (collaboration training) was subject to the realities of non-laboratory research. Additionally, the other independent variables, class-type and ElhiGoal, were not directly selected for, but rather were a consequence of the treatment groups formed. Therefore, the experimental groups per cell in the analysis were not equal as shown by the cell-Ns in Table 4. This posed some concern when doing the statistical analysis to assure that this unbalanced group size did not result in skewed statistics. The follow-up ANOVAs utilized in this analysis used a *type III* mean-square approach, which is somewhat robust for unequal cell size (Field, 2005). The means and standard deviations by independent variables for all dependent variables are shown in Appendixes F and G.
Table 4: Experimental factors’ cell sizes.

<table>
<thead>
<tr>
<th>T-Group</th>
<th>Class-type</th>
<th>ElHiGoal</th>
<th>Cell N</th>
<th>T-Group</th>
<th>Class-type</th>
<th>ElHiGoal</th>
<th>Cell N</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collab</td>
<td>Design</td>
<td>Train</td>
<td>FtoF</td>
<td>ElemSch</td>
<td>13</td>
<td></td>
<td>12</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>DisEd</td>
<td>HighSch</td>
<td>7</td>
<td>HighSch</td>
<td>7</td>
<td></td>
<td>6</td>
<td>13</td>
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<td></td>
<td>18</td>
<td>36</td>
</tr>
<tr>
<td>Totals</td>
<td></td>
<td>ElemSch</td>
<td>25</td>
<td></td>
<td>21</td>
<td></td>
<td>14</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HighSch</td>
<td>14</td>
<td></td>
<td>13</td>
<td></td>
<td>39</td>
<td>73</td>
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</tbody>
</table>

MANOVA Results.

Results of the MANOVA show a significant main effect for the dependent variable Class-type Wilks’ $\lambda = .876$, $F (2, 64) = 4.540$, $p < .05$, $\eta^2 = .124$. Multivariate significant within-subjects interactions were found for the vector Time x ElHiGoal with Wilks’ $\lambda = .886$, $F (2, 64) = 4.126$, $p < .05$, $\eta^2 = .114$. No other multivariate main or interaction effects were found (see Table 5).

Follow-up univariate analyses of variance (ANOVAs) for each dependent variable were conducted as follow-up tests to the MANOVA (see Table 6 and Table 7). The result of the follow-up ANOVAs showed significant main effects for the LV-factor’s ElHiGoal ($F (1, 65) = 13.502$, $p =< .05$) and Class-type ($F (1, 65) = 26.321$, $p =< .05$). The follow-up ANOVAs for multivariate Time x ElHiGoal interaction showed one significant interaction for the LV-factor ($F (1, 65) = 3.353$, $p < .05$). Each of these analyses is explored more fully in later sections of this chapter and discussed in more general terms in chapter 5.
Table 5: Repeated Measures Multivariate Analysis (MANOVA)

<table>
<thead>
<tr>
<th></th>
<th>Wilks' $\lambda$</th>
<th>F</th>
<th>$p$</th>
<th>$\eta^2$</th>
<th>Obs. Power</th>
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</thead>
<tbody>
<tr>
<td><strong>Between Subjects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>.014</td>
<td>2229.6</td>
<td>.000</td>
<td>.986</td>
<td>1.000</td>
</tr>
<tr>
<td>T-group</td>
<td>.975</td>
<td>.831</td>
<td>.440</td>
<td>.025</td>
<td>.186</td>
</tr>
<tr>
<td>ElHiGoal</td>
<td>.940</td>
<td>2.028</td>
<td>.140</td>
<td>.060</td>
<td>.404</td>
</tr>
<tr>
<td>Class-type</td>
<td>.876</td>
<td>4.540</td>
<td>.014*</td>
<td>.124</td>
<td>.754</td>
</tr>
<tr>
<td>T-group x ElHiGoal</td>
<td>.983</td>
<td>.542</td>
<td>.584</td>
<td>.017</td>
<td>.136</td>
</tr>
<tr>
<td>T-group x Class-type</td>
<td>.987</td>
<td>.410</td>
<td>.666</td>
<td>.013</td>
<td>.114</td>
</tr>
<tr>
<td>Class-type x ElHiGoal</td>
<td>.998</td>
<td>.076</td>
<td>.927</td>
<td>.002</td>
<td>.061</td>
</tr>
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<td>T-group x Class-type x ElHiGoal</td>
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<td>.286</td>
<td>.038</td>
<td>.267</td>
</tr>
<tr>
<td><strong>Within Subjects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time (T)</td>
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<td>1.998</td>
<td>.144</td>
<td>.059</td>
<td>.398</td>
</tr>
<tr>
<td>Time x T-group</td>
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<td>.693</td>
<td>.504</td>
<td>.021</td>
<td>.162</td>
</tr>
<tr>
<td>Time x ElHiGoal</td>
<td>.886</td>
<td>4.126</td>
<td>.021*</td>
<td>.114</td>
<td>.710</td>
</tr>
<tr>
<td>Time x Class-type</td>
<td>.958</td>
<td>1.416</td>
<td>.250</td>
<td>.042</td>
<td>.293</td>
</tr>
<tr>
<td>Time x T-group x ElHiGoal</td>
<td>.990</td>
<td>.330</td>
<td>.720</td>
<td>.010</td>
<td>.101</td>
</tr>
<tr>
<td>Time x T-group x Class-type</td>
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<td>.701</td>
<td>.500</td>
<td>.021</td>
<td>.163</td>
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<tr>
<td>Time x Class-type x ElHiGoal</td>
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<td>.334</td>
<td>.717</td>
<td>.010</td>
<td>.101</td>
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<td>Time x T-group x Class-type x ElHiGoal</td>
<td>.944</td>
<td>1.909</td>
<td>.157</td>
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<td>.382</td>
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</table>

Manova: df (2, 64); * = p < .05
<table>
<thead>
<tr>
<th>Source</th>
<th>Factor</th>
<th>Type III Sum of Squares</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>LV</td>
<td>2757.819</td>
<td>2757.819</td>
<td>841.433</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>SE</td>
<td>4093.194</td>
<td>4093.194</td>
<td>3999.306</td>
<td>.000</td>
</tr>
<tr>
<td>T-group</td>
<td>LV</td>
<td>4.553</td>
<td>4.553</td>
<td>1.389</td>
<td>.243</td>
</tr>
<tr>
<td></td>
<td>SE</td>
<td>.190</td>
<td>.190</td>
<td>.186</td>
<td>.668</td>
</tr>
<tr>
<td>ElHiGoal</td>
<td>LV</td>
<td>13.502</td>
<td>13.502</td>
<td>4.120</td>
<td>.046*</td>
</tr>
<tr>
<td></td>
<td>SE</td>
<td>.048</td>
<td>.048</td>
<td>.046</td>
<td>.830</td>
</tr>
<tr>
<td>Class-type</td>
<td>LV</td>
<td>26.321</td>
<td>26.321</td>
<td>8.031</td>
<td>.006*</td>
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<tr>
<td></td>
<td>SE</td>
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<td>1.892</td>
<td>1.848</td>
<td>.179</td>
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<td>T-group x ElHiGoal</td>
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<td>3.437</td>
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</tr>
<tr>
<td></td>
<td>SE</td>
<td>.017</td>
<td>.017</td>
<td>.017</td>
<td>.897</td>
</tr>
<tr>
<td>T-group x Class-type</td>
<td>LV</td>
<td>2.396</td>
<td>2.396</td>
<td>.731</td>
<td>.396</td>
</tr>
<tr>
<td></td>
<td>SE</td>
<td>.163</td>
<td>.163</td>
<td>.159</td>
<td>.691</td>
</tr>
<tr>
<td>ElHiGoal x Class-type</td>
<td>LV</td>
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<td>.481</td>
<td>.147</td>
<td>.703</td>
</tr>
<tr>
<td></td>
<td>SE</td>
<td>.002</td>
<td>.002</td>
<td>.002</td>
<td>.963</td>
</tr>
<tr>
<td>T-group x ElHiGoal x Class-type</td>
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<td>3.116</td>
<td>.951</td>
<td>.333</td>
</tr>
<tr>
<td></td>
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<td>1.921</td>
<td>1.921</td>
<td>1.877</td>
<td>.175</td>
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<tr>
<td>Error</td>
<td>LV</td>
<td>213.039</td>
<td>3.278</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SE</td>
<td>66.526</td>
<td>1.023</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

df = 1, 65; *p < .05
Table 7: ANOVA Tests of Within-Subjects by Factor.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Type III</th>
<th>Sum of Squares</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>LV</td>
<td>.269</td>
<td>.269</td>
<td>.446</td>
<td>.507</td>
</tr>
<tr>
<td></td>
<td>SE</td>
<td>.750</td>
<td>.750</td>
<td>2.142</td>
<td>.148</td>
</tr>
<tr>
<td>Time x T-group</td>
<td>LV</td>
<td>.643</td>
<td>.643</td>
<td>1.068</td>
<td>.305</td>
</tr>
<tr>
<td></td>
<td>SE</td>
<td>.318</td>
<td>.318</td>
<td>.909</td>
<td>.344</td>
</tr>
<tr>
<td>Time x ElHiGoal</td>
<td>LV</td>
<td>3.353</td>
<td>3.353</td>
<td>5.565</td>
<td>.021*</td>
</tr>
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<td></td>
<td>SE</td>
<td>.114</td>
<td>.114</td>
<td>.326</td>
<td>.570</td>
</tr>
<tr>
<td>Time x Class-type</td>
<td>LV</td>
<td>.109</td>
<td>.109</td>
<td>.181</td>
<td>.672</td>
</tr>
<tr>
<td></td>
<td>SE</td>
<td>.616</td>
<td>.616</td>
<td>1.758</td>
<td>.190</td>
</tr>
<tr>
<td>Time x T-group x ElHiGoal</td>
<td>LV</td>
<td>.114</td>
<td>.114</td>
<td>.190</td>
<td>.665</td>
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<tr>
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<td>.073</td>
<td>.208</td>
<td>.650</td>
</tr>
<tr>
<td>Time x T-group x Class-type</td>
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<td>.856</td>
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<tr>
<td></td>
<td>SE</td>
<td>.068</td>
<td>.068</td>
<td>.194</td>
<td>.661</td>
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<td>Time x ElHiGoal x Class-type</td>
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<td>.405</td>
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<td>.025</td>
<td>.071</td>
<td>.790</td>
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<td>Time x T-group x ElHiGoal x Class-type</td>
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<td>.056</td>
</tr>
<tr>
<td></td>
<td>SE</td>
<td>.388</td>
<td>.388</td>
<td>1.107</td>
<td>.297</td>
</tr>
<tr>
<td>Error (Time)</td>
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<td>.602</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SE</td>
<td>22.768</td>
<td>.350</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

df = 1, 65; *p < .05

Research Question 1a: Collaborative self-efficacy: pre-service teachers.

The first part of research question one asked: “What is the level of collaborative self-efficacy of students enrolled in a college class for pre-service teachers?” As described in the section “Factor analysis and collaborative self-efficacy measures,” the SE-factor provides the best measure to use in answering these questions. As shown in Table 26 (Appendix F), the SE-factor for collaborative self-efficacy, on a 7-point scale, for the participants as a whole, prior to the training and the collaborative activity, was M = 5.421, SD = .822 and, after training and the collaborative activity it was M = 5.585, SD
The values did not have a statically significant difference for pre to the post timeframe F(1, 65) = 2.142, p = .148, $\eta^2 = .032$, observed power .303 as shown in Table 8 (Source = Time).

**Table 8: SE-factor within subject contrast from ANOVA.**

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
<th>$\eta^2$</th>
<th>Obs. Power*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>.750</td>
<td>1</td>
<td>.750</td>
<td>2.142</td>
<td>.148</td>
<td>.032</td>
<td>.303</td>
</tr>
<tr>
<td>Time x T-group</td>
<td>.318</td>
<td>1</td>
<td>.318</td>
<td>.909</td>
<td>.344</td>
<td>.014</td>
<td>.156</td>
</tr>
<tr>
<td>Time x EL Hi Goal</td>
<td>.114</td>
<td>1</td>
<td>.114</td>
<td>.326</td>
<td>.570</td>
<td>.005</td>
<td>.087</td>
</tr>
<tr>
<td>Time x Class-type</td>
<td>.616</td>
<td>1</td>
<td>.616</td>
<td>1.758</td>
<td>.190</td>
<td>.026</td>
<td>.257</td>
</tr>
<tr>
<td>Time x T-group x EL Hi Goal</td>
<td>.073</td>
<td>1</td>
<td>.073</td>
<td>.208</td>
<td>.650</td>
<td>.003</td>
<td>.073</td>
</tr>
<tr>
<td>Time x T-group x Class-type</td>
<td>.068</td>
<td>1</td>
<td>.068</td>
<td>.194</td>
<td>.661</td>
<td>.003</td>
<td>.072</td>
</tr>
<tr>
<td>Time x EL Hi Goal x Class-type</td>
<td>.025</td>
<td>1</td>
<td>.025</td>
<td>.071</td>
<td>.790</td>
<td>.001</td>
<td>.058</td>
</tr>
<tr>
<td>Time x T-group x EL Hi Goal x Class-type</td>
<td>.388</td>
<td>1</td>
<td>.388</td>
<td>1.107</td>
<td>.297</td>
<td>.017</td>
<td>.179</td>
</tr>
<tr>
<td>Error (Time)</td>
<td>22.768</td>
<td>65</td>
<td>.350</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* computed using alpha = .05

**Research Question 1b: Collaborative self-efficacy: class-type.**

The second part of research question 1 asked: “Does collaborative self-efficacy differ depending on whether the students are taking the class as a face-to-face class or as a distance-education class?” This type of university class factor is coded as class-type in tables and figures. Class-type is a dichotomous variable with either face-to-face (FtoF) or distance education (DisEd) as values.

For SE-factor, the pre-training-activity values (Table 26 in Appendix F) for class-type of face-to-face were M = 5.599, SD = .702; while the post-activity values for face-to-face were M = 5.631, SD = .797. For the SE-factor, the pre-training-activity values for class-type distance education were M = 5.247, SD = .900; while the post values for
distance education were $M = 5.541$, $SD = .821$. With regards to SE-factor and class-type, the ANOVA found no significant main effect between class-type groups $F_{(1, 65)} = 1.848$, $p = .179$, $\eta^2 = .028$ (Table 9 and Figure 6).

Table 9: SE-factor between subjects effects from ANOVA.

<table>
<thead>
<tr>
<th>Source (Type A)</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
<th>$\eta^2$</th>
<th>Obs. Power*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>4093.2</td>
<td>1</td>
<td>4093.2</td>
<td>.000</td>
<td>.984</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>T-group</td>
<td>.190</td>
<td>1</td>
<td>.190</td>
<td>.186</td>
<td>.668</td>
<td>.003</td>
<td>.071</td>
</tr>
<tr>
<td>ElHiGoal</td>
<td>.048</td>
<td>1</td>
<td>.048</td>
<td>.046</td>
<td>.830</td>
<td>.001</td>
<td>.055</td>
</tr>
<tr>
<td>Class-type</td>
<td>1.892</td>
<td>1</td>
<td>1.892</td>
<td>1.848</td>
<td>.179</td>
<td>.028</td>
<td>.268</td>
</tr>
<tr>
<td>T-group x ElHiGoal</td>
<td>.017</td>
<td>1</td>
<td>.017</td>
<td>.017</td>
<td>.897</td>
<td>.000</td>
<td>.052</td>
</tr>
<tr>
<td>T-group x Class-type</td>
<td>.163</td>
<td>1</td>
<td>.163</td>
<td>.159</td>
<td>.691</td>
<td>.002</td>
<td>.068</td>
</tr>
<tr>
<td>ElHiGoal x Class-type</td>
<td>.002</td>
<td>1</td>
<td>.002</td>
<td>.002</td>
<td>.963</td>
<td>.000</td>
<td>.050</td>
</tr>
<tr>
<td>T-group x ElHiGoal x Class-type</td>
<td>1.921</td>
<td>1</td>
<td>1.921</td>
<td>1.877</td>
<td>.175</td>
<td>.028</td>
<td>.271</td>
</tr>
<tr>
<td>Error</td>
<td>66.526</td>
<td>65</td>
<td>1.023</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* computed using alpha = .05
Research Question 2: Instructional scaffolding: effect on collaborative self-efficacy.

Research question 2 asked “Will the collaborative self-efficacy increase in students after taking part in a collaborative learning activity if they first are given an instructional scaffolding in the form of a computer-based training focused on key collaborative knowledge, skills and attitudes over another group which does not receive the collaboration-focused instructional scaffolding?” The change in SE-factor from pre-training to post-activity is used to assess this research question. For the collaborative self-efficacy factor dependent variable (SE-factor), the ANOVA found no significant main effect for treatment-group (T-group) $F_{(1,65)} = .186, p = .668, \eta^2 = .003$ (Table 9).
The pre-activity values for collaboration-training treatment group were $M = 5.359$, SD = .849; while the post values for the collaboration-training treatment group were $M = 5.604$, SD = .864. The pre values for the instructional-design-training treatment group were $M = 5.492$, SD = .797; while the post values for instructional-design-training were $M = 5.563$, SD = .744. Thus even though the collaboration-training treatment group went up from pre to post measurements while the mean values for the design-training group went down, the results were not statistically significant. The pre-post graph of SE-factor T-Group is shown in the first graph (SE-A) of Figure 7.

![Graphs showing SE-factor un-weighted means: T-group, ElHiGoal and Class-type all by time. Time 1: pre-training/activity; Time 2: Post-activity.](image)

Findings of statistical significance are highly dependent on the amount of difference between groups and the variability of individuals’ measurements. The variability of the individual’s collaborative self-efficacy (SE-factor) assessment from the pre-training-activity measurement to the post-activity timeframe is shown graphically in Figure 8. The percentages shown in the figure indicate the percentage of each treatment
group change from pre to post measurements that was positive or zero and those that were negative.

Figure 8: SE-Factor change from pre to post by individual; grouped by treatment group (T-group).

**Research Question 3: Instructional scaffolding effect.**

Research question 3 asked: “Does the computer-based collaboration training have a differential effect on collaborative self-efficacy depending on whether the students are participating in a face-to-face class versus a distance-education class?” Secondly, what is the effect on future-grade-level teaching goal of the student? Thirdly, does the instructor have a differential effect?
Collaborative training and class-type.

To answer the question “Does the computer-based collaboration training have a differential effect on collaborative self-efficacy depending on whether the students are participating in a face-to-face class versus a distance-education class?” one can look at the SE-factor ANOVA for the Class-type by T-group interaction (Table 9). For the SE-factor Class-type by T-group statistical interaction was not significant, $F_{(1, 65)} = .159, \eta^2 = .002$ (Table 9). This relationship for class-type is shown graphically in Figure 9, graphs SE-B and SE-C. Further, all interactions between class-type, training-type (T-group), ElHiGoal and time were not significant as shown in Table 8 and Table 9. The interactions between training-type, class-type and time are shown in Figure 9

![Figure 9: SE-factor: Training-type (T-group) x Class-type x Time Interaction. Time = 1: pre-training and collaboration; Time = 2: post training and collaborative activity.](image)

Training’s effect on collaborative self-efficacy based on ElHiGoal and instructors.

The second part of research question 3 asked: “Secondly, what is the effect of the pre-activity training based on the future grade-level goal of the student?” Thirdly, does
the instructor have a differential effect?” In other words, does the effect of pre-activity training (collaborative skills or instructional design) have a differential effect on the students indicating a preference for teaching elementary school (K-6) and those indicating a preference to teach high school, 7\textsuperscript{th}-12\textsuperscript{th} grade? This factor is called \textit{ElHiGoal}. Similarly does the instructor-type factor make a difference in the effect based on the two types of pre-activity training?

\textit{Combining two-independent variables analysis.} A review of the data found that there was an almost perfect correlation between those students enrolled in each of the two instructor’s sections which oriented to the two grade level goals and the grade-level preference indicated by the students; only one student in one of the secondary education sections indicated a ElHiGoal/grade-goal preference of elementary school. Therefore in doing the initial MANOVA and in answering the two subparts of this question, only a single ANOVA analysis was performed using ElHiGoal preference and none for instructor because this ElHiGoal independent variable factor was essentially identical to the instructor factor.

\textit{ElHiGoal (and teacher) findings.} For the dependent variable collaborative SE-factor, the ANOVA found no significant main effect between those having the goal to teach elementary school over those indicating high school $F_{(1, 65)} = .046, p = .830, \eta^2 = .001$ (Table 9). The pre-training-activity SE-factor values for elementary-school group were $M = 5.404, SD = .853$; while the post values for the elementary group were $M = 5.615, SD = .814$. The pre values for the high-school group were $M = 5.450, SD = .782$; while the post values for high-school group were $M = 5.534, SD = .803$ (See Appendix F). There were no significant interactions found between ElHiGoal and other factors (see
Table 8 and Table 9); however, the graphs shown in Figure 10 do show some indication of an interaction pattern between time and ElHiGoal for the design-training groups (graphs SE-D and SE-F respectively).

![Figure 10: SE-factor: ElHiGoal by training-type (T-group) by time interactions. Time = 1: pre-training and collaboration; Time = 2: post training and collaborative activity.](image)

Research Question 4: Measurement of training effect.

Research question 4 asked: “Do students, who get training on collaborative knowledge, skills and attitudes, show a greater vocabulary use of the collaborative-related terms used in this training after participating in the collaborative activity as compared with students not receiving this training?” To address this question, the 4 “open-ended” questions in the post-activity survey (see Table 19 in Appendix A) were used as data. The four questions were:

1) What group-collaboration strategies/techniques did you utilize on the mini-teach group assignment?

2) What thing(s) would you change/improve about your group's collaboration process if you could do it again?

3) Describe what you enjoyed the most about the mini-teach group assignment.
4) Describe what you enjoyed the least about this mini-teach assignment.

In order to help answer the research question number four described above, it was decided that two different analyses would be performed: content-thematic and word frequency analysis. The original research question implied that a word analysis would be used to answer this question. After reviewing the participants responses, it was decided that two methods would be used in analyzing the data from these questions. The goal was to utilize a type of mixed methods approach to provide both qualitative and quantitative data that combined could possibly provide better information for answering this research question (Creswell, 1998).

*Thematic content analysis.*

Although the answers given to these questions were quite brief; they averaged a little over one sentence (10 words), a thematic-content analysis was performed to see if the two groups’ (collaboration and design training) responses differed in a manner that possibly reflected the different training received.

Thematic content analysis is viewed as a general qualitative technique that is applied in a multitude of ways in practice (Braun & Clarke, 2006). However, it can be defined as: “a method for identifying, analyzing and reporting patterns (themes) within data” (Braun & Clark, 2006, p. 79). With thematic analysis, “a theme captures something important about the data in relation to the research question, and represents some level of patterned response or meaning within the data set” (Braun & Clarke, 2006, p. 87). The analysis described below loosely follows the outline described by Braun and Clark (2006): transcription (done by participants typing in answers to questions), coding, analysis (including interpretation), description (illustrative and narrative), and write-up.
The thematic analysis involved “processing” the responses to each question three times. During the first pass, a coding thematic “key” was developed from the responses and initial coding assigned. The second pass involved verifying that the initial coding still made sense with the availability of the entire thematic key. To check on the key and analysis, a second person coded the responses against the thematic key. The first person and second person’s coding where reconciled where they differed (inter-rater reliability = 84%). Finally, a summary of the coding was compiled. This summary was then analyzed and some thematic-key items were combined because they represented the same theme or concept. Each of the four questions is presented sequentially followed by a summary thematic discussion.

**Question #1: Thematic-content analysis.**

The thematic-analysis coding sheet for question #1 is summarized in Table 10.

Question #1 was worded: “What group-collaboration strategies/techniques did you utilize on the mini-teach group assignment?”

Table 10: Major response themes to open-ended question #1.

<table>
<thead>
<tr>
<th>#</th>
<th>Key Idea</th>
<th>Collab Group</th>
<th>Design Group</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Planned: Divided/Assigned Tasks: Worked separately &amp; combined at end</td>
<td>19</td>
<td>15</td>
<td>“Assigned tasks and roles”</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>“We all did our own work without consulting others”</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>“Divided up the work equally amongst the group.”</td>
</tr>
<tr>
<td>2</td>
<td>Focused on good communication(ing)</td>
<td>15</td>
<td>12</td>
<td>“We constantly emailed/kept each informed”</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>“Lots of communication”</td>
</tr>
<tr>
<td>3</td>
<td>Communication (logistical focus)</td>
<td>14</td>
<td>5</td>
<td>“We exchanged phone numbers”</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>“We used emails to stay in touch”</td>
</tr>
</tbody>
</table>
One of the most striking features of the content analysis of this question is the dominance of the divide-and-conquer strategy as evidenced by thematic item #1 shown in the above table. The students using this technique divided the project up in some manner and each person did something and then they got together toward the end with little interaction during the process to complete the web page and, in the case of the face-to-face group, prepare their talk. The idea that they were doing a collaborative learning project was not in evidence in all but a very few comments. Two of the comments indicative of this theme were: “we assigned each other portions of the assignment and did them” and “we met outside of class and distributed the work.” This strategy would appear similar to the “coordinated learning” model that Haythornwaite (2006) discussed in chapter 2. She describes this strategy, although fairly common, as not truly being collaborative learning. It should be noted that both groups mentioned this approach in large numbers compared to other strategies. A second observation is that communication was a major focus of the responses from both groups. However, the communication theme clearly consisted of two different ideas; one that implied trying to communicate for understanding and one that had a more logistical-sounding focus.
Question #2: Thematic-content analysis.

The second open-ended question’s thematic-analysis is summarized in Table 11.

Question #2 was worded: “What thing(s) would you change/improve about your group’s collaboration process if you could do it again?”

Table 11: Major response themes to open-ended question #2.

<table>
<thead>
<tr>
<th>Key Idea</th>
<th>Collab Train</th>
<th>Design Train</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Better Planning</td>
<td>10</td>
<td>7</td>
<td>“Plan Ahead/More Organized”</td>
</tr>
<tr>
<td>2 Poor teamwork/not enough working</td>
<td>9</td>
<td>8</td>
<td>“I would have liked to have met with them at least once before the day of the presentation.” “More meetings.”</td>
</tr>
<tr>
<td>3 Start Earlier</td>
<td>7</td>
<td>8</td>
<td>“Work on the project earlier”</td>
</tr>
<tr>
<td>5 More (share/even) participation</td>
<td>4</td>
<td>4</td>
<td>“If everyone would have done their fair share”</td>
</tr>
<tr>
<td>6 Improve communication</td>
<td>4</td>
<td>3</td>
<td>“I could not reach them”</td>
</tr>
<tr>
<td>7 Better understanding of assignment</td>
<td>6</td>
<td>2</td>
<td>“We weren’t sure what was expected”</td>
</tr>
<tr>
<td>8 Change Nothing</td>
<td>5</td>
<td>6</td>
<td>“Would not change anything”</td>
</tr>
<tr>
<td>9 Don’t like project</td>
<td>3</td>
<td>1</td>
<td>“I think making a group project for online students is unfair.”</td>
</tr>
</tbody>
</table>

Note: Minor responses not shown. Some responses resulted in multiple codes.

The thematic-content analysis for question 2 does not show any obvious difference between groups. It is interesting to note that the first seven improvements would all be things that were covered to one degree or another in the collaboration group online training. This does raise the question, if the collaboration group were advised of the importance of attending to these issues, there is no obvious evidence from an analysis for this question that they actually did anything different than the design training group.
It is interesting to note that some people would not have changed or improved anything; this could be taken to mean they had the perfect group experience.

**Question #3: Thematic-content analysis.**

The third open-ended question’s thematic-analysis is summarized in Table 12.

Question #3 was worded: “Describe what you enjoyed the MOST about the mini-teach group assignment.”

<table>
<thead>
<tr>
<th>#</th>
<th>Key Idea</th>
<th>Collab Group</th>
<th>Design Group</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Learning about my topic/instructional technology</td>
<td>12</td>
<td>10</td>
<td>“I enjoyed my topic.”</td>
</tr>
<tr>
<td>2</td>
<td>Learning about other group’s instructional technology</td>
<td>10</td>
<td>10</td>
<td>“I learned about a few new resources that I could possibly use in my own classroom.”</td>
</tr>
<tr>
<td>3</td>
<td>Creating/using wiki page/using colors</td>
<td>5</td>
<td>10</td>
<td>“I enjoyed creating the wiki page. Creating and adding videos. Using colors; The freedom to create a creative page.”</td>
</tr>
<tr>
<td>4</td>
<td>Teaching/presenting to the class</td>
<td>4</td>
<td>3</td>
<td>“It was fun teaching the class.”</td>
</tr>
<tr>
<td>5</td>
<td>Working in my group/meeting classmates</td>
<td>4</td>
<td>10</td>
<td>“I enjoyed working in my group.”</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>“Way to meet my classmates that I might not have otherwise.”</td>
</tr>
<tr>
<td>6</td>
<td>Nothing /Did not like assignment</td>
<td>2</td>
<td>3</td>
<td>“I actually didn't enjoy anything about this assignment.”</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>“Online class should not have group projects.”</td>
</tr>
<tr>
<td>7</td>
<td>Freedom to work on project on my schedule/freedom to work</td>
<td>2</td>
<td>2</td>
<td>“I enjoyed the fact that we did not have to meet in person because we could work on the wiki.”</td>
</tr>
<tr>
<td></td>
<td>without meeting people/No need to communicate.</td>
<td></td>
<td></td>
<td>“The lack of necessity to communicate.”</td>
</tr>
</tbody>
</table>
The thematic content analysis for question #3 showed that learning about the instructional technology either directly or from the other groups work dominated the answers. Thus approximately half of the students, equally divided between both collaboration and design trained groups, thought that the thing they enjoyed most in this project was learning about the new technology. Interestingly, only about 20% of face-to-face class students (7 out of 36) listed being able to teach/present to the class was one of the things they enjoyed most. For students who indicated a desire to be teachers, it is a little surprising this percentage was not higher, since they are focused on a profession that requires a person to teach many hours each day.

*Question #4: Thematic-content analysis.*

The fourth open-ended question’s thematic-analysis is summarized in Table 13. Question #4 was worded: “Describe what you enjoyed the LEAST about the mini-teach group assignment.”
Table 13: Major response themes to open-ended question #4.

<table>
<thead>
<tr>
<th>#</th>
<th>Key Idea</th>
<th>Collab Group</th>
<th>Design Group</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Group Project/group work/having to meet people</td>
<td>10</td>
<td>10</td>
<td>“I could have done just as well doing this assignment by myself.”</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>“Did not enjoy the group work aspect since it is an online course.”</td>
</tr>
<tr>
<td>2</td>
<td>Poor teamwork/poor performance by group members/ poor communication</td>
<td>10</td>
<td>10</td>
<td>“The group work did not work really well.” “No one communicated with one another.”</td>
</tr>
<tr>
<td>3</td>
<td>The assignment (many aspects)</td>
<td>6</td>
<td>4</td>
<td>“Being told that I was going to work and teach a technology I was unfamiliar with.”</td>
</tr>
<tr>
<td>4</td>
<td>Nothing. I enjoyed it all.</td>
<td>6</td>
<td>1</td>
<td>“I can honestly say that I enjoyed it all.” “I enjoyed it.”</td>
</tr>
<tr>
<td>5</td>
<td>Not enough meetings/schedule conflicts</td>
<td>5</td>
<td>3</td>
<td>“I least enjoyed that we could not get together to work on it more.”</td>
</tr>
<tr>
<td>6</td>
<td>Not enough time to present/for project</td>
<td>5</td>
<td>2</td>
<td>“I wish we could have taught for at least 30-35 minutes.”</td>
</tr>
</tbody>
</table>

Note: Minor responses not shown. Some responses resulted in multiple codes.

The thematic content analysis for question #4 was interesting in that approximately 25% (especially when the responses to item #3 are added) of the participants seemed to dislike the group project. A similar 25% number, as evidenced by item #2, thought that the teamwork or the participant’s performance or communication was something they liked the least in this activity.

The thematic analysis provided little evidence that the two treatment-training groups differed in their responses. Therefore it provides no indication any effect of the
collaboration-training received by one of the groups as compared to those who received
design training.

*Word count frequency analysis.*

The second method used to obtain data to see if there was an effect from the
training was word count frequency (WCF) analysis. WCF analysis has been used
successfully in analyzing the written content in a number of experimental contexts
(Tausczik & Pennebaker, 2010). WCF analysis of written text has been shown to lead to
analytic and predictive models of such things as poets who are likely to commit suicide
(Stirman & Pennebaker, 2001), bereavement behavioral responses one year later
(Pennebaker, Mayne, & Francis, 1997), effect of brief (2-minute) journaling on emotional
health and longevity (Pressman & Cohen, 2001). In another experiment, WCF analysis
was utilized to group people by those who used different word frequency and then
correlated to the groups with measures of depression. In this experiment, those who used
more first-person singular words (I, me, my) compared to those who used first-person
plural words (we, us, our) had a differential correlation with measures of depression
(Rude, Gortner, & Pennebaker, 2004). Further Abe (2009) found, from a WCF analysis
of the journals of students participating in field practicums, that there was a significant
correlation with supervisor ratings of the student-teachers. The Abe study highlights the
fact that people’s use of words can, in certain cases, be a reflection of behaviors as
assessed by other methods. The recent availability of online word counting programs has
provided an easy means to do word frequency analysis on text. Thus, the research
literature provides evidence that WCF can function as a valid measurement and as an
analog to a person’s perceptions, emotions and attitudes.
In the current study, a WCF analysis was done that looked at the top five-word frequency (excluding articles and forms of the verb “do”) used in answering the four questions (#3 thru #6 in Table 19 of Appendix A) by both training-type groups. These are the same questions for which the thematic analysis was done and reported in the previous section. The analysis also compared these frequently-used words to their frequency of occurrence in the related training materials (see Appendix B & C). The results of this analysis are shown in Table 14.

Table 14: Highest word frequency written response to open-ended questions and training materials by training-type (pro-rated for different size of groups).

<table>
<thead>
<tr>
<th></th>
<th>Collaboration Training Group</th>
<th>Inst. Design Training Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top 5 Words/Q</td>
<td>Q1</td>
<td>Q2</td>
</tr>
<tr>
<td>group</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>project</td>
<td>16</td>
<td>6</td>
</tr>
<tr>
<td>work</td>
<td>9</td>
<td>7</td>
</tr>
<tr>
<td>communication</td>
<td>17</td>
<td>15</td>
</tr>
<tr>
<td>enjoyed</td>
<td>13</td>
<td>1</td>
</tr>
<tr>
<td>person</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>technology</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>learning</td>
<td>9</td>
<td>28</td>
</tr>
<tr>
<td>through</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>time</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>think</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>wiki</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>assignment</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>class</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>meet</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>really</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>together</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>different</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

TMF = word frequency in training material

It is interesting to note that the word “group” occurred in the participants’ responses almost twice as often (59) in the collaboration-trained group than in those
groups given design-training group (34). Further the word *group* occurred 33 times in the collaboration-training groups’ slides and only once in the design-training groups’ slides. Another item of note is the use of the word *communication*, which was used 15 times by the collaboration-trained group compared to zero times by the design-trained group. It should be noted that a large part of the collaboration training slide-text included the word communication or its synonyms. Finally, a correlation was performed between each group total word count and the training material. The correlation for the collaboration training group responses with their training materials word content was $r = .68$ while the correlation for the design-training group and their training materials was $r = .05$. However, the difference in values of these two correlations must be taken with some caution because the correlation between the design-trained group’s responses and the collaboration-training materials is $r = .62$. This implies that some part of the correlation found between the collaboration-trained group and their training materials may be a consequence of the nature of the questions, which focused on collaboration and not on design. On the other hand, correlation is measuring the similarities of the relative ordering of items rather than individual item one-to-one relationship comparisons focused on here. Thus the correlation between the collaboration-trained participants’ words and the design group is $r = .66$, even with large differences in the word frequency use of some key words. Although far from definitive, this evidence would suggest that the brief collaboration training had some effect, approximately three weeks later, on those receiving it; at least in words utilized in the responses to open-ended questions.
Summary results for research question number 4.

The results from the two techniques give contradictory results. The thematic analysis does not indicate any difference in the survey responses of the two different types of treatment-training groups. On the other hand, the word-frequency analysis provides evidence that the groups may differ by the vocabulary used. Further, the word-frequency analysis indicates that the treatment group’s most utilized words correlate significantly with the word-frequency analysis of the words used in their training slides.

Other quantitative findings.

Liking-valuing factor.

The factor analysis discussed earlier in this chapter identified a set of questions (see Table 2) that were termed “liking/valuing collaborative learning” or LV-factor. The LV-factor appears to be assessing something different from collaborative self-efficacy; therefore it was not directly applicable to the main research questions of this study. However, at least two interesting questions arose from the availability of this LV-factor. First, how does LV-factor correlate with the measures of collaborative self-efficacy? In other words, if one has high collaborative self-efficacy, does it mean one really likes and values collaborative learning? A second question is how does this factor correlate with the training received?

To address the question of how the LV-factor relates to the training and other independent variables a follow-up ANOVA (see Table 15 & Table 16) was done with the LV-factor pre and post-activity data (Table 28 of Appendix F). The result of this ANOVA showed significant main effects for ElHiGoal ($F_{(1, 65)} = 4.120, p < .05, \eta^2 = .060$) and Class-type ($F_{(1, 65)} = 8.031, p < .05, \eta^2 = .110$) and a significant interaction
between Time and ElHiGoal ($F_{(1, 65)} = 5.565, p < .05, \eta^2 = .079$). The significant main effects for ElHiGoal and ClassType are shown graphically in Figure 12 graphs LV-K and LV-L respectively. The significant interaction of Time with the ElHiGoal means that students who had the goal of teaching elementary school, like-value collaborative learning activities significantly more (i.e. rate LV-factor higher) than those who plan on teaching high school but only before they (elementary school goal) have training and participate in the collaborative activity (see Figure 11, LV-D). After the training and activity, the difference in the LV-factor rating gap has narrowed and was not significantly different for the two ElHiGoal groups. The significant main effect for class-type (Figure 12, graph LV-L) indicates that those students who chose to take the class face-to-face value-like collaborative activities significantly more than those who chose to take the class as a distance education version. Further this difference in the LV-factor between the different class-type groups is true before and after the training and collaborative activity (see Figure 11, graph LV-G).
Table 15: LV-factor ANOVA for between subject effects.

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>p. Sig.</th>
<th>$\eta^2$</th>
<th>Obs. Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>2757.8</td>
<td>1</td>
<td>2757.8</td>
<td>841.4</td>
<td>.000</td>
<td>.928</td>
<td>1.000</td>
</tr>
<tr>
<td>T-group</td>
<td>4.553</td>
<td>1</td>
<td>4.553</td>
<td>1.389</td>
<td>.243</td>
<td>.021</td>
<td>.213</td>
</tr>
<tr>
<td>ELHiGoal</td>
<td>13.502</td>
<td>1</td>
<td>13.502</td>
<td>4.120</td>
<td>.046*</td>
<td>.060</td>
<td>.516</td>
</tr>
<tr>
<td>Class-type</td>
<td>26.321</td>
<td>1</td>
<td>26.321</td>
<td>8.031</td>
<td>.006*</td>
<td>.110</td>
<td>.797</td>
</tr>
<tr>
<td>T-group x ELHiGoal</td>
<td>3.437</td>
<td>1</td>
<td>3.437</td>
<td>1.049</td>
<td>.310</td>
<td>.016</td>
<td>.172</td>
</tr>
<tr>
<td>T-group x Class-type</td>
<td>2.396</td>
<td>1</td>
<td>2.396</td>
<td>.731</td>
<td>.396</td>
<td>.011</td>
<td>.134</td>
</tr>
<tr>
<td>ELHiGoal x Class-type</td>
<td>.481</td>
<td>1</td>
<td>.481</td>
<td>.147</td>
<td>.703</td>
<td>.002</td>
<td>.066</td>
</tr>
<tr>
<td>T-group x ELHiGoal x Class-type</td>
<td>3.116</td>
<td>1</td>
<td>3.116</td>
<td>.951</td>
<td>.333</td>
<td>.014</td>
<td>.161</td>
</tr>
<tr>
<td>Error</td>
<td>213.0</td>
<td>65</td>
<td>3.278</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* = significant at .05 level

Table 16: LV-factor ANOVA for within subject contrasts.

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>p. Sig.</th>
<th>$\eta^2$</th>
<th>Obs. Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>.269</td>
<td>1</td>
<td>.269</td>
<td>.446</td>
<td>.507</td>
<td>.007</td>
<td>.101</td>
</tr>
<tr>
<td>Time x T-group</td>
<td>.643</td>
<td>1</td>
<td>.643</td>
<td>1.068</td>
<td>.305</td>
<td>.016</td>
<td>.175</td>
</tr>
<tr>
<td>Time x ELHiGoal</td>
<td>3.353</td>
<td>1</td>
<td>3.353</td>
<td>5.565</td>
<td>.021*</td>
<td>.079</td>
<td>.642</td>
</tr>
<tr>
<td>Time x Class-type</td>
<td>.109</td>
<td>1</td>
<td>.109</td>
<td>.181</td>
<td>.672</td>
<td>.003</td>
<td>.070</td>
</tr>
<tr>
<td>Time x T-group x ELHiGoal</td>
<td>.114</td>
<td>1</td>
<td>.114</td>
<td>.190</td>
<td>.665</td>
<td>.003</td>
<td>.071</td>
</tr>
<tr>
<td>Time x T-group x Class-type</td>
<td>.856</td>
<td>1</td>
<td>.856</td>
<td>1.421</td>
<td>.238</td>
<td>.021</td>
<td>.217</td>
</tr>
<tr>
<td>Time x ELHiGoal x Class-type</td>
<td>.405</td>
<td>1</td>
<td>.405</td>
<td>.673</td>
<td>.415</td>
<td>.010</td>
<td>.128</td>
</tr>
<tr>
<td>Time x T-group x ELHiGoal x Class-type</td>
<td>2.288</td>
<td>1</td>
<td>2.288</td>
<td>3.798</td>
<td>.056</td>
<td>.055</td>
<td>.484</td>
</tr>
<tr>
<td>Error(Time)</td>
<td>39.2</td>
<td>65</td>
<td>.602</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* = significant at .05 level
Figure 11: LV-factor: Liking-valuing collaboration graph of Training-type (T-group), ElHiGoal and Class-type by time; un-weighted marginal means; time: 1 = pre-training & activity; 2 = post-activity.

Figure 12: LV-factor: Liking-valuing collaboration main effect graphs by Training-type (T-group), ElHiGoal and Class-type; un-weighted marginal means.
Figure 13: LV-factor: Liking-valuing collaboration for ELHiGoal by time by training type; un-weighted marginal means time: 1= pre-training & activity; 2 = post-activity.

Figure 14: LV-factor: Liking-valuing collaboration graphs by T-group (training type) by class-type.

Correlation of collaborative self-efficacy and computer skills assessment.

The computer skills self-assessment given at the beginning of the class was available for purposes of the current study for each participant. The availability of this measure allowed for the asking of a question such as: how do the participant’s
assessments of their skills about technology-use correlate with the assessments of collaborative self-efficacy, the SE-factor? The value for the participant’s technology skills self-assessment was derived from the mean of the answers given on the classes’ Introductory Computer-Skills Survey tech questions 12-36 (Table 20 in Appendix D). This composite tech-skills score for each person was correlated with the pre-activity values for the SE-factor measure obtained from the same person. The correlation found was very small and not statistically significant. The correlation, for technical skills self-report composite value with SE-factor, was $r = .124$.

*Post-activity questions 7 and 8 results.*

The goal of these two additional statements in the post-activity survey was to get data on what the students thought of their group’s work product (i.e. wiki-page and presentation) and also data about the overall collaborative functioning within his or her group. This assessment was done using the following two statements:

1) Rate the overall product (wiki page and presentation) your group produced for the Mini-teach project.

2) Rate the overall level of collaboration and teamwork in your Mini-teach project group.

The first statement could be described as a “work-product” and the second statement as “overall-collaboration.” These statements were rated on a 9-point Likert-scale (see Appendix A: Table 19). The work-product rating was $M = 7.01$, $SD = 1.968$; while the overall-collaboration rating was $M = 7.89$, $SD = 1.62$. A review of these correlations shows that, for the students, in this study, there was a small but statistically significant positive correlation between how the students rated their wiki-presentation work products
and their rating on overall group collaboration, $r = .371$. There was also a small but
significant correlation between work-products rating and post-activity LV-factor, $r =
.248$. The students overall rating of collaboration (Question 8) was positively and
significantly correlated to SE-factor, $r = .301$.

Table 17: Pearson R correlation of question 7 & 8 to LV-factor and SE-factor

<table>
<thead>
<tr>
<th>Measure</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Rate wiki &amp; presentation.</td>
<td>----</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Rate overall collaboration</td>
<td><strong>.371</strong></td>
<td>----</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. LV-factor (post)</td>
<td>*.248</td>
<td>.224</td>
<td>----</td>
<td></td>
</tr>
<tr>
<td>4. SE-factor (post)</td>
<td>.230</td>
<td><strong>.301</strong></td>
<td><strong>.321</strong></td>
<td>----</td>
</tr>
</tbody>
</table>

**= correlation is sig. at .01 level (2-tailed). * Correlation is sig. at .05 level (2-tailed).

Summary of Quantitative Results.

The quantitative results above provide some evidence that collaborative self-
efficacy is multi-faceted but can be measured and used to explore a number of questions
about collaborative learning. The lack of sufficient statistical power hampers this study’s
potential significance and interpretation of its results. At the same time, the analysis,
would suggest that effects and interactions may be present but are not statistically
significant due most probably to some combination of too small of a sample size and too
imprecise a measurement instrument; thus resulting in too little statistical power. The
data presented in the quantitative results for the research questions above are discussed in
more general terms in Chapter 5.
Qualitative Perspective

This study is fundamentally a quantitative study. However some effort was taken to observe and review aspects that were not directly related to answering its enumerated major research questions. What is reported here should not be considered qualitative research; rather, the goal of this section is to add some qualitative perspective to this quantitative study.

Classroom Instructor and Presentation Observations.

Both instructors were observed in the teaching of their face-to-face classes and also while some of the face-to-face class groups made their class presentations. The total time of these observations was about two hours per class. These observations were not planned but rather were purely envisioned as getting a “feel” for these two aspects of the project.

The two instructors are, as one might expect, different individuals. One is male and he has a worldly, brusque-friendly demeanor with a slightly sarcastic-tinged teaching style. He wants his students to get it, where get it means that they will realize that technology will be an important part of their future teaching lives and they should master it. The other instructor is a female with a background in elementary teaching before becoming a professor in curriculum and instruction. She, therefore, “knows of what she speaks” about being an elementary-level teacher. Her style is formal-friendly, while being very focused on getting her “future teachers” to transition from thinking like a student to thinking like a teacher.

Both instructors were equally focused on empowering the students to learn about and appreciate the beneficial aspects of educational technology. The conclusion from
this observation of the two instructors was that they are different and, although surely, their effects on the students vis-à-vis the mini-teach lesson were different; however the actual differential effects on this study’s research variables that might follow from the instructor’s different personalities and approaches cannot be obtained by any short informal observation.

The presentations by the groups observed were at a level one might expect in an undergraduate college class. It was fairly obvious, as noted earlier, that the presentations were more coordinated than collaborated in the sense that most groups seemed to have agreed shortly before class who would talk about what. There was little evidence that the groups had practiced their presentations. There were several occurrences of words to the effect “that’s your part…;” thus implying that a particular portion of the web page was done by that person and therefore that person should talk about that area.

**Review of Wiki Pages.**

I reviewed two wiki-pages from each face-to-face and each distance education class; one for each training-treatment type. It was not evident from a review of the wiki-pages that the pages differed in any systematic way based on class-type or training-treatment. It became clear from this informal review that the wiki pages would be difficult to analyze in a manner providing significance to this study. Beyond the elements required by the assignment rubric, the evaluation of what makes a good wiki-page would probably be open to much debate.
CHAPTER 5: DISCUSSION, SIGNIFICANCE AND FUTURE RESEARCH

This study was built around the three concepts of collaborative learning (see Johnson & Johnson, 1999a; Slavin, 1995), instructional scaffolding (Wood, Bruner, & Ross, 1976; Hogan & Pressley, 1997), and self-efficacy (Bandura, 1982, 1993, 1997). This research was driven, in part, by the increasing popularity of collaborative learning pedagogy within academic worlds (Johnson & Johnson, 1999; Ruys, Van Keer & Aelterman, 2010; Anstrom, 2010) and collaboration in the business world (Gardner & Korth, 1997).

The primary goal of the current study was to gain important information about the attitudes, namely collaborative self-efficacy that students had toward performing collaborative work in the context of a university class for pre-service education majors. A second goal and experimental focus involved obtaining data related to seeing whether collaborative self-efficacy attitudes are affected by a pre-collaborative-activity training scaffold. This study hypothesized that increased knowledge about generally accepted positive concepts, strategies and ideas about collaborative activity should, when combined with a group experience, increase a person’s collaborative self-efficacy about such activities. In other words, this study proposed that a brief online computer-delivered training intervention, the purpose of which was to increase a person’s knowledge about collaboration, would affect the student’s collaborative self-efficacy ratings after participating in a collaborative learning group and group activity. To gain a more nuanced understanding of this hypothesis, the hypothesis was expanded to explore whether collaborative self-efficacy measures obtained and collaborative training-treatments interact in significant ways with the type of class the student was taking (face-
to-face or online), the grade level goal they hoped to teach (elementary or high school) or time of measurement (pre or post the collaborative activity). In order to accomplish these goals, a computer-based survey instrument was developed, evaluated, and utilized that allowed for obtaining attitudes, including collaborative self-efficacy, related to collaborative learning activities. Factor analysis of this survey instrument resulted in a composite factor that provided the primary dependent multi-question composite measure for collaborative self-efficacy (SE-factor) used in this study. Further, the factor analysis identified an additional collaborative related variable: the collaborative liking-valuing factor (LV-factor). It is interesting to note that in a previous study looking at attitudes related to computer use, the analysis of the survey used in that study, ended up with two grouped measures, computer confidence and computer liking, that sound analogous to the current study’s factors: collaborative self-efficacy (SE-factor) and liking-valuing collaboration (LV-factor) (Busch, 1995).

Data were obtained from the treatment and control groups before the experimental or control scaffolding-training and after the students completed their training and the group collaborative activity. The results of the data collected from the survey instrument and the statistical and qualitative analysis were reported in chapter 4. Each of this study’s research questions will be discussed in turn, followed by a general discussion, followed by a discussion of some of this study’s limitations, and concluding with a discussion of the possible significance of this study to education and future research.

**Research Question 1a: Students’ Collaborative Self-Efficacy.**

The first part of research question 1 asked: “What is the level of collaborative self-efficacy of students enrolled in a college class for pre-service teachers?” The
procedures outlined in chapter 3 and the results reported in chapter 4 related to this question were meant to provide quantitative measures of the students’ self-efficacy toward collaborative-learning group work and activities prior to the collaborative activity and also after the scaffolded-training and participation in the collaborative activity. A factor-analysis derived measure called the SE-factor was used in analyzing each question. The SE-factor measures of self-efficacy did not differ significantly from the pre-training-activity to the post-activity; however, the self-efficacy values did increase from pre to post. This gives weak evidence, on average, that the students felt more collaborative self-efficacy after the period of time that included collaborating in a group, working on the assignment of researching/building the wiki page, and receiving one of the two versions of computer-based training. As can be seen in the analysis related to the SE-factor done based on the variables such as class-type, EiHiGoal and treatment, the general increase of collaborative self-efficacy is due to particular groups, treatment and interactions; these are revisited further within subsequent discussions in this section.

One of the reasons for developing and obtaining collaborative self-efficacy measurements was to establish a baseline level for the selected subset of college students. A number of the limited findings about the attitude of students about collaborative work have dealt with different age (e.g. graduate students) and majors (i.e. business majors, human resource, etc.) (Yazici, 2004; Chapman, Meuter, Toy & Wright, 2010). The research finding for the current study, showing that students have a mean collaborative self-efficacy (SE-factor) of 5.64 (pre) to 5.79 (post), on a scale of 1 to 7, suggests a moderate-to-strong confidence about performing such collaborative learning activities. This value compares favorably with other research with teenagers collaborating online
which found a 4.07 (pre-activity) to a 4.32 (post-activity on a 1-5 scale) response to the question “I feel very confident in my ability to work with a team of other youth online in solving a problem or completing a task” (Wang, Poole, Harris, & Wangemann, 2001, p. 208). The current research’s finding adds another reference point of data in an area where very little experimental measurement data currently exists. A review of the data does raise at least two issues: substantial variability-swings and justification for high self-efficacy.

Variability-swings in collaborative self-efficacy.

As shown graphically in the scattergram in chapter 4 (see Figure 8), there is considerable, both positive and negative, change in collaborative self-efficacy ratings from pre-training-activity to post-training-activity. Quite a number of the self-efficacy assessments went up or down 2 full scale points which would be approximately 2.5 average standard deviations (~ 0.8) for the pre and post full group means. Is this a usual occurrence? Was this a real change, or was perhaps a result of the imprecision of the measurement tool? No literature was found that shows the type of variability displayed shown in the scattergram. In fact as noted in chapter 3, most self-efficacy assessments are single point-in-time measures (e.g. Pajares & Miller, 1994; Ryan, Bordoloi & Harrison, 2000); the one exception found was the study done with teenagers in Britain (Wang, Poole, Harris & Wangeman, 2001). In the Wang et al. (2001) study, the changes in collaborative self-efficacy measures are shown pre and post. However, the limitations in this study are two-fold; there is no standard deviations shown and there is no scatterplot that shows the variability in terms of plus and minus changes. The changes in the means for collaborative self-efficacy were not significant for face-to-face
collaboration but were significant for the online collaboration groups. Thus the limitation of the information reported in the Wang et al. study provides data that are difficult to compare to this current study’s results. From a more theoretical standpoint, Gist and Mitchell (1992) provide a discussion of the determinants and malleability of self-efficacy. They suggest in their discussion that determinations of self-efficacy judgments are more complex than those specified by Bandura (1982, 1997; see chapter 3). Gist and Mitchell note that the more complex the task, the more things that a person has to factor in to a self-efficacy assessment. It would seem that a collaborative learning activity would be on the high end of any such complexity scale. They further argue that it is this complexity that may make for variability in self-efficacy assessments; thus one aspect may change or experience happen and it significantly change a person’s self-efficacy. Intriguingly, they also suggest that in some cases “the individual is apt to refer simply to his or her previous performance level and to utilize that level as the primary determinant of self-efficacy” (p. 191). The idea that self-efficacy assessments may be highly dependent upon the last experience or performance, what might be called a theory of last experience, may help to explain the variability seen in the current study. The data in the current study may also provide some evidence as to the impact of the last experience on collaborative self-efficacy. The data analysis indicates that there is a significant, but small, correlation between the students’ overall assessment of collaboration and the post SE-factor of $r = .301$; whereas the correlation of the overall collaboration rating with the pre SE-factor measure is $r = -.060$. This might imply that when a person is being asked to rate collaborative self-efficacy, the most recent experience may have a major influence on the assessment. The current research explored the malleability of self-efficacy to scaffold-
training. In the current experiment the training intervention and the experience are temporally combined. More research would be helpful that attempts to separate these two antecedents to self-efficacy. In the case of the current study, any training effect may be overwhelmed by the effect of the collaborative experience. This situation may help to explain the large SE-factor variability and lack of significant effect from the training-treatment.

**High collaborative self-efficacy and pre-service teacher optimism.**

The all-groups combined collaborative self-efficacy SE-factor measurement result, found in the current study, reflects a moderately high level (5.421 pre-training-activity and 5.585 post activity). Is this based purely on the student’s assessment of collaborative self-efficacy or is it influence by a more general predisposition in the study’s participants’ optimism or some combination? In Bandura’s (e.g. 1982, 1997) conception, the assessment of self-efficacy is meant to measure a narrow construct related to a specific domain; further, he contends it is based on prior experiences. However, there is some disagreement as to how much a general disposition might influence a self-efficacy assessment (Scott, 2005). Further, there is evidence suggesting that teachers may have an “unrealistic optimism” about many aspects of teaching (Weinstein, 1987, 1989). At the same time, the low correlation reported on in chapter 4 between the student’s computer technical skills assessment and collaborative self-efficacy in the current study suggests that the nature of the interaction between a fundamental trait like optimism and a more focused attitude like self-efficacy may be complex.
Research Question 1b: Student’s collaborative self-efficacy and other factors.

The second part of research question 1 asked: “Does collaborative self-efficacy differ depending on whether the students are taking the class as a face-to-face class or as a distance-education class?” This question arises because as noted in chapter 3 there is some evidence that the students who select online classes may have personality characteristics differing from those students that choose traditional face-to-face classes (Russell, 2002; Ellis, 2003). The ANOVA result for the relationship of class-type to the SE-factor is shown in Table 8 and Table 9 in chapter 4. The relationship is shown graphically in Figure 6 in chapter 4. The graphic view does show that for the SE-factor the face-to-face group means were higher than the distance education students for both pre and post-activity measurements. However, for the SE-factor there was no statistically significant main effects or interaction for the class-type and other independent variables.

Some differences have been found between face-to-face and distance education students, as discussed in chapter 2 (Parker, 1999; Rovai, 2003; Ross & Powell, 1990; Rowntree, 1995; Wang & Newlin, 2002). This literature and research did not provide any clear reason why the differences found would lead to difference in collaborative self-efficacy assessments such as those measured by the SE-factor. Thus the findings of the current study only provide tentative data that might apply to the question of differences in students in different class types. As with the other questions related to SE-factor, further research with a larger number of participants would be necessary to add support or non-support to the differences seen in the current study.
Research Questions 2 & 3: Instructional scaffolding: Its effect on collaborative self-efficacy and how it varies with class-type and other variables.

Research question 2 asked: “Will the collaborative self-efficacy increase in students after taking part in a collaborative learning activity if they first are given an instructional-scaffolding in the form of a computer-based training focused on key collaborative knowledge, skills and attitudes over another group which does not receive the collaboration-focused instructional scaffolding?”

Research question 3 asked: “Does the computer-based collaboration training have a differential effect on collaborative self-efficacy depending on whether the students are participating in a face-to-face class versus a distance-education class? Secondly, what is the effect on the future grade-level goal of the student? Thirdly, does the instructor have a differential effect?” A quantitative analysis of the data related to these two questions was presented in chapter 4.

The prediction was that those students having the training would increase their knowledge, skills and attitude about collaborative learning resulting in better collaboration and higher collaborative self-efficacy. The idea that an instructional-scaffolding in the form of a brief computer-based training would have enough effect was a major question to be tested in this research. As discussed in chapter, there are some studies that report a positive effect of training on self-efficacy. However in the current study, the statistical analysis, as reported in chapter 4, showed no significant training-treatment main effect for the SE-factor measure. Thus, as measured by the collaborative self-efficacy measure, SE-factor, no statistically significant increase or decrease was found. The finding of no significant training-treatment effect could be due to many
factors. The fact that the sample size was relatively small could result in no significance being found even when there was one. Also, it could be due to flaws in the instrument such that it does not actually accurately assess collaborative self-efficacy. It may be that the collaborative training affected the students, but that having knowledge alone does not increase collaborative self-efficacy; this latter possibility is reinforced by learning theories that suggest learning is situated within a particular context and not predominately conceptual (Lave & Wenger, 1991). Lave and Wenger argue that knowledge acquired outside of a particular use-setting may not be easily transferred to another setting.

Even though the training treatment was not shown to make a statistically significant difference, some indication of a possible interaction of training-treatment with class-type can be seen in Figure 9 (see chapter 4) that shows a classic interaction profile. Further, a review of the two right graphs (SE-B and SE-C) in this figure shows that the interaction represented in the left-most general factor graph (SE-A) is due in large part to the interaction of treatment-type and face-to-face students. This face-to-face graph shows that, although the face-to-face group who received the collaboration training had a much lower collaborative self-efficacy (SE-factor) mean score before the training and activity, their scores were higher than the design-trained group at the end of the activity. This interaction for face-to-face class groups is in contrast to the distance education class groups (graph SE-C), where although both training groups increased slightly from pre to post measurements, they basically remained with the same differential between them from beginning to end. One possible reason, for why the face-to-face students increased their collaborative self-efficacy more than the distance education students is, beyond this being a non-statistical anomaly, that the face-to-face students may have chosen an in-
person class purposefully over an online-distance-education class because they are more social or extroverted. Although this study did not measure in any way the sociability or introversion/extroversion of the students, this would seem to be a natural factor to consider adding in future research.

*ElHiGoal, instructors and collaborative self-efficacy.*

Question three also asked: “Does the effect of pre-activity training (collaborative skills or instructional design) have a differential effect on the SE-factor, for those students indicating a ElHiGoal preference for teaching elementary school compared with those preferring to teach high school. Similarly what is the differential effect, if any, by instructor?” The first part of this question is an empirical one suggested by the research literature which finds some characteristics differ between those wishing to teach in elementary school and those whose preference is high school teaching (Book & Freeman, 1986). Some research suggests that elementary school teachers may tend to be more collaborative and social than those focusing on secondary teaching; the latter tend to be more focused on the area of study (Sears, Kennedy & Kaye, 1997). The differences between these two groups, noted in prior research, as discussed in chapter 2, led to a “tenuous” hypothesis that those students indicating a desire to teach elementary school might be more disposed toward collaborative learning. The second part of this question is an empirical one that asks whether differences can be discerned between the two instructors. There is not deductive logic from a particular body of research for this two-instructor question other than the commonsense understanding that no two teachers will handle that same curriculum in the same way due to personality, experience and other factors.
The two variables ElHiGoal and instructor were treated as identical factors for statistical analysis purposes. Therefore, for the discussion that follows in this section, only the variable term ElHiGoal is used. For SE-factor, there were no significant main effects or interactions. Thus one could conclude that the current study did not find any significant differences between pre-service teachers based on their teaching grade-level goal (ElHiGoal). In spite of no significant ElHiGoal interactions in the data, the graphic representations of the SE-factor (Figure 10) only hints at a classic interaction profiles. These graphs in this figure, would suggest that it might make a difference as to the ElHiGoal of the student as to the effect that collaboration or design training have on collaborative self-efficacy (SE-factor). These collaborative self-efficacy interaction graphs however would indicate that elementary-school-goal students show a positive increase in self-efficacy when given the design training whereas high-school-goals student’s self-efficacy actually decreases (graph SE-F). There is no interaction in either ElHiGoal group for those receiving collaboration training. Graph SE-D portraying the overall effect shows that, on average, those with a ElHiGoal of elementary school show higher self-efficacy at the post measurement than those indicating an ElHiGoal of high school.

In summary, for the question of whether a student’s ElHiGoal or instructor has an effect on collaborative self-efficacy, this study showed no significant main or interaction effect. Thus, although there is other research literature which reports that elementary school teachers differ on a number of dimensions with those teaching high school, there is scant evidence that those differences affect collaborative self-efficacy or interactions with the other variables studied (time, class-type or training-treatment).
**Research Question 4: What evidence is there of the treatment-training?**

Research question 4 asked: “Do students, who get training on collaborative knowledge, skills and attitudes, differ from those not receiving this training in their use of, or frequency of words, or descriptions when asked open-ended questions about the collaborative activity?”

The primary goal of this study was to assess students’ collaborative self-efficacy and the effect that collaborative knowledge, skills and attitude training combined with a collaborative learning activity had on that self-efficacy. It was thought that some measurement means should be employed to see if there would be evidence of the effect of the training itself at the time of the post-activity self-efficacy assessment. Four open-ended questions in the post-activity survey asked about the collaborative strategies and/or techniques used by the students, changes or improvements he or she would make in the group collaboration process and what aspects of the activity were enjoyed the most or the least. Two analysis methods were employed to provide information related to the answer for question number 4. A thematic analysis and a word frequency analysis related to this question were presented in chapter 4.

The information from the two analyses gave somewhat contradictory answers. The thematic analysis suggested that there was little difference in the two training-treatment groups; while the word frequency analysis found noticeable differences in the two groups’ choice of words. As discussed later in this chapter, the training-treatment intervention was shorter and smaller and less intensive than that generally called for when trying to increase a person’s knowledge, skills and attitudes in a domain (e.g. Johnson, Johnson, & Houlebec, 1991). The fact that no significant differences were
found for the collaborative self-efficacy measure, SE-factor, would tend to support the conclusions one could draw from the results of the thematic analysis. On the other hand, it may be that there was an effect of the training as noted in the word frequency analysis and the graphic representation of the SE-factor data.

**Other Quantitative Findings.**

*The Collaborative Self-Efficacy Instrument.*

The collaborative self-efficacy instrument, developed for and trialed in this research, provided a reasonable measurement instrument and resulted in data for use in answering a number of this research’s major questions. Additionally, the factor analysis of the responses to the 24-questions provided both a measurement of collaborative self-efficacy and a factor for measuring the student liking/valuing of collaborative-group work.

*The LV-factor: Liking-valuing collaborative activity.*

The discovery of the LV-factor (liking-valuing collaborative activity), from the factor analysis of the collaborative self-efficacy items and its analysis, provides some interesting findings that were not the primary focus of this study. Data tables, graphs and quantitative analysis for the LV-factor are presented in the “Other Quantitative Findings” section of chapter 4.

As was discussed in the chapter 2, Neo’s (2003) study found that the vast majority of students, 86%, preferred to work in groups; although somewhat contradictorily, 36% felt that “teamwork kept them from doing their best work” (p. 471). Similarly, The overall rating for the LV-factor in the current study (pre M = 4.681, SD = 1.452; post M = 4.505, SD = 1.479 on a scale of 1 to 7) suggests an above-the-mid-point (4) liking-
valuing of collaborative learning activities. The current study tends to support Neo’s results, but because the questions and scales used were not the same, the results are not directly comparable.

There was a statistically significant finding in regards to the LV-factor and ElHiGoal grade-goal variable. Those students reporting a desire to teach elementary school were shown to like-value (LV-factor) collaborative-learning activities more than those students whose students whose goal was reported as high school teaching. It is interesting, when reviewing the interaction graphs (Figure 13 in chapter 4), to note the positive effect that the collaboration activity had on the high-school ElHiGoal group (graph LV-E). This positive effect hints at the possibility the high-school preference group start out with a much lower like-value opinion of collaborative activities but after actually participating, they felt more positive. An intriguing question raised by the graphs in Figure 13 is why those wishing to teach elementary school started out significantly higher before training and the collaborative activity, but went down substantially by the post assessment. No data collected in this study or ideas from the literature suggests a possible answer to this question. It would be interesting to see if this phenomenon is reproducible.

As shown in graph G of Figure 11 in chapter 4, there is a significant main effect of class type. The LV-factor face-to-face values are significantly higher, both before training and after training-activity. Thus result suggests that people who take distance education classes do not value or like collaborative activities as compared to those who take face-to-face classes (Figure 11, Graph LV-G). At the same time, for the face-to-face students, the graph (Figure 14, Graph LV-B) indicates that, if you received the
collaboration training and you are taking a face-to-face class, you had a substantial
increase in your liking/valuing after this training and collaborative activity over those
who received design training. Although this interaction was not found to be statistically
significant, this graph hints at a potential effect of collaboration training on how much
students subsequently like and value collaborative activities, at least for people who are
enrolled in face-to-face classes. In looking at this graph for the LV-factor, it is
interesting to ask whether the fact that face-to-face group participants had higher starting
collaborative self-efficacy (SE-factor; see graph SE-G in Figure 7) plus the opportunity to
collaborate in-person, results in the differential observed in the graph). Thus, as a
number of theorists have suggested, our behaviors are a function of not just how
competent we feel about doing something (i.e. self-efficacy: SE-factor), but also how
much we like or value the activity (i.e. LV-factor) (Gist & Mitchell, 1992; Bandura 1997,

**Collaborative self-efficacy and computer skills assessment.**

An interesting issue explored in the data is the question: Do the participant’s
assessments of their skills about technology use correlate with the assessments of
collaborative self-efficacy? A quantitative analysis related to this question was presented
in the “Other Quantitative findings” section of chapter 4. One would predict that there
should not necessarily be a correlation between technical self-efficacy and collaborative
self-efficacy (SE-factor) based on the theoretical model and general research findings that
self-efficacy is domain specific (Bandura, 1993, 1997). In other words, a person’s
confidence about being able to perform in one domain does not necessarily correlate with
a person’s confidence in another domain. The current study supports this non-correlation
because as reported in chapter 4, the correlation between the technical assessment and the SE-factor was $r = .124$, indicating very small correlation. The finding of only a small correlation between each student’s self-assessment of his or her computer software application skills and his or her collaborative self-efficacy measure (SE-factor) is in keeping with Bandura’s contention. Thus, how a student feels about his or her computer technical competency has no correlation with how the student feels about his or her competency to do collaborative work.

Post-activity questions 7 & 8 discussion.

Chapter 4 presents the data about these two post-activity questions in which students were asked to rate their group’s “work-product” (i.e. wiki-page) and the “overall-collaboration” of their group. The students rated the work-products at an average of 7.01 and overall-collaboration at 7.89, both on a 9-point scale. These values correspond to approximately 78% and 87% of the maximum for the scale. Similarly, the mean post-activity collaborative self-efficacy measure, SE-factor, was at 5.585 or 80% on the 7-point scale. These results indicated that these students thought they were quite competent at collaboration, that their group did a good job of collaborating, produced a good wiki and that they would give their group’s project at least a grade of “B.” These ratings support the contention that most students think they are quite skilled at group collaboration, that their group collaborated well and produced a high quality assignment.

Collaborative Activity Compared to a Model

One interesting discussion, related to the current study, is to compare the collaborative activity that the student participated in with a model such as that defined by Johnson, Johnson and Houlebec (JJH) (1990). The JJH model proposed five key
essentials for good collaborative learning groups and activities: positive independence, face-to-face encouraging interaction, interpersonal-group skills, individual accountability-responsibility and group-improvement processing.

In the JJH model, positive independence requires that students need each other to be successful. Clearly one of the things noted in the current study is that a significant number of groups used a divide-and-conquer technique. Further, the evidence, from observation and the analysis of open-ended questions, suggested that little concern was given to assuring that each member learned what the other team members had discovered. In this particular case, the way the exercise was formulated did not require either positive interdependence in the task or learning. It could be argued slightly however that there was a type of positive interdependence in that if one student did not do his or her assigned piece then the group’s final wiki and presentation might be negatively affected.

The JJH model also requires face-to-face encouraging interaction emphasizing large amounts of verbal interchange and information sharing. As was noted in chapter four, there is some evidence that the interaction of a number of the groups was minimal. Thus, on this measure the activity for a number of the current study’s groups, fell below JJH model’s standard. The JJH model, in this regard, shows its origin at a time before today’s online classes in which all communication is done in a written form.

The JJH model also depends on the students having the interpersonal and small group skills necessary and available for good group functioning. The current study did not have a means, other than tangentially, to assess group skills. The current study assumed that the collaboration skills, as is documented in the literature (e.g. Bosworth, 1994; Johnson, Johnson, & Houlebec, 1991), for many of the students were far from
excellent; hence this was one of the reasons for the current study’s intervention of the collaboration-training for half of the teams.

The JJH model further requires individual accountability and responsibility. No direct measure of this aspect of collaboration was obtained in the current study. However, it was the case, from the responses to the open-ended questions analyzed in chapter 4 that some students clearly felt that some team-members were not responsible; although the incidence of such comments was small. Since the grades were given mainly based on the team product, it was possible for students to not contribute to the product and still get a passing or good grade. A feedback path to the instructors was, in theory, available for students who felt that a team-member did not do his or her fair share. How this information, if available, affected a student’s grade is not directly measurable.

The final delineated piece of the JJH model requires what is called group-processing. This is envisioned as a type of periodic group retrospective discussion and assessment of the processes, interactions, products, etc. that leads to an improvement in the group’s functioning as well as increasing group members’ personal skills and knowledge enhancement. No such retrospective group-processing was required during this collaborative activity. It is probably the case, in many if not most cases, of the classes employing collaborative activities at the college level, that this step is not done; it is imagined that this is because the primary focus of most classes is on a particular subject and not increasing collaborative skills of the students. This type of group-processing feedback would seem to be a powerful way for people to increase collaborative skills and knowledge, but it is easy to see why it is seldom done.
The classes involved in the current study were not designed or structured in a manner delineated by the JJH model. This does not mean that the activity as implemented was improper or deficient. As discussed in chapter 2, there are many models and views of collaborative learning. The group activity assignment used in the current study is probably similar to what is done in many, if not most, cases at the college level. However, it does raise the issue of whether a different design for such types of activities would have resulted in better collaboration and, therefore, in a successful “mastery experience” for the students. Such a mastery experience Bandura (1982, 1993) would argue is one of the primary ways that self-efficacy about a domain is raised.

The next section deals with limitations of the current study, followed by a section discussing the possible significance of this research and some thoughts on future research opportunities.

**Summary of the Discussion**

This study involved the intersection of the three constructs of collaborative learning, self-efficacy and instructional scaffolding. The goal of the current study was to get some measure of the collaborative self-efficacy of a particular subset of college students and to see if it was possible to affect this self-efficacy with computer-based instructional scaffolding focused on collaborative knowledge, skills and attitudes. It was hypothesized that increased knowledge about collaborative activity should increase a person’s self-efficacy about it. This idea is an extension of the concept elaborated by Reiser (2004) in which he argues that the function of scaffolding is “focusing learners on an aspect of the task not yet performed” (p. 287). The training-scaffold given to the
treatment group in the current study could be seen as focusing the students on important aspects of the collaborative group process.

This study also had the goal of seeing how the measurements for collaborative self-efficacy and training-treatments varied depending on type of class and future grade-level teaching goal. In order to accomplish these goals an instrument was developed, assessed and tested. The instrument would appear, with a few modifications, to provide a means of assessing collaborative self-efficacy as well as assessing how well students like and value collaborative learning.

The self-efficacy instrument was employed, both before and after the training intervention and group activity. The results show that, in general, students judge their confidence about doing group work fairly high; however, although the group-comparison statistical results were not significant for the most part, there are indications that different class-types and ELHiGoals groups may have different collaborative self-efficacy. Most importantly, the interactions suggested by the graphic representation of the data, but not found to be statistically significant, for the SE-factor between different groups and treatments suggest that this is a complex issue. Additionally, although the effect of collaborative training on collaborative self-efficacy did not reach the level of hoped for significance, the findings from the post-activity open-ended questions’ word analysis and thematic analysis provides some contradictory evidence that the training had some effect on the treatment group.

**Limitations of the Study**

This research was done within the confines of the Mini-Teach class assignment and within the natural flow of a class. The instructors indicated that they did not want the
students’ normal flow to be interrupted or an additional “burden” imposed on the students since they would be busy completing the assignment. These concerns resulted in a design that limited the length of the computer-based training interventions and pre and post survey length. The fact that this limited training may have had a demonstrable effect, as measured by word count in after-activity questions, is intriguing.

An additional factor that could have affected results is that there were two different instructors, each teaching two of the classes used. The two instructors provided different class environments that could have uniquely affected students’ attitudes toward the class, class assignments, communication, and activities. As described earlier in the chapter 4, a brief single day observation of the classroom was done. The important information from this observation was that these two instructors clearly taught with different techniques in spite of using very similar syllabi. The differences evident in the instructors’ styles of teaching is an issue of unknown significance to the assessment of the impact of the ElHiGoal factor used as an independent variable in the research questions and analysis.

A limitation of the current study was that the instrument used to measure collaborative self-efficacy had not been used before. As noted in the literature review about self-efficacy measurement instruments, the lack of an available instrument is somewhat in-line with research on the self-efficacy construct (Bandura, 2006). The same limitation exists for the open-ended questions in the post-survey. It would be hoped, that in further research focused on collaborative self-efficacy, that the instrument used in this study would be reused in some form. Steps were taken in the analysis to look for internal consistency by calculating a Cronbach’s Alpha on the self-efficacy questions (Breakwell,
Hammond & Fife-Schaw, 2000). More fundamentally, the key question that needs to be answered is whether the measurement instrument used in this study, and the SE-factor derived from it, adequately measures collaborative self-efficacy. Finally, is the instrument sensitive enough to measure what may be small changes in collaborative self-efficacy brought about by a short training or collaborative activity?

An important limitation of this study was sample size. Only 73 students chose to participate in the research. The power of the measure used to test the effects in this study was generally low (see the power calculated for various ANOVAs between and within the subject tables in chapter 4 for the SE-factor or LV-factor). “The power of a test is the probability that a given test will find an effect assuming one exists in the population” (Field, 2005, p. 33). Although there is no easy method to calculate the power of the self-efficacy collaborative-attitude scales; it is probably the case that this power value was too low to find a significant result even if one existed (Myors, 2006). This low power is probably due in part, and, maybe large part, to the sample sizes and unequal cell sizes but it also could have been due to imperfections in the instrument used and the limitations of the effect of the training-treatment. However, coming up with an accurate estimate of the desired effect size is difficult as described by Lipsey (1990):

“Answering that question [estimation of desired effect size] requires an analysis which integrates information about the strength and integrity of the treatment to be implemented, the responsiveness of the dependent measures to that treatment, the amount and nature of the variability in the dependent measures, and the magnitude of difference between experimental groups that is meaningful in the treatment context of interest” (Lipsey, 1990, p.47).
Given the challenges of doing research within an actual classroom and the number of variables potentially affecting the measured variables (e.g. SE-factor), it is clear that Lipsey’s standard creates a significant challenge. It is easier to say that quadrupling the sample size will improve the power but a careful review of the variability evident in the SE-factor pre and post scores and questions about the effect of the treatment make it difficult to know for sure if even this increased size would be enough. Many of the SE-factor graphs in chapter 4 show some types of trends in the data indicating interactions and possible main effects. The fact that the statistical analysis shows that the effects revealed in the graphs were not significant indicates that the observed trends and relationships may be due to chance (Lipsey, 1990; Fields, 2005). However, the low power of the current study also suggests the possibility that there is an effect present but this experiment did not have a good chance of detecting it because of its design characteristics. However, optimistically one would hope that significant results might be found in a new experiment with a significantly larger number of students.

Group selection may have affected this study’s result. The instructors determined the quasi-experimental group membership so that students would not be in a group studying something they had expressed an interest in exploring. Although this strategy might sound strange, the instructors did this to assure that students did not try to “game” the assignment by putting down something they were already familiar with or to get their friends on the same team by all selecting the same subject. This method of selection may result in a selection bias (Breakwell, Hammond & Fife-Schaw, 2000).

Finally, the inability of the current training intervention to significantly modify the collaborative self-efficacy of these students raises key questions about the training. In
the Wang, Poole, Harris & Wangemann (2001) study, the mentors played an integral and
time-intensive role in the scaffolding of the groups’ formation, interactions, project
management, etc. It is hard to imagine that the results measured by attitude (including
self-efficacy), learning or project products would have been as positive in the Wang et al.
study if this active mentoring had not taken place. To compare such scaffolding to the
intervention provided in the current study is impossible except as to suggest that the
mentoring intervention was, clearly more involved than the current study’s computer-
based training intervention. It is surprising that the improved attitudes, found in the
Wang et al. study, were not more as compared to the current study’s changes. The
current study results and some collaborative learning literature suggests that a more
rigorous or lengthy training might be necessary to affect the type of collaborative self-
efficacy being measured in the current study (e.g. Wang et al, 2001; Salanova, Grau,

Future Research

A number of the findings in this research advance our understandings of the
important area of collaborative learning. The popularity of this pedagogical technique
requires that it be used wisely and with an understanding of its nuances.

New Instrument and New Factor.

This study adds to the previously limited data about attitudes related to
collaborative learning (i.e. self-efficacy, liking-valuing) held by pre-service teachers (e.g.
Wang et al., 2001). The fact that an instrument for assessing collaborative self-efficacy
has been trialed and analyzed in this study should provide an important tool for future
researchers who wish to study group collaboration including collaborative learning. The
delineation of the two factors related to collaboration, self-efficacy (SE-factor) and liking-valuing (LV-factor), should provide a new perspective on the multi-faceted nature of attitudes about this domain.

The new instrument attempted to reach a moderate level of specificity in asking about the self-efficacy related to collaborative learning activities that was in keeping with strictures suggested by Bandura (2006). Since self-efficacy is not meant to measure a general attitude, it should focus on a particular domain skill (i.e. algebraic factoring) as opposed to a more general skill (i.e. algebra) or as opposed to an even more general domain term (i.e. mathematics). In general, greater specificity in self-efficacy assessments is considered more accurate. However, achieving the proper level is not a simple task. The current survey could have asked more specific questions of the form “how do you feel about working on group projects focused on technology?” This more specific focus may have resulted in more reliable and, possibly, more construct-valid responses; but without testing one cannot be sure. On the other hand, if students had never worked in a group on a collaborative project focused on technology, they may not have been able to give a reasoned answer, simply guessed or they may have answered, “I do not know.” If an experimental environment could be found in which teams do a series of similar group projects then it might result in findings that would help in answering questions related to self-efficacy task specificity. At the least, revising the current survey toward more task specificity could further enhance the current experiment; and possibly provide additional valuable information related to the issue of level of specificity.
Pre-service Teacher Optimistic Self-Assessments.

The results raise another important question: are pre-service teachers actually as skilled as is indicated by their expressed responses to the self-efficacy questions? Some studies have shown a substantial discrepancy between how collaborative group members view their collaborative behavior and how it appears to knowledgeable observers (Faidley, Evenson, Salisbury-Glennon, Glenn, & Hmelo, 2000; Tipping, Freeman & Rachlis, 1995). This group of research indicates that students tend to rate their group interactions and group processes as much better than the ratings given by knowledgeable researchers who observe the groups’ interactions. A future study that establishes the actual skills required for successful collaboration, assesses students on those skills, and then compares the findings to the students’ collaborative self-efficacy rating would be valuable. This question is an important one because much evidence outside the education arena suggests that people are, in general, not very skilled at collaboration (Beebe & Masterson, 2000; Adams & Galanes, 2003). Some widely published people in the field of collaborative learning maintain that students also could benefit from improving their knowledge, skills and attitudes about this pedagogical technique (Johnson, Johnson, & Houlebec, 1991). Getting a better understanding of actual collaborative skills may also be important because students who think they can collaborate well, but actually cannot, may be involved in sub-optimal collaborative learning experiences and also negatively affect classmates’ learning. Further research comparing actual collaborative interaction to the reported collaborative self-efficacy of students might be of great use to educators.
Theory of Last Experience.

One item that would have been potentially valuable is to understand why a person rated his or her self-efficacy lower or higher in the post survey than in the pre survey. As discussed earlier in this chapter, in the current study, there were large collaborative self-efficacy rating changes for many individuals from pre to post. One of the fundamental questions related to self-efficacy research asks: What are the determiners or antecedents to a person’s self-efficacy assessment (e.g. Bandura 1997; Gist & Mitchell, 1992; Bates & Khasawneh, 2007)? It was hypothesized earlier in this chapter, in what I called the theory of last experience, that it may be that our assessment of something like self-efficacy may be weighted disproportionately based our immediate prior experience. Obtaining a better understanding of the effect of temporal and/or sequencing of factors is important to a more thorough understanding of self-efficacy. To further this goal, it would seem that with the available online survey technology one could actually allow for smart questions in surveys such as those used in the current research. Smart questions would note how a person rated something before and provide a customized question in a follow-up survey. The customized question could be in the following format: “In the current survey you rated this question X and in the earlier survey you completed you rated it Y, what were you thinking about when you made the current rating?” This type of inquiry might provide some new insights into what had altered the person’s thinking when answering the question. Alternatively, a qualitative research inquiry could ask questions similar to those used in this current study with follow-up questions to see what the participant’s thinking behind a rating entails. Gaining more insight into what a
person is thinking when making the self-efficacy judgment would be very valuable in self-efficacy research.

Second Collaborative Factor: Liking-Valuing Collaboration.

This study also provides previously unavailable and, arguably important, data indicating how pre-service teachers’ value and, in another sense, like or dislike collaborative learning activities. The fact that little quantitative information exists that provides student measures of this type of attitude about collaborative activities is surprising given the increasing use of collaborative learning techniques. This baseline liking-valuing (LV-factor) data from this study should be valuable to future research in collaborative learning. The fact that the results provide some indication that students’ attitudes about collaborative-learning differ by class-type and teaching EIHiGoal, suggests that students desiring to be teachers are not all alike on this dimension and, as a consequence, further research should be done to investigate these differences in more depth. Such research could extend the existing literature on pre-service dispositions toward teaching pedagogies including their intention to use collaborative techniques. The research would compare pre-service teachers’ dispositions about future use of collaborative and other pedagogical techniques to their attitudes of liking-valuing collaboration as measured in the current study.

Impact of Instructional Scaffolding.

The secondary finding, that brief instructional scaffolding may have an impact on students’ answers to some partially open-ended questions, is surprising but also intriguing. Other research, discussed previously, as well as general learning theory would argue that complex behavioral or attitude change requires extensive time, learner-
effort and practice. The findings of some training effect in the current study suggests that a complex behavior such as collaboration may be impacted and, possibly improved, by providing relatively short-duration training to collaborators. If further research bears out this hypothesis, it would be a significant finding in the area of collaborative learning. The fact that computers make the delivery of such training very easy and cost-effective, adds to the significance of this preliminary finding.

Additionally, a new experiment following the model of the current study but with a much enhanced and longer collaborative training component seems reasonable. The knowledge, skills and attitudes engendered in this study’s training (e.g. organizing, planning, communication, etc) could be expanded both in depth and time. The training could involve a number of approaches such as role-playing, video modeling, video novellas, etc., which have each been shown to be successful in teaching complex domains.

**Predicting the Future Use of Collaborative Learning in the Classroom.**

What is the relationship between the students’ self-efficacy and liking-valuing disposition toward collaborative learning and future use in their classroom? Prior research has shown a relationship between teacher-training in technology and their use in the classroom (Vannatta & Fordham, 2004; Milman & Molebash, 2008). Does the same relationship apply to the use of collaborative learning? A future study could utilize the Vanatta and Fordham model, replacing technology use with collaborative learning. It is interesting to note that in their study they found that “time spent beyond [the] contractual work week, and openness to change” in addition to technology training made the best predictors of actual classroom use.
Milman and Molebash’s study looked at, among other things, the self-efficacy of pre-service teachers in a class similar to the one used in the current study. They found that the self-efficacy of the teachers related to being able to utilize technology in a classroom was significantly higher at the end of class but dropped from this high when follow-up was done five years later. This study forms a model for a future study where students’ attitudes about using collaborative learning in the classroom is measured pre and post group activities to see if having a single experience in a group affects their self-efficacy about using group work in their classrooms. The literature on the challenges of getting teachers to utilize technology in the classroom may have a real parallel with their use of collaborative learning pedagogy. Such a study might provide valuable insight into whether the preparation provided for teachers about collaborative learning. Simply having them participate in group work in a few college classes may not be adequate preparation if the goal is having them utilized this technique later in their careers.

Exploring the Collaborative Self-Efficacy Construct.

The current study assumed that the construct collaborative self-efficacy could be measured by asking about the skills and behaviors as reported in the literature about group work in general with modifications to make them more specific to collaborative learning groups. This could be correct but it may also be missing important aspects of the self-efficacy construct as it applies to collaborative learning. The responses in the current study to the open-ended questions suggest that this study’s approach may need to be enhanced. The responses show that students are thinking about a wide number of things when asked about their collaborative group experience. A qualitative study is called for that explores, in depth, the thinking of students when they are approaching, doing and
completing group work. Such a study would provide important insights into the thought process of students about collaboration. It would also shed light on whether the models of group work the students hold bear any resemblance to the models portrayed by the literature.

**Conclusion.**

This study was able to look at a particular set of classes, teachers, and students engaged in a specific type of collaborative activity. Prior literature, on collaboration and self-efficacy, demonstrates the complexity of these domains and points to the necessity to generalize cautiously from any one instance of research. Nevertheless, the current study adds to the body of knowledge about collaboration, instructional scaffolding and collaborative self-efficacy by providing: a new assessment tool, an expanded vision of collaboration-related constructs (e.g. collaborative self-efficacy versus liking-valuing collaboration), a possible new method to scaffold collaborative self-efficacy, some reference data as to students’ attitudes/self-efficacy regarding collaboration and a new hypothesized theory of last experience.
REFERENCES


Hewitt, J. (2001). From a focus on tasks to a focus on understanding: The cultural transformation of a Toronto classroom. In T. Koschman, R. Hall & N. Miyake (Eds.), *CSCL 2: Carrying forward the conversation* (pp. 11-41). Mahwah, NJ: Lawrence Erlbaum Associates.


strategies and cooperative learning. Journal of Educational Psychology, 82(1), 171-177.


Appendix A: Pre and Post Activity Survey.

Table 18: Standard 24 Likert-style questions on both pre and post survey.

<table>
<thead>
<tr>
<th>#</th>
<th>Question</th>
<th>Collab. Focus Type</th>
<th>Reverse Coding</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I am confident in my ability to do group work in classes.</td>
<td>Overall Collab.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>I am NOT sure how to organize a collaborative learning-group.</td>
<td>Planning</td>
<td>X</td>
</tr>
<tr>
<td>3</td>
<td>In groups I will communicate to make sure my views and concerns are heard.</td>
<td>Communications</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Groups I am on... always produce the best results.</td>
<td>Goal Accomplishment</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Groups I participate in have a hard time filling all needed team roles.</td>
<td>Roles</td>
<td>X</td>
</tr>
<tr>
<td>6</td>
<td>The time I spend working in learning group is valuable.</td>
<td>Learning</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Group work in classes is NOT fun.</td>
<td>Overall Worth/Value</td>
<td>X</td>
</tr>
<tr>
<td>8</td>
<td>Groups I participate in plan effectively so as to accomplish goals.</td>
<td>Planning / Functioning</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Groups I participate in... will have communication problems.</td>
<td>Communications</td>
<td>X</td>
</tr>
<tr>
<td>10</td>
<td>Groups I am on... accomplish the group's goal or assignments.</td>
<td>Goal Accomplishment</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Groups I participate in have uneven contributions and efforts from members.</td>
<td>Organization</td>
<td>X</td>
</tr>
<tr>
<td>12</td>
<td>I learn more working by myself than when working in a group.</td>
<td>Learning</td>
<td>X</td>
</tr>
<tr>
<td>13</td>
<td>Group work in classes is enjoyable.</td>
<td>Overall Worth/Value</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Class related groups I participate in struggle with how to plan in order to accomplish the group's goals.</td>
<td>Planning</td>
<td>X</td>
</tr>
<tr>
<td>15</td>
<td>Groups I participate in... communicate well.</td>
<td>Communication</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Group products and outcomes are worse than I could have done by myself.</td>
<td>Goal Accomplishment</td>
<td>X</td>
</tr>
<tr>
<td>17</td>
<td>In groups I participate in everyone will do his or her share of the work</td>
<td>Functioning</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>The time I spend working on group learning projects would be better spent studying by myself.</td>
<td>Learning</td>
<td>X</td>
</tr>
<tr>
<td>19</td>
<td>I avoid working in groups in classes when I can.</td>
<td>Overall Worth/Value</td>
<td>X</td>
</tr>
<tr>
<td>20</td>
<td>I have the ability to influence others to plan what my class-related groups are going to do.</td>
<td>Planning</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>I understand the problems that can arise in group communication and how to avoid or remedy them.</td>
<td>Communications</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>I know how to assure that groups accomplish their goals.</td>
<td>Goal Accomplishment</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>I am confident that I know the roles that need to be filled in cooperative groups.</td>
<td>Planning</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>I learn more working on group-learning projects than when studying by myself.</td>
<td>Learning</td>
<td></td>
</tr>
</tbody>
</table>

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Appendix A: Pre and Post Activity Survey (Continued)

Figure 15: Sample Likert layout of 24 pre and post self-efficacy questions.

<table>
<thead>
<tr>
<th>Yes: Exactly me / It's how I think / Very True</th>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>NOT me / NOT how I think / Very False</th>
<th>No answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am confident in my ability to do group work in classes.</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
</tbody>
</table>

Figure 16: Sample image of survey page for 24 pre & post Likert questions.
Appendix A: Pre and Post Activity Survey (continued)

Table 19: Eight (8) additional questions on post activity survey
(These are in addition to the standard 24 in Table 18)

1) How would you rate the interpersonal communication on this mini-teach group project?
   Please choose *only one* of the following:
   ___ Excellent
   ___ Good
   ___ Fair
   ___ Poor

2) How would you rate your mini-teach group's collaboration on this project?
   Please choose *only one* of the following:
   ___ Excellent
   ___ Good
   ___ Fair
   ___ Poor

3) What group-collaboration strategies/techniques did you utilize on the mini-teach group assignment? Use the space below for your answer.

4) What thing(s) would you change/improve about your group's collaboration process if you could do it again? Use the space below for your answer.

5) Describe what you enjoyed the most about the mini-teach group assignment. Use the text box below for your answer.

6) Describe what you enjoyed the least about this mini-teach assignment. Use the space below for your answer.

7) Rate the overall product (wiki page and presentation) your group produced for the Mini-teach project. Please choose *only one* of the following:
   Excellent 8  Good 6  Avg/Ok 4  Acceptable 2  Very Poor

8) Rate the overall level of collaboration and teamwork in your Mini-teach project group. Please choose *only one* of the following:
   Excellent 8  Good 6  Avg/Ok 4  Acceptable 2  Very Poor
Appendix B: Group skills/collaboration training slides.

**Slide #1 Group Learning and Collaboration**

"Group work"... or "Group learning"...

Whether such words bring joy or apprehension to you... you must admit that collaborative group work/learning has become a common technique in education.

Why is that? Why is group learning/collaboration so popular in education today?

What do you think a benefit might be?

Write one benefit below and then click the "next" button to see what most teachers and research would say.

**Slide #2 Group Learning and Collaboration**

Some benefits of group learning...

1) Have a more enjoyable, social learning experience.
2) Make new friends.
3) Get more feedback (which generally increases learning).
4) Get better explanations of things you don't understand.
5) Learn more by explaining things to fellow learners.

How did you do? Click the "next" button to continue.
Appendix B: Group skills/collaboration training slides (continued)

Slide #3 Group Learning and Collaboration

What Is Your Learning Group/Collaboration Skill Level?

So if you had to tell someone about how to maximize learning and have the best group experience...

What would you say?
What actions/things should you and your group members do?
What actions/things should you and your group members avoid?

Although much of what is in this tutorial may be "old hat" to you... hopefully it will help you to refresh your memory and possibly even learn something new that will help make your mini-teach group project a better learning experience.

Click the "next" button to continue

Slide #4 Group Learning and Collaboration

Key point #1

Learning to collaborate and communicate effectively is a learned process... we all can learn how to do it better!

Would you agree this is possible?

Select yes or no... then click the "next" button to continue.

Slide #5 Group Learning and Collaboration

Key point #2

As a future teacher you will need to understand group learning processes so you can plan for and teach/guide your students in their experiences!

Click the "next" button to continue.
Appendix B: Group skills/collaboration training slides (continued)

Slide #6 Group Learning and Collaboration

Group "Forming"

So one of the first considerations in working in a group is to think about "forming" the group in terms of:

1) Getting to know each other.
   The more you "know" the other members,... other things being equal, the better the experience and assignment product. Even a little effort here can give big dividends.

2) Make sure everyone understands the assignment.
   For example: What, when, who, why, how... and in "what manner" will it be assessed?

3) Learning about individual goals
   What are the important things about this learning group/task to each member?
   A key here is to understand that people may assign very different values to different aspects of this assignment and group experience.

4) Where and When You'll Meet
   Decide where and when you will meet.
   Remember that you can also do this online or via other communication routes at a distance - just establish a time frame.
   (For example: Let's provide our updates by 6:00 p.m. on Thursday.)

5) Decide How You Will Communicate
   How will you communicate... in person, on the phone, chatting online, email? The "Rule" is communicate MORE OFTEN!

Click the "next" button to continue.
Appendix B: Group skills/collaboration training slides (continued)

Slide #7 Group Learning and Collaboration

Forming (part 2)

Learning groups work best when they get agreement about key "values"... and "ground rules."

Here's a few suggested topics/ideas you might consider...

1) Everyone understands the need for full participation... meaning each member needs to do his or her fair share of the work.

2) Value creativity... learn from each member's unique perspective.

3) Embrace "mistakes"... some educators believe that we learn the most from our mistakes.

4) The goal is to maximize learning (and for most, also the "grade").

5) Communicate more and often.

6) Group work = learn from someone + teach someone!

What else might you add to this list?

Enter a "consideration or thought" you might add to the above list in space below and click the "next" button to continue.
Appendix B: Group skills/collaboration training slides (continued)

Slide #8 Group Learning and Collaboration

Planning

Many learning groups are formed rapidly and are under pretty short timelines to get things done.

The necessity for some speed makes doing some "project planning" important... so the project can be completed on time, to desired quality and without having to rush things at the last minute.

Here are a few suggestions about planning for learning groups:

1) First step is to develop a plan... Not having a plan can cause project frustration/failure.

2) A good second step is to brainstorm the tasks that need to be done and what will be accomplished at the end of each task ("the deliverable").

3) Order the tasks (what depends on what?)

4) Estimate how much time each task will take.

5) Agree on responsibilities: who will do what by when
   Remember: Learning is about doing. Just dividing up tasks... means each person mostly learns only what they did... the goal is to maximize the learning by... working together on tasks as much as possible.

6) Allow time for review/discussion and improving your product (things are seldom done very well the first time).

7) Allow some "slack" period at the end for final "tweaking," which includes editing to correct minor errors and addressing unforeseen problems.

8) Allow for plans to be modified... but make sure everyone understands and agrees.

Enter below what you would add to this list? and then press the "next" button to continue.
Appendix B: Group skills/collaboration training slides (continued)

**Slide #9 Group Learning and Collaboration**

Listening Skills

1) Have an "involved posture"...
   communicate attentiveness...
   I'm intent on understanding you.

2) More eye contact is better than no/little eye contact.

3) Use attentive silence...
   Silence frees the speaker to think, feel and express.
   During pauses attend to postures, body language,
   think about what the other person is trying to communicate.

4) Give encouraging signs (nods, "yes," "ok," etc) to let
   the speaker know you are listening.

5) Paraphrase what the speaker says:
   Be concise -- condense the response
   Reflecting feelings
   Reflecting meanings

Click the "next" button to continue.

**Slide #10 Group Learning and Collaboration**

Feedback

Giving feedback is very important in group-learning situations.

1) State positives (It's good to hear from you...Wow,
   we're all busy. It's good that we're starting on this. Here's what we have so far...).

2) Be descriptive... state what you see.

3) Don't use labels (i.e. "loaded words").
Appendix B: Group skills/collaboration training slides (continued)

4) Don't exaggerate.

5) Talk in terms of the group's agreed upon values and goals.

6) Speak for yourself.

7) Talk first about how you feel...
   "I'm glad we're in touch. However, I feel pressured and
   challenged when you are late for our meetings."
   "It's good to hear from you. I appreciate your coming to meetings on time."

8) Think -->Empathy... how will the other person feel?

9) Remember it is always easier to critique than create the first version.

10) Seek feedback on your feedback... then listen to it!

Click the "next" button to continue.

Slide #11 Group Learning and Collaboration

Feedback (part 2)

Suggestions on how to receive feedback

BREATHE !!!

Listen carefully / Try very hard to not interrupt
Allow the person to finish...
and then... acknowledge the feedback.

Ask questions for clarity... paraphrase the feedback... acknowledge valid points

Take time to sort out what you heard

Remember feedback is about... increasing learning and improving!!!

Enter anything you would add to the list above in the box below and then click the "next" button to continue.
Some group member behaviors that have negative effects on learning groups:
In all of these.... lead by example

1) group member being late to meetings or to produce a task/product
2) group member not coming to agreed upon meeting
3) group member not being prepared
4) chatting inappropriately
5) departing early
6) not doing their jobs
7) dominating meetings, discussions, etc.
8) not listening to other group members' contributions
9) displaying know-it all behavior
10) talking too much
11) not providing important feedback and assuming other's know...
12) putting others down
13) not doing a "plan/do/review/replan" cycle often enough

What would you add? Enter below and click the "next" button to continue.
Appendix B: Group skills/collaboration training slides (continued)

Slide #13 Group Learning and Collaboration

Distance Education Challenges

All the previous information, actions, techniques and issues in this tutorial can be challenging to do in face-to-face groups/classes. When these learning-groups have to deal with forming, planning, communicating, etc. within a distance education class the challenges tend to be greater.

One reason for this is that the communication channels (email, phone, chatting, etc) lose some of the cues we rely when communicating in person.

Here are a few hints that prior classes said they would recommend for future distance education students when doing group projects:

1) Communicate often!

2) When you receive an email respond promptly... when you receive an answer... respond to it also.. even if only to say thanks.
   This 3-sided technique encourages further communication.

3) Written communication can be misinterpreted more easily than in-person verbal communication. Therefore take extra care in crafting your online communication.

4) You can use your wiki as place to develop plans, project notes, etc. Also, check out "Google Docs" as a way to have shared documents accessible and modifiable by everyone in the group.

5) Be proactive... initiate contact/communication... don't wait for the other group members.
6) Everything takes more time online... plan accordingly.

Click the "next" button to continue
Appendix B: Group skills/collaboration training slides (continued)

Slide #14 Group Learning and Collaboration

Final Thoughts...

We hope this was helpful in setting the stage for your group learning Mini-teach assignment.

We know you can have a great group-learning experience!
Appendix C: Learning theory and design training slides.

Slide #1 Learning Theory & Lesson Design

Your Mini-Teach Challenge.

In your Mini-teach assignment one of your learning-group tasks will be to create a wiki page(s) about some aspect of technology related to education.

What things should you consider in your wiki's design to maximize your fellow classmates understanding and learning?

Enter one design aspect you might need to consider in the box below and click the "next" button to continue.

Slide #2 Learning Theory & Lesson Design

"Learning Theory and Message Design"...

Some of you may know a fair amount about how to plan a lesson or put together some type of teaching product (like a web-page/wiki-page).

Others of you may not have learned or been exposed to the principles or techniques used.

This tutorial is a brief overview of some of the learning and message design principles which you may find helpful in your Mini-teach assignment.

Write one teaching/learning principle that comes to mind in the space below and then click "next" button to continue.
Appendix C: Learning theory and design training slides (continued).

Slide #3 Learning Theory & Lesson Design

Planning for a Lesson

One model of teaching is that developed by Dr. Robert M. Gagne. His model has nine steps:

1) Gaining the learners attention.
2) Informing the learner of the objectives (activating motivation).
3) Stimulating recall of prior knowledge (relate to the current information/lesson).
4) Presenting the information/lesson.
5) Provide learning guidance (how to approach, use, think about and learn the information).
6) Eliciting performance.
7) Provide feedback on the learner's performance.
8) Assessing whether the learner has learned the lesson/skill/information.
9) Enhance retention and transfer (repetition, mnemonics, generalizing information).

Click "next" to continue.

Slide #4 Learning Theory & Lesson Design

Another Model of Teaching/Learning

Another model looks at the guiding "r-u-l-e-r-s" of teaching and learning. This model proposes that learning and remembering are enhanced by the following (although sometimes seemingly contradictory concepts):

R: Repetition (being exposed to information repeatedly)
U: Uniqueness (things that are unique are remembered better than common events)
L: Logicalness (the more logical the information is, the more we tend to remember it)
E: Emotional (if there is some emotional aspect to something we tend to remember it)
R: Reinforcement (events and behaviors which are followed by reinforcing consequences tend to be remember and repeated)
S: Sequence (the sequence in which information is presented will effect learning and memory)

Enter below the one you think is most important. then click "next" to continue.
Appendix C: Learning theory and design training slides (continued).

**Slide #5 Learning Theory & Lesson Design**

Key point!

As a future teacher you will need to have a good grasp of learning theory which you can utilize in your lesson design and teaching!

Click "next" to continue.

**Slide #6 Learning Theory & Lesson Design**

What's The Learning Objective?

A key to developing any lesson, website or wiki page is to have a clear idea of your instructional purpose. What do you expect the person to know after viewing the page (information) or participating in the lesson?

Having a clear idea of the instructional or educational objective will help insure that your Mini-teach wiki will achieve its intended purpose.

Click the "next" button to continue.

**Slide #7 Learning Theory & Lesson Design**

Message Design

Developing a wiki page, web-page or lesson can be considered "message design." Here are some concepts about designing lessons/lesson materials that will be remembered:

Motivation --> Variation and Curiosity:
1) Provoke mental conflict to increase curiosity thus attention and learning.
2) Introduce topic from a problem perspective to stimulate an attitude of inquiry.
3) Variation in sequencing of elements (events) maintains attention.
Appendix C: Learning theory and design training slides (continued).

Motivation --> Stimulate Need / Relevance
4) Learners are more interested in things that are related to what they already know.
5) Learner's motivation is greater when there is a clear relationship between teaching objectives and the learner's goal.
6) Connecting the lesson to role models, common anecdotes or stories increases interest and motivation.
Click "next" to continue.

Message Design (part 2)
Here are some additional concepts about designing lessons/lesson materials should be remembered:

Text and Graphics
1) First impressions are important: Make initial perception seem easy and approachable.
2) Keep amount of text in any block reasonable (not too short and not too long).
3) Too many fonts or colors distract from learning.
4) Familiar typefaces and sizes are generally better than "unique" ones.
5) Sentences should be of moderate length (8-10 words) generally.
6) Be careful with technical jargon (use it when necessary but define it with non-jargon terms).

Click "next" button to continue.

Message Design (part 3)

Pictures/Graphics
1 ) A picture is worth thousands of words (sometimes) but graphics for graphics sake can be distracting. Pictures play many roles in instruction. It is therefore necessary to know precisely what a picture's function is intended before it is included.
Purely decorative pictures should be used sparingly.

2) Many times pictures need specific information/instructions on how to look at and interpret them.
Click "next" button to continue.
Appendix C: Learning theory and design training slides (continued).

Slide #10 Learning Theory & Lesson Design

Message design --> Learning principles

Pictures/Graphics

1) Learning from media/presentations is correctly attributable to well-orchestrated lesson/message design and not just the display of information.

2) There is a paradox: learning is better when the information is easy to understand but learning also improves as the amount of mental effort by the learner increases.

3) There is a limit (cognitive-load) to how much a learner can keep in his or her head at any moment in time. This limit is generally thought to vary from 3 to 7 chunks or items of information.

So the trick is to help your learner by limiting what they must "keep in memory."

When there are more than a few items they need to keep in memory... help them out by keeping items close together on a page or close together in time in a verbal presentation.

Click "next" button to continue.

Slide #11 Learning Theory & Lesson Design

Final Thoughts...

We hope this was helpful in setting the stage for your group learning Mini-teach assignment.
Appendix D: Introductory Computer-Skills Survey

Table 20: Introductory Computer-Skills Survey.

(Unformatted = not as actually seen in survey system)

1. General Demographic Questions
2. Last Name First Name What is your UNLV email address?
   Gender | Female | Male | No answer
3. Who is the instructor for your class?
4. Are you taking this class online (as distance ed class)?
   In Person/On Campus | Online/Distance Ed
5. What is your teaching grade-goal? (ElHiGoal is the variable used grouping)
   Preschool | Kindergarten-3rd | 4th-6th | 7th-8th/Mid school | High School
6. How many online classes have you taken?
7. Have you changed a wiki page before?
   Yes | No | No answer
   My computer skills are best described as:
   Choose only one of the following
   Poor | Fair | Good | Very Good | Excellent
8. I primarily access the Internet via a
   Off-campus Dial-up modem | Off-campus Cable modem (e.g., Cox)
   Off-campus DSL (e.g., Sprint/Embarq) | UNLV Computer Lab
   UNLV Dormitory | Other | No answer
9. Do you have a wireless network where you are living?
   Yes | No | No answer
10. I prefer to work with the following operating system...
   "Mac" / Macintosh | Windows | Linux | No preference | Other | No answer
11. Do you have any of the following?
   Notebook Computer | Wireless network in your home | iPhone | Google Phone
   (e.g., G1, Droid, Nexus One . . . ) | Blackberry | Gmail Account | Apple iPod (e.g.,
   Shuffle, Nano, Video iPod) | Other MP3 player | Facebook Account | Twitter
   Account | MySpace page

Continued on next page.
Appendix D: Introductory Computer-Skills Survey (continued)

Table 21: Computer Skills Questions 1-25 on Introductory Computer-Skills Survey

The next series of questions used a Likert response scale as follows:
No/Not at All | 1 | 2 | 3 | 4 | 5 | Yes/Highly Skilled | No Answer

12. On my computer... I can use menu toolbars and pull-down menus.
13. I can identify and use icons for files, programs, folders, and disks.
14. I can open, close, and resize a window using a mouse.
15. I can use keyboard shortcuts to open, save, and print documents.
16. I can open the control panel and apply changes, as appropriate.
17. On a computer... I can create a folder and organize files.
18. I can delete a file or folder.
19. I can save files to different locations (folders, desktop, network, portable drive, etc.).
20. I can identify types of files by their extensions (.doc, .xls, .jpg etc.).
21. I know how to access and use my university email account.
22. I can send email with an attachment.
23. I can delete, cut, copy, and paste text.
24. I can change the margins and spacing of a word processed document.

25. I can use header and footer commands.

26. I can insert and re-size a graphic.
27. I can use the spellchecking features to proof a document.
28. In spreadsheet software I can enter text and numbers into cells.
29. I can format cells (numbers and text) in a spreadsheet.
30. In a spreadsheet I can build (or insert) a formula in a cell.
31. I can use spreadsheet data and commands to produce a basic graph.
32. In PowerPoint software I can make new slides.

33. I can add and modify text on slides within PowerPoint.

34. I can add a graphic to slides.
35. I can apply slide transitions.
36. I can animate text in PowerPoint.
### Appendix E: Pre-activity Self-efficacy Survey Tables and Figures

Table 22: Pre-activity self-efficacy survey items 1-24 -- Cronbach’s Alpha

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Table 23: Pre-activity self-efficacy survey 1-24 -- item individual statistics.

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Self-efficacy survey questions correlations and significance (2 of 2).
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Correlations values in bold. 1-tailed significance values in normal text. Based on pre-activity survey responses N=73.

Table 25: Pre-activity survey items 1-24 summary statistics.

<table>
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<th>Item Means</th>
<th>Mean</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Range</th>
<th>Maximum / Minimum</th>
<th>Variance</th>
<th>N of Items</th>
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Figure 17: Scree plot for factor analysis of pre self-efficacy survey items 1-24.
### Appendix F: SE-factor Data Tables

#### Table 26: SE-factor Means and Standard Deviations by Independent Variables

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<tr>
<th>T-Group</th>
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<th>ELHiGoal</th>
<th>Pre Activity</th>
<th>Post Activity</th>
<th>Pre Activity</th>
<th>Post Activity</th>
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<td>5.889</td>
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Totals keyed by superscripts.

#### Table 27: Collaborative self-efficacy factor (SE-factor) questions Cronbach's Alphas.

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<th># of Items</th>
<th># of Cases</th>
<th>Cronbach’s Alpha</th>
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### Appendix G: LV-factor Data Tables

Table 28: LV-factor means and standard deviations by independent variables.

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Totals keyed by superscripts.
Appendix H: Post Self-efficacy Survey (questions 1-24) Statistics.

Table 29: Cronbach’s Alpha for post survey questions 1-24.

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Table 30: Post survey questions 1-24 descriptive statistics.

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* = reverse coded questions.
Appendix I: Introductory Computer-Skills Survey Statistics

Table 31: Cronbach’s Alpha for Introductory Computer-Skills Survey questions 12-36.

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Table 32: Introductory Computer Skills Questions 12-26 Descriptive Statistics.

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