The Design and Development of a Theory Driven Process for the Creation of Computer-Supported Collaborative Learning in an Online Environment

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Abstract

Educators are struggling to meet the ever-increasing challenges of preparing students to meet the demands of a global society. The importance of collaboration and social interaction in online education has been well documented (Berge, 1998; Brown, Collins& Duguid, 1989, Fulford &Zhang, 1993; Gunawardena & McIssac, 2003; Kanuka & Anderson, 1998; Kearsley & Schneiderman, 1999; Sardamalia & Bereiter, 1994). Teachers and instructional designers are struggling to change the academic environment to meet the needs of millennial learners. The purpose of this study is to develop a theory driven process for designing computer-supported collaborative learning in an online environment. A careful analysis of the process for creating collaborative online instruction is conducted and a design strategy for the process is developed. The study provides suggested guidelines for practitioners to create collaborative online instruction. The design procedures emphasize social interaction to allow learners opportunities to explore, discover, and negotiate meaning in an authentic context. Online instruction requires the coupling of multiple areas of expertise to be successful. Although the pedagogical principles are the same, the global implications of "flat world" technology require an important weaving of collaborative interaction, graphic design, and pedagogy. Technology provides the transportation for achieving a collaborative environment; and, quality pedagogical practices provide the GPS

(guidance positioning system) to direct collaborative instruction to its ultimate destination—knowledge building.

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Chapter 1: Introduction and Background of Study

Educators are struggling to address the ever-increasing challenges of preparing students to meet the demands of a global society. The importance of collaboration and social interaction in online education has been well documented (Berge, 1998; Brown, Collins & Duguid, 1989, Fulford &Zhang, 1993; Gunawardena & McIssac, 2003; Kanuka & Anderson, 1998; Kearsley & Schneiderman, 1999; Scardamalia & Bereiter, 2006). According to Siemens (2005), "by recognizing learning as a messy, nebulous, informal, chaotic process, we need to rethink how we design our instruction" (p.7). Teachers and instructional designers are working to change the academic environment to meet the needs of the millennial learners. Jenkins, Healey and Zetter (2007) indicate a revolution in teaching strategy is necessary to address the complexities of a digital society. Friedman (2005) suggests that *the world is flat* and today's students must be prepared to work in a world without boundaries. Yet the American educational system has been slow to revamp its teaching practices to incorporate the collaborative, digital tools of today.

> "Schools face the challenge of preparing students to live, learn, and work successfully in today's knowledge-based digital society. To do so will require high-performance learning of academic content using 21st-century skills and tools. To accomplish this, schools must become high-performance learning organizations" (enGauge 21st Century Skills, 2008).

The CEO Forum on Education and Technology (2001) states:

> The emergence of new information technologies, the evolution of the global digital economy, and the global competition for technically skilled workers creates a national urgency to improve our educational system. Schools that functionally reflect the culture of the past, rather than the demands of the future, will not prepare students to thrive in the digital age (CEO Forum, 2001b, p. 3).

In order to produce "digital-age literate" and productive citizens who possess the skills of inventive thinking and effective communication, change must become a priority.

Purpose of Study

The purpose of this study was to develop a theory driven process for designing computer-supported collaborative learning in an online environment. A careful analysis of the process for creating collaborative online instruction was conducted. A design strategy for this process was developed. The procedures developed emphasize social interaction to allow learners opportunities to explore, discover, and negotiate meaning in an authentic context (Lave & Wenger, 1991; Moore, 1989; Scardamalia & Bereiter, 2006; Wagner, 1994; Shank, 2002).

In order to implement this study, the researcher focused on the utilization of collaborative activities that incorporate Web 2.0 type resources. According to Wikipedia (an example of a Web 2.0 tool), "Web 2.0 can refer to a trend in Web design and development, a perceived second generation of Web-based communities and hosted services ... which aim to facilitate creativity, collaboration, and sharing between users." As technology continues to evolve, global collaboration becomes a viable option in course design: "Advances in technology also increase our ability to create more interactive and engaging learning environments, a goal of developers designing from virtually all theoretical perspectives" (Gustafson & Branch, 2002, p. 85).

Developmental Aspects of Design Addressed

This study addressed the specific design issue of creating collaborative online instruction, as well as identifying what constitutes productive collaborative activity in an online environment. The following areas were addressed:

1. The development of guidelines for when and how collaborative activities should be included in the design of online instruction;

2. Determining the practicality of using existing strategies from other design models to create a conversion model; and

3. The development of guidelines for creating collaborative online units of study.

Creating collaborative online instruction required that special attention be given to the social, collaborative components to optimize the potential for construction of knowledge (Gunawardena & McIsaac, 2003; Garrison, Anderson & Archer, 2003; Roblyer & Wiencke, 2003). There is a need for an instructional design strategy that focuses on implementing collaborative aspects of computer-supported collaborative learning. Based on the *Standards for Quality Online Teaching* created by the Southern Regional Education Board in August 2006, distance learning experiences should include "strategies to encourage active learning, interaction, participation and collaboration in the online environment" (SREB, 2006, p. 4).

Instructional design models communicate the procedures necessary to produce instruction. Based on the work of Gustafson and Branch (1997), Instructional Design (ID) models should contain adequate details about the process to "establish guidelines for managing the people, places and things that will interact with each other and to estimate the resources required to complete a project" (p.4). Further, Gustafson and Branch (1997) create a taxonomy of three categories for ID models: classroom, product, and system. Using overlapping elements from the classroom and system categories, a new framework for creating collaborative online instruction is possible. An investigation of the possibilities for this process should be explored.

According to Garrison (2000), distance education models need to be developed that reflect a collaborative and flexible approach: "Adaptability in designing the educational transaction based on sustained communication and collaborative experiences reflects the essence of the postindustrial era of distance education. (p.13). Other researchers are concerned with the affective domain. For instance, Hiltz and Wellman (1999) state, "virtual or electronic, communities involve sociability, emotional support and a sense of belonging as important ends in themselves, though they are often accompanied by exchanges of information and services" (p.45). Their argument is that if a student feels connected, he/she may participate more in the class and experience increased affective and cognitive learning. In order to address the challenge of creating the socio-collaborative components of Computer-Supported Collaborative Learning (CSCL) in distance delivered instruction, a new instructional design process is needed.

Using the framework of CSCL (Harasim et al, 1996; Koschman, 1996; Sorensen et al, 2006; Stahl, Koschmann & Suthers, 2006), this study investigates the inclusion of collaborative activities in order to foster communities of learners (O'Malley, 1995; Lave & Wenger, 1991; Wenger, 1998). Using the principles of group interaction to form collaborative communities to construct knowledge (Vygotsky, 1978; Lave, 1991; Lave & Wenger, 1991; Scardamalia & Bereiter, 1996; Wagner, 1994), the learning activities will occur in an authentic group context, be project based, and include activities with an authentic focus (Kearsley & Shneiderman, 1999). The quality of the design of instruction plays a major impact on learning, as well as the ability to incorporate small and large group activities in distance education. Online conferencing and collaborative projects are techniques for facilitating the dialogue and interaction necessary to allow learners to negotiate meaning and construct knowledge (Gunawardena & Duphorne, 2000).

According to Garrison, Anderson and Archer (2003), "the emergence of new asynchronous and synchronous communications technology has made possible collaborative distance education experiences based on adaptive teaching and learning transactions" (p.114). Rovai (2003) states that social quality, small-group activities, teaching style, group facilitation, and learning community size are positive correlates to building a sense of community. Online instruction offers the ability to network students across the world, and provides a means to foster collaboration and to develop communities of learners.

Definitions

In order to develop a concise understanding of this research study, it is necessary to define essential key terms. Terms are defined based on a review of literature. It is important to note that many of these terms are plagued with dichotomous meanings across the literature; however, the definitions stated are compiled for the purpose of this study and the perspective of the researcher.

Computer-supported collaborative learning

Based on the work of Koschmann (2002), CSCL focuses on meaning and the practice of making meaning in the context of joint activity, "and the ways in which these practices are mediated through designed artifacts" (p.18). CSCL focuses on both the cognitive processes of group participants through social interaction, as well as the learning events that occur during the interaction. Computer support for collaborative meaning making is an essential component of CSCL and is the key element for making it a unique field of study: "the ability to combine these two ideas (computer support and collaborative learning or technology and education) to effectively enhance learning remains a challenge—a challenge that CSCL is designed to address" (Stahl, Koschmann & Suthers, 2006, p. 409). This study focuses on the computer support and collaborative learning context of CSCL.

Collaboration

Collaboration is a coordinated activity where learning occurs as part of the social group dialogue. The activities are not individual-learning activities, but group interactions of negotiations and sharing (Roschelle & Teasley, 1995; Stahl, Koschmann & Suthers, 2006). An important aspect of collaborative learning is the process of meaning making in the context of group dialog:

> Collaborative learning involves individuals as group members, but also involves phenomena like the negotiation and sharing of meanings—including the construction and maintenance of shared conceptions of tasks—that are accomplished interactively in group processes (Stahl, Koschmann, & Suthers, 2006, p. 411).

For the purposes of this study, Stahl's perspective on collaboration will be adopted.

Web 2.0 tools

According to Wikipedia (an example of a Web 2.0 tool), "Web 2.0 can refer to a trend in Web design and development, a perceived second generation of Web-based communities and hosted services ... which aim to facilitate creativity, collaboration, and sharing between users." For the purposes of this study, Web 2.0 tools will refer to web-based tools and services that facilitate collaboration among users separated by time and/or space.

In the next chapter, a methodical review of literature related to collaboration in online instruction is discussed. Primary areas of analysis include distance education, computer-mediated communication, social presence, instructional design, situated cognition and computer-supported collaborative learning.

Chapter 2: Literature Review

This literature review highlights important research related to distance education and computer-supported collaborative learning (CSCL). The review begins with an historical overview of distance education and concludes with a review of CSCL. The purpose of the review is to highlight important aspects of distance education and unique attributes of CSCL. The following areas are included in this study:

1. Defining distance education
2. Computer-mediated communication
3. Design Issues
4. Designing collaboration in online instruction
5. Existing Design Models
6. Defining CSCL
7. History of CSCL
8. Research in CSCL

Computer Mediated Communication

Computer-mediated communication (CMC) is a focal area of research in distance education. "Some forms of CMC are purely synchronous, some purely asynchronous, while others (e.g., NetMeeting, ICQ) are now allowing the two to occur in the same environment" (Romiszowki & Mason, 2004, p. 397). Since CMC was first established as a major method of communication in the late 1980's, a diverse body of research has been collected. Typically, there are two distinctly different research perspectives on the effectiveness of CMC. One viewpoint is that CMC is a significant technique for establishing social interaction in an asynchronous distance education setting and the other perspective is that CMC lacks the nonverbal and social cues necessary to foster a feeling of community. Sproull and Keisler (1986) studied the work of Mehrabian (1969) and approach CMC from a different perspective than Short, Williams and Christie (1976). Sproull and Keisler (1986) are concerned with the lack of social cues in mediated communication. They postulate the lack of nonverbal cues have a negative effect on interpersonal communication and lead to uninhibited communication such as “hostile and intense language (i.e., flaming), grater self-absorption, and a resistance to defer speaking turns to higher-status participants” (Rourke, Anderson, Garrison & Archer, 2001, p. 2). Daft and Lengel (1986) agree that the lack of nonverbal cues creates an environment conducive to short, pragmatic interchanges, but they argue that in some situations this might be beneficial: “When messages are very simple or unequivocal, a lean medium such as CMC is sufficient for effective communication. Moreover, a lean medium is more efficient, because shadow functions and coordinated interaction efforts are unnecessary” (Daft & Lengel, 1986, p. 57). Walther (1994) disagrees with Sproull and Keisler (1986) and Daft and Lengel (1986). Walther proposes that CMC can be detailed and even “hyper-personal” rather than impersonal (p.9). Learners may share more information than they typically would in a face-to-face setting. According to Rourke, Anderson, et al (2001) “computer-mediated conferencing (CMC) is unique among distance education media because of its ability to support high levels of responsive, intelligent interaction between and among faculty and students while simultaneously providing high levels of freedom of time and place to engage in this interactivity” (p. 50). The research of Daft and Lengel (1986) suggest that communication media have varying capacities for resolving ambiguity in communication. The two main assumptions of media richness theory are as follows: Assumption one is people want to overcome uncertainty in organizations; and assumption two is there are a variety of media commonly used in organizations that work better for certain tasks than others (Daft and Lengel, 1986).

CMC supports three types of communication: email, computer conferencing, and audio/video conferencing. "These services are useful to educators in building learning communities around course content. Email among students and between student and instructor form the fundamental online form of communication" (Gunawardena & McIsaac, 2004, p. 370). E-mail provides a simple and inexpensive means for communication via the Internet. Walther (1994) cites several studies in which "experienced CMC users rate text-based media, including e-mail and computer conferencing, `as rich or richer' than telephone conversations and face-to-face conversations" (p. 18). Salmon (2000) describes computer-mediated conferences at the Open University Business School as a tool for establishing closer connections between students, teachers, the learning system, and information resources.

Course satisfaction with CMC has also been studied. Gunawardena (1999) studied student satisfaction in computer conferences. In the first phase of the study Gunawardena "uses a regression model to examine how effective 'social presence' is as a predictor of overall learner satisfaction in a text-based medium" (p. 105). Gunawardena's studies provide the groundwork for understanding the significance of social presence in distance education.

In a qualitative study conducted by Leh (2001), the appropriateness of CMC in an upper level university foreign language course and an upper level math course in two countries, the United States and Mexico are examined. Based on her results, Leh concludes, "CMC as used in this study not only fosters communication, but also assists in learning" (p. 117). However, Leh notes several limitations of the study. A significant limitation is that the course instructors do not integrate the e-mail component into the course curriculum, and the e-mail component is an addition to the course syllabus and participation is not required.

In a study on the relationship of social presence and interaction in online classes, Tu and McIsaac (2003) define social presence as “a measure of feeling of community that a learner experiences in an online environment” (p. 131). In this study the researchers are interested in three dimensions of social presence: social context, online communication, and interactivity. These three areas are established in previous research conducted by Tu (2000, 2001). In social context, Tu and McIsaac (2003) include the following areas: “task orientation, privacy, topics, recipients/social relationships, and social process” (p.134). Online communication deals with “the attributes of the language used online and the applications of online language” and interactivity “includes the activities in which CMC users engage and the communication styles they use” (p.135). Immediacy is an important component of interactivity. Delays in responses will create a sense of low interactivity and a diminished sense of social presence. Tu and McIsaac (2002) conclude from their study that “social presence positively influences online interaction” and “social presence is a vital element influencing online interaction” (p.140, 146). Tu and McIsaac (2003) determine that social presence is a more complicated construct to study than they had previously believed and their CMC instrument needs to be revised.

Symbolic interactionism (Blumer, 1969) has become more important as communication has become mediated through computer-mediated-communication. According to this theory, “society is viewed as a dynamic web of communication. Society is interaction, and interaction is symbolic in the sense that it is conducted in terms of the meanings people assign to things” (Trevino, Lengel & Daft, 1987, p. 555). Symbolic interactionism has as its foundation the work of John Dewey (1936) and George Mead (1934). The three core principles of symbolic interactionism are meaning, language and thought. “What is essential to communication is that the symbol should arouse in one’s own self what it arouses in the other individual” (Mead, 1934, p. 149). According to interactionists, people adjust their behavior according to the actions of others. Adjustments are made based on interpretations of meaning and imaginative rehearsal of alternative actions.

As most research in symbolic interactionism has been conducted in face-to-face settings, the transference of application of this theory to computer-mediated communication is not well developed. However, shared understanding of meaning is important to group communication and, as symbols evolve and develop different meanings, it is important that the group be able to negotiate these changes and develop a group understanding of meaning (Trevino et al, 1987). In a computer-mediated environment, understanding meaning can be quite complex. For example, the use of emoticons introduces another level of negotiating meaning. Emoticons are symbols that replicate human faces, made from typing symbols to indicate a variety of emotions and reactions (Kramare, 2003, p. 268.) According to Kramare (2003) emoticons may symbolize how text is to be read, but they are not nearly as effective as other forms of non-verbal communication such as smiles or frowns. Another important issue with emoticons is cultural differences. Different symbols are used to convey different meanings in different cultures. Verbal symbols (words) are the most common and most frequently employed symbol system (Cyrs, 1997, p. 28). Emoticons add another level of intricacy to symbol interpretation. Charon (2006) states:

> Symbols are used intentionally, not unconsciously, not accidentally, not automatically; symbols are intentional acts of communication. One tries to

> communicate. One communicates on purpose. We are actively using these representations we understand for purposes of sending something to others (p.50).

In order to establish communication, a shared understanding of the symbol system is required.

Learner to learner interaction is the sharing of information and exchanging of dialog related to coursework whether this occurs in a structured or spontaneous manner. "It is this type of interaction that will challenge our thinking and practice in the 21st century as we move to designing networked learning communities" (Gunawardena & McIsaac, 2004, p.362). Kearsley (1995) promotes making a distinction between synchronous (real time) and asynchronous (delayed) interaction. Kersley (1995) also argues that differentiating types of interaction is very important. Garrison (2000) notes that the challenge facing distance education in the 21st century is understanding the opportunities and challenges created by new technologies and methodologies: "This adaptability in designing the educational transaction based upon sustained communication and collaborative experiences reflects the essence of the postindustrial era of distance education" (p.13). He continues by adding that asynchronous text-based collaborative learning may be the most significant characterizing technology of current distance education. According to Gunawardena and McIsaac (2003) the future theoretical challenges for distance education revolve around issues related to learning and pedagogy in a variety of computer-mediated instructional environments:

> Unique aspects such as the time-independent nature of an asynchronous environment can create communication anxiety, or the lack of visual cues in a text-based medium can give rise to the development of emoticons. This environment forces us to reformulate the way in which we view the social

dimension and how learners actively influence each other's knowledge and reasoning processes through social networks" (p.364).

The next stage of CMC environments will allow instructors and students to make use of both synchronous and asynchronous communication technology tools based on the needs and demands of the curriculum, learner requirements, teaching styles and access needs (Garrison, Anderson & Archer, 2003).

According to Garrison (2000), distance education theory needs to be developed that reflects a collaborative and flexible approach: "Adaptability in designing the educational transaction based on sustained communication and collaborative experiences reflects the essence of the postindustrial era of distance education. (p.13). Other researchers are concerned with the affective domain. For instance, Hiltz and Wellman (1997) state, "virtual or electronic, communities involve sociability, emotional support and a sense of belonging as important ends in themselves, though they are often accompanied by exchanges of information and services" (p.2). Their argument is if a student feels connected, he/she may participate more in the class and experience increased affective and cognitive learning. However, Peters (2003) contradicts this perspective when he states: "communication mediated through technical media remains mediated communication and cannot replace an actual discussion, an actual argument, discourse among people gathered at a single location (p.99). He argues that asynchronous distance education should be combined with some number of synchronous events. In mediated communication "what is missing is the consciously perceived presence of the others, their aura, the feeling of being together, which arises in a different manner in every meeting" (Peters, 2003, p.99). Hybrid forms of distance education as described by Peters (2003) include both synchronous and asynchronous course assignments. Online distance education is evolving at a tremendous rate and such hybrid courses have the potential to optimize the best of both offerings.

Design Issues of Online Collaboration

Instructional designers for distance education face the intriguing challenge of developing educational courses that are both effective and efficient. Efficiency is defined as the relation between costs and quality and implies a relationship between input and output (Moonen, 1997). Maintaining efficiency while insuring quality in distance education is of critical importance. At the heart of the effectiveness side of the debate is student learning. “Successful teaching at a distance places the recipient's needs before organizational convenience and at the center of planning and decision making” (Smaldino, 1999, p. 11). Distance education provides learning opportunities for students from all over the world and for students with disabilities who have difficulty accessing site-based programs.

Effectiveness Versus Efficiency

Access, as well as cost, time, energy, and delivery encompass the broad concept of efficiency (Rumble, 1997). In traditional university settings, distance education should bring added value to the existing setting. “The implicit assumption thereby is that the quality, and thus the effectiveness of the courses will increase” (Moonen, 1997, p.73). According to Berge, Muilenberg, and Haneghan (2002), there are 10 factors that act as barriers for delivering distance learning: administrative structure, organizational change, technical expertise, social interaction, quality, faculty compensation and time, technology, legal issues, evaluations/effectiveness, access, and student-support services. Berge’s article reports responses to a survey administered to online teachers in higher education. Responses are given based on perceptions of barriers to the success of the respondents’ online classrooms. Berge developed the survey based on a review of literature, from previous survey work (Berge, 1998), and from content analyses of selected case studies (Berge & Mrozowski, 1999). Two beta tests were conducted and revisions were made before the final version was published on the web. According to the authors, results indicated the faculty's ranking of obstacles most important to solve altered as the organization gained experience with distance education.

A major issue in the effectiveness versus efficiency debate revolves around time and course content. Unfortunately, time constraints often determine the instructional method. For instance, if the learner analysis reveals that students have a very limited background or understanding of prerequisite knowledge, prerequisite information will need to be added to the curriculum and the most efficient method of presenting information will need to be selected. States and/or districts have specific, required curriculums with detailed scope and sequences to be covered in pre-established, rigid timelines. Because more information can be conveyed through direct lectures than perhaps group activities, instructional methods may be limited by the constraints of time. Therefore, time efficiency becomes the dominating factor in instructional method and effectiveness becomes a secondary issue. "Timelines are not established in service to the intellectual development of the learner (Brooks & Brooks, 1999, p.39). The debate is a difficult one as time constraints are a reality in all academic settings.

According to Winn (1990) technology "greatly affects the efficiency with which instruction can be delivered" (p.53). A disadvantage of including collaborative components in the course design of distance education may be a reduction in course efficiency and a reduction in learner control. Learner control refers to the amount of control the learner has over the learning situation (Shearer, 2003). According to Moonen (1997), "Research has indicated that computer-based learning motivates students to invest more time in a subject-area (time-on-task), in particular when the student can work according to his own pace and time schedule" (p. 74). By including collaborative activities in the design of a course, some learner autonomy is lost. Designers are cautioned about the importance of the amount of control given to the learner: "If we provide too much structure within pacing, sequencing, and timing of assessment, the learner, with competing life demands, may be forced to drop out. If we provide too little structure then the learner may feel cut off and flounder through the course" (Shearer, 2003, p.277). Finding the appropriate balance is a significant challenge for the instructional design of distance education.

Other issues of concern around the inclusion of collaborative components are increased time demands on the instructor, training and development of instructional staff, maintaining virtual group work, class size, class management (keeping members on task/topic in an asynchronous environment), administrative and development cost, and increased importance of language and written communication skills (Lynch, 2002; Morrison, Ross & Kemp, 2007; Romiszowski & Mason, 2004). In order to create a sense of social presence, collaborative activities and modeling of good communication must occur. Much time is required for developing and moderating these types of instructional practices. Instructors must share the responsibility of promoting interactive learning with the students (Moore & Kearsley, 1996). Establishing the requirements and parameters for communication is another time-consuming task given to the course instructor. Without teacher moderation, students may select to work independently or become overly competitive in such an environment. Research indicates that although computer interfaces may be designed for the inclusion of collaborative activities, the design is not enough. Placing students into assigned groups does not guarantee that collaboration will take place (Hathorn & Ingram, 2002), and without some extrinsic requirement or reward, Hathorn and Ingram (2002) suggest that students will tend to use the most efficient and direct method of completing assignments. To overcome this obstacle, instructions for collaboration and monitoring of progress are required (Ahern & Repman, 1994).

Extrinsic rewarding is significant in a study conducted by Brewer and Klein (2006): "students given rewards felt that they benefited from working with others and that they generated better ideas as a group than they could have done as individuals" (p.18). This result validates prior research that illustrates the magnitude of extrinsic motivation on group perception of positive interactions in collaborative work and reduces the amount of "social loafing" (Johnson, Johnson & Holubec, 1994). Monitoring group interactions and providing extrinsic motivation are examples of increased time demands on distance education instructors creating social presence through collaborative projects and modeling.

In research conducted by Anderson, Beavers, VanDeGrift and Videon (2003) synchronous distance education and videoconferencing are studied. Their results indicate two problems with synchronous distance education. Challenges highlighted in their study include low quality audio/video, as well as presentation technologies that made it difficult to provide extemporaneous teaching opportunities. Anderson et al (2003) state that analysis of qualitative data indicated that problems with technology and loss of connections increased the students' feelings of separation between instructional sites. Based on this finding, the researchers decided to design and implement new distance learning software to improve connectivity and add flexibility to the instructor's capabilities (Anderson et al, 2003). The new distance learning software requires more training on the part of the instructional staff and an increase in time demands. Cost would also increase based on the expense of development, implementation, and training.

Another factor, class size must be taken into account in a distance education course that intends to include collaborative components. In a case study of asynchronous learning at the University of Wisconsin-Stout, the class size was limited to a low number of students: “To insure vibrant interaction among students, enrollment limits of 20 students per course were established” (Bourne & Moore, 2000, p.100). By limiting the enrollment, a component of efficiency in asynchronous learning is lost. Also, small class size decreases one of the cost-effectiveness factors in asynchronous learning environments. Therefore, the inclusion of collaboration may reduce the efficiency of asynchronously delivered distance education.

In 1997 the Government Relations Committee of the American Association of University Professors (AAUP) published a report on distance learning issues. The report acknowledges that in the area of faculty workload, instructors who teach distance learning courses via the web face greater time demands than faculty in traditional settings. Based on a study by Browne, Warnock and Boykin (2005), “The additional time demands result from requisite technological and software training, greater course preparation time, coordination with technical and support staff, and the need to resolve problems unique to distance learning (e.g., student assessment issues)” (p.1). Correspondence with students adds another time demand. Email has established an expectation on the part of both student and instructor for fairly rapid response times and more frequent communication (Tao, 1995). Email can be sent and received twenty-four hours a day and the increased level of communication increases the time demands of the instructor. Modeling dictates another time constraint for the instructor. Githens’ (2007) qualitative study on interpersonal interactions in an online professional development course for adults working in rehabilitative and disabilities services fields found that the inclusion of collaborative activities required modeling from the instructor. Modeling requires more interactive time on the part of the course facilitator, which also increases faculty workload.

Based on the work of Mason and Gunawardena (2001), non-native students find the asynchronous interactions of online courses easier to comprehend than the faster-paced dialogue of face-to-face instruction. However, the same issues of understanding jargon and culture-specific references apply to both academic settings. For an online course developed for a collection of international students, the inclusion of social presence in the form of collaborative components may prove to be disadvantageous. "While many students find online courses particularly stimulating when students come from several cultures, they also find that cross-cultural communication principles are seldom explicitly discussed or honored" (Kramarae, 2003, p.268).

Another concern related to the inclusion of collaborative activities in distance education is the form in which communication takes place. For example, as noted earlier, Sproull's and Keisler's (1986) concern about the lack of social cues in mediated communication is an important issue. Negative interpersonal communication may lead to uninhibited communication. This lack of inhibition may be a deterrent to the inclusion of collaborative activities in distance education. Walther (1994) expressed a similar concern. Walther indicated that computer mediated communication may become too detailed and overtly personal. Learners may forget they are sharing private information with other people and share inappropriate intimate details of their daily lives. This form of communication would also detract from collaborative instruction.

Another potential issue with the inclusion of collaboration in course design relates to student work ethic. A problem with sharing the workload exists in collaborative activities that produce social presence. Students may view collaborative work as an opportunity for reducing personal work demands. "Despite these mechanisms that seem to promote effective learning in a collaborative environment, there are also potential losses such as free-riding and social-loafing, status differential effects and diffusion of responsibility" (Benbunan-Fich & Hiltz, 2004, p. 4). In this scenario, educational effectiveness is lost to both the group and to those learners who shirk their group responsibilities.

In the corporate world, e-learning is developing at a rapid pace. Technology-based training is replacing instructor led programs. "According to Training Magazine, 36% of online training is delivered through platforms that allow students to interact with their instructor and with each other; 64% of trainees only interact with the computer" (Oblinger & Rush, 2003, p.593-594). Clearly, in a world where training is imperative to survival, efficiency and effectiveness are critical. The instructional designer must select an instructional method that is most effective within the given time constraints. According to George Siemens (2002) "Elearning is the marriage of technology and education, and most often, the instructional designer's greatest role is that of 'bridging' concepts between the two worlds" (p.1). The instructional designer would determine the inclusion of collaborative activities in this arena might not be desired.

In resolving the efficiency versus effectiveness debate, the instructional designer assumes a significant accountability:

> Many of the concerns of online learning drop out rates, learner resistance, and poor learner performance can be addressed through a structured design process. The resulting benefits - reduced design costs, consistent look and feel, transparency, quality control, standardization - make organizational investment in ID a simple decision (Siemens, 2002, p.3).

The decisions made by the instructional designer and the design team throughout the development, implementation and evaluation processes affect the delicate balance between effectiveness and efficiency. Maintaining this balance is the pedagogical challenge facing instructional designers as well as traditional and non-traditional educators. Therefore, the inclusion of collaboration in the design of any given course must be made based on the requirements of the instruction and the needs of the students.

Designing Collaboration in Online Instruction

The design of distance education must take into account the following factors: the teaching method, the media attributes, and the delivery mode (Head, Lockee, & Oliver, 2002). Harasim (1997) indicates that the design of online instruction should include student participation in group activities and intellectual dialogue among students. Research indicates that collaboration is one variable that builds a sense of community with distance learners. Instructional methods vary for creating collaborative interaction in distance education courses. "Collaborative learning deals with instructional methods that seek to promote learning through collaborative efforts among students working on a given learning task (Kumar, 1996, p.1). The quality of the design of instruction plays a major impact on learning and on creating a setting conducive to the existence of collaborative learning. Computer conferencing is one technique for facilitating the dialogue and interaction necessary to allow learners to negotiate meaning and construct knowledge (Gunawardena & Duphorne, 2000).

Based on the *Standards for Quality Online Teaching* created by the Southern Regional Education Board in August 2006, distance learning experiences should include "strategies to encourage active learning, interaction, participation and collaboration in the online environment" (SREB, 2006, p. 4). The instructional design of this type of course includes interactive, collaborative activities. Tu's (2000) research indicates that a high level of social interaction is necessary to foster, increase and enrich communication. According to Garrison, Anderson and

Archer (2003), “the emergence of new asynchronous and synchronous communications technology has made possible collaborative distance education experiences based on adaptive teaching and learning transactions” (p.114).

Small group activities facilitate collaboration. Defining the appropriate group size has been debated for years, but general consensus holds that group size can range from two to ten students working together towards a common goal (Johnson & Johnson, 1994; Slavin, 1983; Slavin, 1999; Lynch, 2002; Morrison, Ross & Kemp, 2007). Although Morrison, Ross and Kemp (2007) highlighted strengths and limitations of small-group activities for traditional face-to-face instruction, these same strengths and limitations can be applied to small-group activities in an online environment. Strengths cited by Morrison, Ross and Kemp (2007) include: discussion of materials, exchanging ideas, collaborative problem-solving, experiences with oral expression and peer teaching, active learning, and increased social skills. Drawbacks cited by Morrison, Ross and Kemp (2007) include the following: assigned readings need to be completed prior to small group meetings; instructors may resort to lecturing or provide too much input at the expense of discussion; careful planning of group composition is required; feedback and prompting is required; and students are not trained instructors. Morrison, Ross and Kemp (2007) continue by offering suggestions for small group activities. The activities they suggest can also be appropriate in large groups or self-paced settings for either face-to-face or online environments. Activities include instructor-led discussions, group-centered instructions, problem-based or project-based discussions, panel discussions, guided-designs (Wales, Nardi & Stager, 1987), case studies, role plays, simulations, and games. Strengths and limitations of group work must be taken into account when designing collaborative activities online.

Rovai (2003) states that transactional distance, social presence, social quality, small-group activities, teaching style, group facilitation, and learning community size are positive correlates to building a sense of community. Aragon acknowledges that social presence is only one element towards building community, but he states: “I believe it [social presence] is one of the first components that must be established in order to initiate learning in an online environment” (Aragon, 2003, p.57). Instructors or moderators of online communities can build social interaction into their courses by intentionally developing interaction skills (Gunawardena, 1995). Based on the work of Northrup (2001), interaction needs to be intentionally designed into distance education courses.

The University of Southern California conducted research to determine what works in distance education. The research, funded by the Office of Naval Research to study “Knowledge, Models and Tools to Improve the Effectiveness of Naval Distance Learning” focuses on five dimensions of distance learning: management strategies, learner characteristics, instructional strategies, multimedia strategies, and assessment strategies (O’Neil, 2003). Based on their findings, the researchers develop distance learning guidelines in five key areas: instructional design, multimedia, learning strategies, assessment strategies, and management strategies. According to Clark (2003) “learning gains come from adequate instructional design theory and practice, not from the medium used to deliver instruction” (p.3). The ability to express and share ideas among learners and with the instructor promotes collaboration and deepens the learning experience (Reio & Crim, 2006). Based on the research of Lynch (2002), there are five key ingredients that act as indicators for student success in distance education: “Intention to complete the course, early submission of work, completion of previous distance education courses, degree of interaction provided in the course, and course relevance to the student’s real-world experiences" (p.19). Gorham (1988) concurs that interaction among students is critical to the learning process and cognitive development. Stahl (2006) also highlights the importance of interaction: "Shared knowledge is not a stockpile of fixed facts that can be represented in a database and queried on all occasions but an ongoing accomplishment of concrete groups of people engaged in continuing communication and negotiation" (p.25-26).

Because learning is a social and human activity, collaboration should be a consideration in the design of distance education courses (Knowles, 1996). Social interaction is acknowledged as critical in the development of learning processes (Vygotsky, 1986). Harasim (1989) establishes the importance of social interaction and knowledge construction: "knowledge building occurs as students explore issues, examine one another's arguments, agree, disagree, and question positions" (Harasim, 1989, p. 53). According to Reio and Clim (2006), "an emphasis on and perceived benefits associated with interpersonal social dynamics is consistent with the constructivist framework that argues that promoting learning interactions is integral to effective online learning" (p. 968).

Feedback is another important consideration in the design of distance education. Kluger and Dinisi (1998) found that one third of all feedback decreases performance, another third has no impact on progress, and the final third indicates positive increase in performance. "The finding that poor feedback was obvious in two-thirds of all well-planned research studies suggests that it may be even more prevalent in practice since researchers tend to select what are thought to be the best strategies to test in experiments" (O'Neil, 2003, p.18).

Clark (2003) notes the importance of student motivation in the design of distance education courses. He indicates that strategies need to be included that increase student motivation, encourage active engagement, and increase student persistence:

The more that instruction supports student interest and utility value for course goals and

> student self-efficacy for the course by convincing students that they are capable of achieving the learning and performance goals of the course, the more they will become actively engaged in the course and persist when environmental events distract them (p. 20).

One method for motivating students is illustrated in Keller's ARCS model. ARCS is an acronym for Attention, Relevance, Confidence, and Satisfaction. Maintaining student interest is the essence of Attention. Relevance refers to the learners' perceptions related to the instruction. The instruction should be relevant to the instructors' learning goals, compatible with individual learning styles, and related to past educational experiences (Keller, 2007). Relevance is achieved by illustrating how the instruction is important to the student and by including problem and project-based learning with real-world activities. Confidence relates to the learner's belief in whether he/she can or cannot be academically successful. Keller incorporates Bandura's (1977) theory of self-efficacy, Weiner's (1992) attribution theory, and Dweck's and Leggett's (1988) and Nicholl's (1984) goal orientation theory into his understanding of confidence (Keller, 2007). Confidence can be achieved by providing explicit expectations, accurate instructions, examples of quality of work, and also making the course navigation seem simple. Satisfaction is gained through frequent and detailed feedback, sharing of work with others, and participation in real-world activities. Satisfaction, according to Keller (2007), "refers to sustaining motivation and performance by using extrinsic reinforcements, such as positive rewards and recognition in accordance with established principles of behavior management (Skinner, 1969) in ways that do not have a detrimental effect on intrinsic motivation" (p.7). Keller also includes the concept of equity in his explanation of learner satisfaction. The four categories of the ARCS model do not occur in isolation; instead, they interact with other influences on learning and performance.

Valuing the course objectives and believing that they (the students) have the ability to be successful in the course (self-efficacy) are critical factors in learner motivation. "Beliefs of personal efficacy constitute the key factor of human agency. If people believe they have no power to produce results, they will not attempt to make things happen" (Bandura, 1977, p. 3). According to Bandura (1986) individuals actively search for models that possess the skills or knowledge that they, the learners, desire. In distance education, the instructor and classmates act as models. Collaborative activities provide one means of increasing motivation and self-efficacy.

A Different Pedagogical Approach

According to Crumpacker (2001), "advanced distance education in today's technology-driven milieu requires a different pedagogical approach whereby distance education students acquire knowledge." (p.1). Crumpacker's study explores the research on pedagogical approaches and skill and motivational factors that influence distance education instructors. Crumpacker (2001) states: "collaborative, problem-based learning (PBL), in conjunction with Asynchronous Learning Networks (ALNs), is the premier pedagogical approach shown to promote quality education at a distance" (p.10). Designing effective and efficient forms of distance education is an evolving challenge. Michael Niederman (2005) states:

> A narrative paradigm shift has occurred, the catalyst being the technology shift to digital in virtually all forms of communication. Kuhns suggests that human experience will qualitatively evolve under the influence of a new invention. The technological shift from analog to digital is one of those events in the world that affects our basic mode of communication and has had a direct effect on how we "organize" our world (p.45).

Garrison, Anderson and Archer (2003) also acknowledge the importance of digital technology. They indicate digital technology allows distance educators to conduct collaborative learning experiences without the constraints of time and space. It is within this new context of online learning that the role of activity creates a more significant impact on pedagogical practice: “The influence of a constructivist philosophy, of problem-based and case-based learning, and the use of immersive scenarios and role-play have placed the activity students’ complete as they study firmly at the heart of the curriculum” (Reeves, Herrington, & Oliver, 2002, p.562). The emergence of learning theories such as situated cognition (Brown, Collins, & Duguid, 1989; Lave & Wenger, 1991) and computer-supported collaborative learning (Bereiter and Scardamalia, 1996) provide structural support for the development of authentic, collaborative activities in the design of online instruction.

Social interaction plays a significant role in learning. Compelling evidence of the significance of social interaction is indicated in a study conducted by Light and Cox (2001) at Harvard School of Education. This study found that one of the strongest indicators of success in higher education was the ability of students to be able to form or participate in small work and study groups. The best learning results when students, teachers and subject matter experts from the community work together in a situated activity to construct shared solutions to problems and new understandings of underlying principles. Deeper understanding is developed through sharing, applying and debating ideas with others; further, these intellectual interactions create a community of learners (Vygotsky, 1978; Brown, Collins & Duguid, 1989; Lave, 1991; Lave & Wenger, 1991; Jonassen, 1997; Scardamalia & Bereiter, 1996; Harasim, Calvert, & Groeneboer, 1996; Light & Cox, 2001; Lynch, 2002; Brown, Browne & Adler, 2008). The use of cognitive tools amplifies and expands what students are able to learn. “Mastering a field of knowledge involves not only ‘learning about’ the subject matter but also ‘learning to be’ a full participant in the field. This involves acquiring the practices and the norms of established practitioners in that field or acculturating into a community of practice” (Brown, Browne & Adler, 2008). Learning technologies support students in accessing and collecting a range of information; provide tools for visualizing complex, abstract ideas; allow for distance collaboration; assist in planning, building and testing models; allow for the development of multimedia knowledge artifacts that can be shared globally; and enhance the development of communities of practice.

Review of Existing Design Models

According to Gustafson and Branch (2002) instructional design models provide reliable and consistent procedures for developing education and/or training programs. The core elements of instructional systems design (ISD) are often referred to as ADDIE. ADDIE is the acronym for the systematic processes included in instructional development: *analyze* learners’ needs; *design* instruction; *develop* instructional materials; *implement* instruction; and *evaluate* effectiveness of instruction through formative and summative evaluation (Gustafson & Branch, 2002). During instructional analysis, the instructional designer must identify the skills required to meet the instructional goals. The instructional goals may be fairly broad, but they should be specific enough to provide direction for the instructional design process. Online learning is a marriage between pedagogy and digital technology (Nicholls, 2007). ISD attempts to put into place controls for a systematic, deliberately planned process. For the purposes of this research the following instructional design models are analyzed: Dick and Carey Model (DCM) (Dick, Carey & Carey, 2004); Morrison, Ross and Kemp Model (MRKM) (Morrison, Ross & Kemp, 2004); Gunawardena et al’s WisCom Design Model (WDM) (Gunawardena, Ortegano-Layne, Carabajal, Rechette, Lindemann & Jennings, 2006); Reeves and Reeves Interactive Learning

Model (RRILM) (Reeves & Reeves, 1997); Tuzun's Model (TM) (Tuzun, 2001); and IDOL model (Siragusa, Dixon & Dixon, 2007) (See Appendix A).

WisCom Design Model

The WisCom Design model focuses on the inclusion of collaboration and dialogue in an online environment:

> The goal of WisCom is to create a wise community that shares a common mission, engages in reflection and dialogue, believes in mutual trust, respect, and commitment, cares for the common good, and empowers its members. The community provides the opportunity for participants to interact, receive feedback, and learn and grow together (Gunawardena et al, 2006, p. 219).

Gunawardena et al's WisCom Model is community centered with the focal goal of building a wise community. WisCom encourages reflective dialogue to promote learning within the community. Mentoring acts as a mechanism for scaffolding and moving learners from novice to expert by matching inexperienced community members with experienced community members. Knowledge innovation requires the intentional creation, sharing and preserving of meaningful, socially-constructed ideas. The WisCom model provides a Five Step design:

1. Learning Challenge
2. Initial Exploration
3. Resources
4. Reflection
5. Preservation (Gunawardena et al, 2006).

These five steps are part of a cyclic process, but they actually unfold in the following four phases: create, record, access, enable. These phases occur through interaction, the creation of archives, the retrieval of information, and the making of connections between concepts.

Reeves and Reeves Interactive Learning Model

Like the WisCom model, Reeves and Reeves Interactive Learning Model (1997) includes a section on collaborative activities. According to Reeves and Reeves (1997), collaborative activities require students to work in pairs or groups to accomplish shared goals:

> Given an appropriate instructional design, two or more learners working together via the WWW might accomplish more than an isolated learner because the interactions among the learners may have more influence on their learning than the interactions between the learners and the Web-based content. The proliferation of Web-based tools for group work makes this one of the potentially most powerful factors in this model of interactive learning on the Web (p. 6).

The Interactive Learning Model includes a compilation of several components. Learner aptitude and individual learning differences, as well as motivation are significant considerations in the model. The Interactive Learning Model provides opportunities to construct learning, encourages task ownership, provides a sense of audience (who the artifact is created for), and also includes collaborative support, teacher support, and metacognitive support. Reeves and Reeves emphasize the development of knowledge and skills, robust mental models, and higher order outcomes. The six stages of this model include:

1. Provide opportunities to construct knowledge
2. Encourage task ownership
3. Create an awareness of audience
4. Collaborative Support
5. Teacher Support
6. Metacognitive Support (Reeves & Reeves, 1997).

IDOL Model and Tuzun's Model

The IDOL model (Siragusa, Dixon & Dixon, 2007) and Tuzun's Model also include collaborative components. The IDOL model (2007) builds on the pedagogical dimensions of Reeves and Reeves model (1997). However, IDOL model incorporates 24 pedagogical dimensions into its design, but is not intended to be a stand alone design. The IDOL model is intended to work in conjunction with other existing design models to insure that the 24 pedagogical principles are included in the actual design process. Tuzun's Model is built "upon the cognitive-based theories of learning, where the learners purposefully interact with the environment, actively participate, thus following the knowledge-building paradigm" (Tuzun, 2001, p. 5). This model is designed to support participation and collaboration.

Collaborative Design Model

Moallem's Collaborative Design model (2002) is a cyclical model with four phases and four stages. The four phases of the design include: create, record, access, enable. Within these phases, the model promotes the establishment of individual accountability, the encouragement of commitment to the group and to group goals, stability of group dynamics, and the facilitation of interactions.

R2D2 Model

Bonk and Zhang (2006) created a model based on Kolb's (1984) effective learning phases of experiential education. This model focuses on the type of tasks, resources, and activities that should be embedded in online instruction to address differences in human learning strengths and preferences. They posit four types of learning activities: reading/listening, reflecting/writing, displaying and doing. The focus of their model is clearly on how to meet the needs of the individual learners.

Theoretical Foundation for Study

Situated Cognition

Based on the theory of situated cognition, learning occurs through real-world experiences by doing what experts in a given subject area perform. Learning is a social and situational activity that Lave (1991) terms "learning-in-practice." According to Brown, Collins and Duguid (1989), "to learn to use tools as practitioners use them, a student, like an apprentice, must enter that community and its culture. Thus, in a significant way, learning is, we believe, a process of enculturation (p. 33). Therefore, knowledge is a matter of competence as defined by the learning community. As learners engage in real-world activities, their understanding evolves with each negotiation of the new activity or situation (Lave & Wenger, 1991; Brown, Collins & Duguid, 1989). Brown, Collins and Duguid (1989) continue the tool metaphor by comparing conceptual knowledge to a tool set:

> People who use tools actively rather than just acquire tem, by contrast, build an increasingly rich implicit understanding of the world in which they use the tools and of the tools themselves. The understanding, both of the world and of the tool, continually changes as a result of their interaction. Learning and acting are interestingly distinct, learning being a continuous, life-long process resulting from acting in situations (p. 33).

Therefore, knowledge is situative and interdependent with the activity and the culture in which it is engaged. Authentic activities, ordinary practices of a given culture, are mediated and socially constructed through negotiations among members of that specific community of practice (Brown, Collins & Duguid, 1989; Lave & Wenger, 1991; Blumenfeld, Marx, Krajcik, & Soloway, 1996; Krajcik & Blumenfeld, 2006; Fishman & Krajcik, 2003; Savery & Duffy, 1995; Torp & Sage, 1998; Sage, 2000; Hmelo-Silver & Barrows, 2006; Savery, 2006; Kumar &

Natarajan, 2007).

There are many pedagogical approaches to situated cognition. Anchored instruction situates learning in realistic problems, providing students with the opportunities to experience real-world dilemmas faced by professionals in a given field. Research studies indicate that anchored instruction can help resolve the problem of student boredom (Csikszentmihalyi, Rathunde, & Whalen, 1993). When students are not engaged, boredom usually interrupts focus; therefore, students are less likely to learn (Blumenfeld et al, 1991).

Project-based Learning

Learning sciences research suggests that project-based learning, a form of anchored instruction, offers a potential solution to the problem of boredom in school. Students are more engaged and less likely to be bored (Krajcik & Blumenfeld, 2006). Students learn by doing and applying ideas through real-world activities. The 5 key features of project-based learning include:

1. Instruction starts with a driving question, a problem to be solved;
2. Students explore the driving question by participating in authentic, situated-inquiry. As students explore the question, they develop an understanding of the discipline and also how to apply their understanding;
3. Students, teachers, and community members engage in collaborative activities to find answers to the question;
4. During the inquiry process, students are scaffolded with learning technologies that allow them to perform activities normally beyond their individual ability;

5. Students create a set of products to address the needs of the question. These products are shared artifacts that represent the learning of the class (Blumenfeld et al, 1991; Krajcik, et al., 1994; Krajcik, Czerniak, & Berger, 2002).

The theoretical background of project-based learning includes active construction, situated learning, social interactions and cognitive tools.

Learning sciences research indicates deep understanding occurs when learners actively construct meaning based on their experiences and interactions. Situated learning requires that learning take place in real-world, authentic context. For example, in science, when students design their own investigations to answer a question important to them or to their community, they discover value in science and also develop a deeper understanding of how science can be applied to solve real-world problems. Social interaction plays a key role in learning; therefore, the best learning results when students, teachers and subject matter experts from a community work together in a situated activity to construct shared solutions to problems as well as to expand understandings of underlying principles. Deeper comprehension is developed through sharing, applying and debating ideas with others. This process of back and forth interaction creates a community of learners. The use of cognitive tools amplifies and expands what students are able to learn (Krajcik & Blumenfeld, 2006). Learning technologies can support students in accessing and collecting a range of information; provide tools for visualizing complex, abstract ideas; allow for distance collaboration; assist in planning, building and testing models; and allow for the development of multimedia knowledge artifacts that can be shared globally.

Project-based learning reinforces an awareness that there may be more than one technique for interpreting data and more than one approach to solving a problem. Driving questions guide instruction and are meaningful and important to learners. The driving question should be a tool for organizing and directing the activities of the project, as well as providing an authentic context in which students can establish and explore learning goals. Continuity and coherence are instilled in the project with the development of quality driving questions. Features of driving questions include the following attributes:

1. Feasible: Students can design and perform an investigation to answer the question;
2. Worthwhile: Question contains rich science content that aligns with national and state standards and relates to real-world science;
3. Contextualized: Question is real-world and important;
4. Relevant: Question is meaningful, interesting and exciting to learners; and
5. Ethical: Question does no harm to individuals, organizations or the environment.

(Krajcik, Czerniak & Berger, 2002).

Developing in-depth driving questions requires quality interaction among group members. It requires involvement of higher-order thinking skills such as synthesis and interpretation where the learners must actively process the requirements of the project and make sense of the information given. During group interactions, students interact to develop a feasible driving question worthy of investigation, with real-world relevance.

Problem-based Learning

Another form of anchored instruction is problem-based learning. Similar to project-based learning, problem-based learning includes a real problem for students to solve through collaborative work with peers. They are required to “seek out a variety of resources, technological and otherwise, to help them arrive at possible solutions” (Driscoll, 2005, p. 405). Key elements of a successful problem-based learning environment include the following: instruction begins with a problem or question; students are actively engaged in an authentic environment; students are actively constructing knowledge relevant to the context; students work with a variety of resources and are exposed to multiple perspectives; students work collaboratively in an iterative process to negotiate meaning; students are thinking critically and creatively to solve the problem; students are engaged in metacognitive reflection during the process; and teachers act as facilitators and supporters of the learning process (Savery & Duffy, 1996; Torp & Sage, 1998; Sage, 2000; Hmelo-Silver & Barrows, 2006; Savery 2006; Kumar & Natarajan, 2007). Savery (2006) adds that instruction in a problem-based learning environment concludes with a debriefing and review of the problem and process.

Learner-centered Principles

In 1990, the American Psychological Association (APA) created an alliance with the Mid-continent Regional Educational Laboratory (McREL) to develop a task force on psychology in education. The task force focused on studying the effects of research and theory on school reform. They were concerned that the results of research on learning, development and motivation were having very little influence on school reform (Bonk & Cunningham, 1998). The task force created 12 learner-centered principles (LCPs), which evolved into 14 LCPs (See Appendix B). These 14 principles are underpinned with a wealth of research that strengthens their value and provides a solid foundation for encouraging transformation in a variety of educational settings (American Psychological Association, 1997; Bonk & Cunningham, 1998; Alexander & Murphy, 1993). These principles highlight the importance of reflection in the learning process and emphasize the importance of the learner:

> The learner-centered psychological principles, which are consistent with more than a century of research on teaching and learning, are widely shared and implicitly recognized in many excellent programs found in today's schools. They also integrate research and practice in various areas of psychology, including developmental, educational, experimental, social, clinical, organizational, community, and school psychology. In

> addition, these principles reflect conventional and scientific wisdom. They comprise not only systematically researched and evolving learner-centered principles that can lead to effective schooling but also principles that can lead to positive mental health and productivity of our nation's children, their teachers, and the systems that serve them (APA, 1997, p. 2).

APA's learner-centered principles emphasize a holistic approach to learning situated in real world settings.

Collaborative Knowledge Building and Discourse

Based on the work of Scardamalia and Bereiter (2006), "Sustained knowledge advancement is seen as essential for social progress of all kinds and for the solution of societal problems. From this standpoint the fundamental task of education is to enculturate youth into this knowledge-creating civilization and to help them find a place in it" (p. 97). Collaborative Knowledge Building allows for discourse, negotiation and sharing of ideas: "Idea improvement is an explicit principle, something that guides the efforts of students and teachers rather than something that remains implicit in inquiry and learning activities" (Scardamalia, 2004, p. 77). Collaborative Knowledge Building also provides opportunities for the construction and development of knowledge artifacts. Artifacts are shaped throughout the learning process and include artifacts produced by use of cognitive tools such as plans, graphs, concept maps, and models (Quintana, Eng, Carra, Wu & Soloway, 2006). Knowledge building is centered in pedagogical practice (authentic activity, project-based learning, situated cognition, etc). Knowledge Building requires keeping a persistent record of discourse and providing common spaces for group members to share (Scardamalia & Bereiter, 2006). For example, communities of practice and/or communities of learners require common space for members and establish that group size should be small. Scaffolding and supports should be designed for a variety of perspectives (small groups' preferences as well as individual learning preferences). Activities should reinforce the transforming personal perspective to group perspective:

> In effective collaborative knowledge building, the group must engage in thinking together about a problem or task and produce a knowledge artifact such as a verbal problem clarification, a textual solution proposal, or a more developed theoretical inscription that integrates their different perspectives on the topic and represents a shared group result that they have negotiated (Stahl, 2006, p. 3).

Such activities support interactions and enable the co-creation of knowledge and the development of knowledge artifacts, as well as the building of a dynamic learning community. In this educational environment, the role of the instructor shifts from being a disseminator of information to a facilitator of learning.

Defining Computer-supported Collaborative Learning

Computer-Supported Collaborative Learning (CSCL) focuses on how students learn together as a collaborative group through the use of computers. CSCL has been defined by Koschmann (1996) as “a field of study centrally concerned with meaning and the practices of meaning-making in the context of joint activity, and the ways in which these practices are mediated though designed artifacts” (p. 2). CSCL is designed to analyze how the combination of computers/technology and collaborative activities enhance learning. According to Stahl, Koschmann, and Suthers (2006), CSCL is concerned with all forms of formal education from kindergarten to graduate level studies. CSCL, as an emerging branch of learning sciences, focuses on meaning making through the combined use of computers and collaboration:

> Small group processes of collaborative knowledge building can construct meanings of symbolic and physical artifacts like words, gestures, tools, or media. The meanings of these meaningful artifacts are group accomplishments resulting from social interaction and are not attributable to individual participants. The artifacts retain intersubjective meaning, which can be learned or renegotiated later. The meaningful artifacts are interpreted by individuals from within the current situation or activity (Stahl, 2006, p.346).

Meaning making as a group process can be observed through dialogue, texts, and other artifacts created by participants. "A small group of learners can - on occasion and under favorable conditions - build collaborative knowing and shared meaning that exceeds the knowledge of the group's individual members" (Stahl, 2006, p. 359). Therefore, it is imperative for designers to incorporate collaborative activities in online instruction.

History of CSCL

CSCL has as its roots three distinct projects. Gallaudet University's Electronics Network for Interactions (ENFI) Project began in 1984. Galluadet University is a school for hearing impaired and deaf students. Writing with a voice is a particularly difficult concept for hearing impaired students. ENFI Project used computer-supported assistance for writing compositions:

> [ENFI] allows teachers and students to explore, collaborate, and expand on ideas in class in writing, and allows them to see each other in the process of developing ideas, writing for each other and not just to "the teacher," ENFI supplements and expands on the activities teachers can use to help students meaningfully participate in a discourse community and improve their writing (Collins & Berge, 1995, p. 25).

Collins and Berge (1995) made specific note of instructors' observations related to collaboration:

> Many instructors who use ENFI have noticed a synergistic process occurring when students collaborate to generate ideas in real time written discussion. That is, after one student contributes a partially formed idea, others may base comments upon it, building a new hypothesis or train of thought not possible without the interaction.

These observations provide one segment of the foundation for CSCL.

Another study, the Computer Supported Intentional Learning Environment (CSILE) project at the University of Toronto, was established in 1986 and is also a forerunner of CSCL. Bereiter and Scardamalia (1996) were interested in the difference in quality of learning that takes place at school versus the learning that takes place in other knowledge building communities. Bereiter and Scardamalia developed technologies and pedagogical practices to assist in converting classrooms to knowledge building communities (Stahl, Koschmann & Suthers, 2006). Like ENFI, CSILE focused on making writing more meaningful through collaborative writing projects.

A third case that contributed to the development of CSCL is the Fifth Dimension (5thD) Project that began at Rockefeller University as an after-school program to enhance reading skills. The program was moved to the University of California at San Diego and was implemented at four different sites in San Diego, but eventually expanded to multiple sites around the world (Stahl, Koschmann & Suthers, 2006). Each of these projects used computers as a tool for collaborative meaning making:

> All three turned to computer and information technologies as resources for achieving this goal, and all three introduced novel forms of organized social activity within instruction. In this way, they laid the groundwork for the subsequent emergence of CSCL (p. 412).

In 1989 the NATO-sponsored Maratea workshop was the first public and international meeting where the term “Computer-supported collaborative learning” was used in a title (Stahl, Koschmann & Suthers, 2006). This workshop marks the beginning of the field of CSCL; however, Indiana University held the first official CSCL conference in 1995 and the study of CSCL as a knowledge field began in earnest.

Computer-Supported Collaborative Learning as a Knowledge Field

According to Stahl (2006) knowledge building requires collaborative interaction among students with teachers acting as facilitators versus information experts:

> The goal of collaborative knowledge building is much more specific than that of e-learning or distance education generally, where computer networks are used to communicate and distribute information from one teacher to several students who are geographically dispersed. Collaborative knowledge building stresses supporting interactions among the students themselves, with a teacher playing more of a facilitating than instructing role (p. 3).

Collaborative knowledge building requires a high level of cognitive activity during group interactions:

> In effective collaborative knowledge building, the group must engage in thinking together about a problem or task and produce a knowledge artifact such as a verbal problem clarification, a textual solution proposal, or a more developed theoretical inscription that integrates their different perspectives on the topic and represents a shared group result that they have negotiated (Stahl, 2006, p. 3).

These collaborative activities rely on the support of technology tools. Today’s Web 2.0 resources offer a wide array of tools for collaborative knowledge building. Many of these applications have been designed to “capture knowledge as it is generated within a community of practice and to deliver relevant knowledge when it is useful” (Stahl, 2006, p.94). Stahl provides an illustration of the knowledge building process and provides a conceptual framework for the phases in collaborative knowledge building emphasizing transformative processes and different forms of knowledge. The relationships between the different elements of knowledge building are complex and take a variety of forms. Stahl states that the most complex relationship to express is “the mutual (dialectical) constitution of the individual and the social knowledge building as a learning process (Stahl, 2006, p. 203). Stahl’s (2006) figure provides a conceptual framework of this relationship (See Appendix C) and is included with the author’s permission (See Appendix D).

In order to develop an environment where collaborative activities flourish, Wilson and Ryder (1998) suggest seven techniques the instructor can implement to foster supportive dialogue and interactions within the class. Based on the work of Wilson and Ryder (1998), students should be encouraged to articulate their learning needs. If students feel comfortable sharing a particular weakness or strength, they are more likely to be actively engaged in the class. Second, the inclusion of a public forum for students to contribute and assist each other encourages a supportive interactive environment. Third, encourage students to consult with each other for assistance and support, as well as with the teacher. Fourth, provide opportunities for self-assessment, group assessment, and consensual agreement. Fifth, share solutions with and across groups and be willing to debate the problems and solutions from different perspectives; and sixth, archive these discussions for future reference. Finally, this process should be repeated throughout the course to support the construction of knowledge. These techniques are powerful components of the knowledge building process.

Analyzing Learning Processes in a CSCL Environment

An analysis of the learning processes in a CSCL environment has been conducted using both qualitative and quantitative approaches; however, several studies suggest using a mixed methods approach (Henri, 1991; Hara, 2000; Lally & DeLatt, 2003; Martinez, de la Fuente & Dimitriadis, 2003; Daradoumis, Martinez & Xhafa, 2004; Pozzi, Manca, Persico & Sarti, 2007). Utilizing a mixed methods approach allows the researcher to collect multiple forms of data. Garrison and Anderson (2003) use a three dimensional model to investigate learning processes in distance education. Their model focuses on social presence, cognitive presence and teaching presence. Text analysis in computer-mediated communication can track specific indicators of social, cognitive and teaching presence (Garrison & Anderson, 2003). Pozzi, Manca, Persico and Sarti (2007) propose a five dimension model for the study of learning processes in a collaborative environment. Their five dimensions include the following: Participative dimension, Interactive dimension, Social dimension, Cognitive and Meta-cognitive dimension, and the Teaching dimension (Pozzi et al, 2007). Within each of these dimensions, specific indicators are defined. Within the participative dimension the following categories are established:

> Indicators of *active participation*, which include the number of messages sent by individual participants, the number of documents uploaded, the number of chat sessions attended, etc; Indicators of *passive participation*, which include the number of messages read, the number of documents downloaded, etc; Indicators of continuity, that is the distribution of participation along time (Pozzi et al, 2007, p. 172-173).

The interactive dimension uses content analysis of messages and documents shared by students:

> Passive participation before posting, that is the number of relevant messages read by a student before posting his/her own, the number of documents downloaded before posting, etc. References to other students' messages, that is the number of answers to other students' messages, the number of implicit or explicit citations of other students' messages, etc. Consideration of other students' contributions in products, that is qualitative analysis of students' messages and documents with the aim of finding references to others' messages or documents (Pozzi et al, 2007, p. 173).

The social dimension is investigated through the identification of "cues that testify to affection and cohesiveness within communication acts (Pozzi et al, 2007, p. 173). The following are cited as indicators in the social dimension: "Thematic units characterized by Affection, that includes expression of emotions, expression of intimacy, presentation of personal anecdotes. Thematic units characterized by Cohesiveness, that include vocatives, references to the group using inclusive pronouns, phatics, salutations" (p. 173). Indicators for the cognitive and meta-cognitive dimension also include thematic units: "Revelation, that is recognizing a problem, showing a sense of puzzlement, explaining or presenting a point of view; Exploration, that is expressing agreement/disagreement, sharing ideas and information, brainstorming, negotiating, exploring; Integration, that is connecting ideas, making synthesis, creating solutions; Resolution, that is real-life applications, testing solutions" (Pozzi et al, 2007, p. 173).

Pozzi, Manca, Persico and Sarti (2007) include the following indicators for teaching presence in their five dimensions model:

> Thematic units containing direct instruction, that is presenting contents, proposing activities, diagnosing misconceptions, confirming understanding through assessment and explanatory feedback; Thematic units aimed at facilitating discourse, that is identifying

areas of agreement/disagreement in order to achieve consensus, encouraging, acknowledging or reinforcing participant contribution, setting the climate for learning; Thematic units addressing organizational matters, that is introducing topics, planning the course, explaining methods, reminding students of deadlines (p. 174).

Using all or several of the dimensions proposed by Pozzi, Manca, Persico, and Sarti (2007), qualitative and quantitative data can be collected to evaluate the learning processes in a computer-supported collaborative learning environment.

Need for Study

The need for this study has been established throughout this literature review. Based on the work of Gustafson and Branch (2002), instructional design models assist designers in conceptualizing representations of reality, making decisions about operational tools and techniques, and inspiring important research questions. Instructional design models are generally adopted for their suitability to address a specific design need and are often modified to meet the conditions of an existing design problem (Gustafson & Branch, 2002). Instructional design models provide guiding principles for analyzing, producing and revising the solutions to instructional design problems. "Instructional designers and instructors trying to convert their courses into web-based instruction format without a time-proven model are similar to those drivers trying to find their target in a remote area without a road map" (Tuzun, 2001, p. 363). Because there are very few established models that emphasize collaboration in the design of online instruction, guiding principles need to be established (Ritchie & Hoffman, 1996; Reeves & Reeves, 1997; Tuzun, 2001; Gunawardena et al, 2006).

The theoretical background of this study revolves around computer supported collaborative learning (CSCL) and the social constructivist theories of collaborative learning

(Scardamalia & Bereiter, 2006, Kanuka & Anderson, 1999). According to Garrison, Anderson and Archer (2000), knowledge can be constructed through discussion and social negotiation with others. Lynch (2002) states that we have become a "global learning society. As such, our educational systems must become a primary vehicle for assisting learners to become successful citizens of the world--a world that demands new knowledge, new thoughts, new frameworks for problem-solving, and new ways for caring for one another" (p. 2). In order to further develop an understanding of this process, more studies need to be conducted on the learning processes of both groups and individuals, as well as the design of learning environments that foster such conditions (Gunawardena, Lowe & Anderson, 1997; Anderson, et al, 2003; Rourke et al, 2001; Lynch, 2002; Pozzi et al, 2007). The implementation portion of the study will address the need for analyzing collaborative learning processes and tools for social interaction in an online CSCL environment.

Significance of Study

This study is significant to the field of Instructional Design for several reasons. First, the study provides suggested guidelines for practitioners to create collaborative online instruction. Online instruction, unlike face-to-face instruction, requires the coupling of multiple areas of expertise to be successful. Although the pedagogical principles are the same, the global implications of "flat world" technology require an important weaving of collaborative interaction, graphic design, and pedagogy. This study places an emphasis on a theory-driven process for designing CSCL components in an online environment. These guidelines will be broken down into iterative phases with suggested steps in each phase. Second, the process will be anchored in theory, with a description of what constitutes productive collaborative activity in an online setting. Third, recommendations for tools to enhance social interaction in an online setting will be included.

The implications of this research serve to provide guidelines for instructional designers in the future conversion or creation of collaborative instruction.

The following chapter provides a detailed description of the developmental research design for this study. It includes a general description of developmental research, as well as a concise description of the focus of this study. All phases and stages of the research process for developing a strategy for creating collaborative online instruction are defined and outlined. The methodology includes all research stages of this project.

Chapter 3: Methodology

Research Focus

The focus of this study is computer-supported collaborative learning and the value of collaboration in the design of online instruction. This study addresses the following issues:

1. The development of guidelines for when and how collaborative activities should be included in the design of online instruction;

2. Determining the practicality of using existing strategies from other design models to create a conversion model; and

3. The development of guidelines for creating collaborative online units of study.

Creating collaborative online instruction requires that special attention be given to including social, collaborative components of CSCL to optimize the potential for construction of knowledge (Gunawardena & McIsaac, 2003; Garrison, Anderson & Archer, 2003; Roblyer & Wiencke, 2003). Pozzi, Manca, Persico and Sarti (2007) propose a five dimensions model for the study of learning processes in a collaborative environment. Their five dimensions include the following: Participative dimension, Interactive dimension, Social dimension, Cognitive and Meta-cognitive dimension, and the Teaching dimension (Pozzi et al, 2007). Although this study is not directly related to the learning processes, the five dimensions provide guideposts for developing a collaborative conversion process. Important considerations for collaborative components in the conversion process also include: activities designed in advance as authentic tasks relevant to students' interests; inclusion of an integrated system of web resources; structured conferences where students comment on each other's work; and occasional synchronous events to motivate and enhance group tasks (Lave & Wenger, 1991; Mason & Gunawardena, 2001; Hawkridge, 2002; Reiser & Dempsey, 2006; Gunawardena et al, 2006). Other collaborative components may be identified from the theoretical foundations of collaboration, CSCL and situated cognition during the research process.

Developmental Research

Based on the Type 1 and Type II classifications of developmental research by Richey, Klein & Nelson (2004), a context specific study is a Type I Developmental research project. Type I research projects focus on the design and development of an instructional program or process (Richey, Klein & Nelson, 2004). Therefore, this research study emphasizes the design and development stages for creating an instructional design model for the creation of collaborative online instruction.

Research Design

This study implements a developmental design research methodology. According to Reeves (2000), this type of research is characterized by the following traits: it addresses complex problems in real contexts through collaboration with practitioners; it integrates known and hypothetical design principles with technological advances to create possible solutions to complex issues; and it employs “rigorous and reflective inquiry to test and refine innovative learning environments as well as to define new design principles” (p.58). The goal of developmental design research is “to develop new theories, artifacts, and practices that can be generalized to other schools and classrooms” (Barab, 2006, p.153). Cobb, Confrey, diSessa, Lehrer & Schauble (2003) state:

> Prototypically, design experiments entail both “engineering” particular forms of learning and systematically studying those forms of learning within the context defined by the

means of supporting them. This designed context is subject to test and revision, and the successive iterations that result play a role similar to that of systematic variation in experiment (p.9).

The purpose of this study is to develop online pedagogy and evaluate the value of collaboration in its design.

This study addresses the specific design issue of creating collaborative online instruction, as well as to analyze collaborative learning processes in an online environment. A careful analysis of the process for creating collaborative online instruction is conducted. “As a relatively new discipline that seeks to apply principles of educational psychology and communications theory to improve instruction, instructional design continues to evolve in response to new developments in instructional theory and practice” (Cennamo & Kalk, 2005, p. 3). Therefore, it is important to note that developmental design-based research is “less a method than it is a collection of approaches that involve a commitment to researching activity in naturalistic settings…with the goal of advancing theory and at the same time directly impacting practice” (Barab, 2006, p. 155.)

Stages of the Developmental Research Design

The core of this study is the development of an instructional design strategy for the creation of a theory-driven process for designing computer-supported collaborative learning in an online environment. In order to implement this study, several stages of research were required.

Stage One: Literature Review

First, the researcher conducted a thorough literature review of CSCL and situated cognition, with an intentional focus on identifying collaborative components from CSCL and situated cognition.

Stage Two: Establish Protocol and Criteria

Next, based on Koschmann's (1996) definition of CSCL, a protocol was established. Then, the researcher returned to the literature to establish fundamental guiding principles for creating collaborative instruction that addressed the requirements of the protocol. Based on the literature, criteria was established and entered into the database. The criteria were used to identify matching theoretical constructs.

Stage Three: Database

Then, after identifying the theoretical constructs of CSCL and situated cognition, these constructs were entered into a database along with APA's Learner-centered Psychological Principles. Next, using the database, the researcher was able to filter out which theoretical constructs from CSCL and Situated Cognition, as well as the APA principles, aligned with the criteria for inclusion in the development of a new design model (See Appendix E). The theoretical constructs and APA Learner-Centered Principles that matched the established criteria became the foundation for developing the collaborative design model.

Stage Four: Existing Design Models

Finally, a survey of selected design models was conducted to determine if instructional strategies existed that aligned with the theoretical constructs. Each design model was analyzed to determine its appropriateness for CSCL instruction. The selected models were broken into specific steps or stages in order to isolate the collaborative components of each.

Stage Five: Collaborative Components

The identified collaborative components from the reviewed design models were added to the database. The database became a filter for the process. The collaborative components that matched the constructs and met the established criteria were considered for inclusion in the design of the model (See Appendix F).

Stage Six: Summary of Matching Components

Next, using the established criteria, the database was used to filter out which collaborative components best supported the identified theoretical constructs and principles identified in Stage Three. A summary of existing components matching the identified constructs and principles was created (See Appendix H). This summary provided the data pool from which all constructs, principles and collaborative components were selected for use with the model.

Stage Seven: Guideline One

Based on the results of the prior stages, guidelines for determining the appropriateness of using a collaborative online instruction model was developed (See Appendix I). This became the first stage or step of the process.

Stage Eight: Guideline Two

Based on the results of the prior stages, guidelines for creating a theory-driven process for designing collaboration in an online environment were established. These guidelines were broken down into iterative phases with suggested steps in each phase. Second, this process was anchored in theory, with a description of what constitutes productive collaborative activity in an online setting.

Stage Nine: Operationalizing Constructs

Next, the theoretical constructs were operationalized as a design model and included suggested collaborative instructional strategies for online instruction. Recommendations for tools to enhance social interaction in an online setting were also included.

Stage Ten: Presentation of Design Model

Finally, the design model was introduced and packaged with accompanying materials. This design package included all materials necessary to send to expert reviewers.

Stage Eleven: First Round of Reviews

The developed guidelines, the design model and suggested collaborative instructional strategies that made up the model package were sent to expert instructional designers for review. A cover letter and some documentation created in the previous stages were included for the purposes of clarification.

Stage Twelve: Modifications

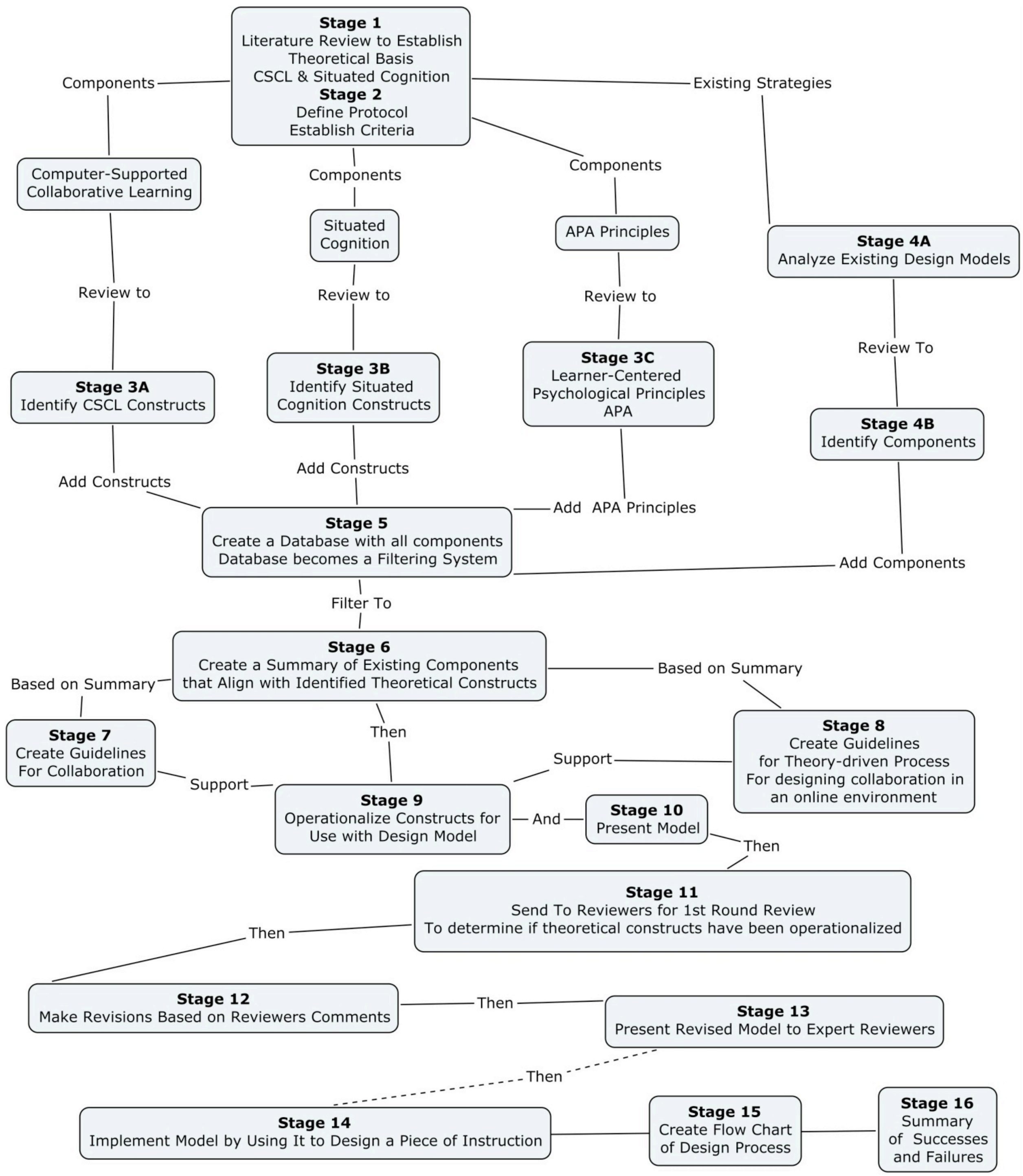
Once the reviewers' comments had been received, the researcher compiled the comments and compared the comments from all of the reviewers. Based on the expert reviewers' opinions, modifications to the collaborative design model were made.

Stage Thirteen: Second Round of Reviews

After modifications were completed, the revised guidelines, design model and suggested collaborative instructional strategies were presented to the expert instructional designers via email with a note of explanation. Also, a note of thanks and a gift certificate were sent to each reviewer to express appreciation for their involvement in the process

The stages of the research process described above are illustrated in the following flow chart (See Figure 1). The implications for this research serve to provide guidelines for instructional designers in the future creation of computer-supported collaborative learning programs in an online environment. The next chapter discusses the implementation of the research methodology and provides a detailed description of the procedure.

Figure 1: Stages of Research



Chapter 4: The Process

Introduction

The design of this study focused on the development of strategies to promote computer-supported collaborative learning activities in an online learning environment in order to produce a set of guidelines grounded in the collaborative theoretical components of CSCL and Situated Cognition. The guidelines provided a process for determining the appropriateness of collaboration in the course design, as well as a strategy for creating collaborative online instruction. “While models provide the conceptual reference, they also provide the framework for selecting or constructing the operational tools needed to apply the model” (Gustafson & Branch, 1997, p.4).

Explanation of Process

Computer-supported collaborative learning required far more than simply posting content to the Internet or across computer networks. Digitizing content and disseminating the information to a large number of students with little or no interaction between students and instructors did not equate to quality instruction (Stahl, Koschmann & Suthers, 2006). This developmental study involved the design, development, evaluation, and revision of an instructional design process to create a theory driven design model for creating collaborative online instruction.

Stage One: Literature Review

In order to develop a design model that incorporated collaborative interaction, a thorough review of literature was conducted. This review of literature established the foundational principles of instructional design, collaborative knowledge building, computer-supported collaborative learning, situated learning and two forms of anchored instruction (problem-based learning and project-based learning). Please refer to Chapter Two for an in-depth review of the referenced literature. Based on the data gathered during this stage of the process, the protocol and criteria for building a new design model was established in Stage Two.

Stage Two: Establish Protocol and Criteria

The protocol for selecting theoretical constructs to develop this model required that the construct must support the development of shared knowledge and group cognition. The term 'shared knowledge' is fairly ambiguous. According to Stahl (2005), shared meaning was collaboratively created by the group as a whole; however, "the establishment of that meaning as shared involved the process of negotiation through which the individual group members had to interpret the meaning from their own personal perspectives, to display their understanding of the meaning and to affirm that meaning as shared" (p. 81). Stahl (2006) also listed 3 perspectives for defining the term 'shared knowledge':

> (1) Similarity of individuals' knowledge: the knowledge in the minds of the members of a group happen to overlap and their intersection is 'shared.'
>
> (2) Knowledge that gets shared: some individuals communicate what they already know to the others.
>
> (3) Group knowledge: knowledge is interactively achieved in discourse and may not be attributable as originating from any particular individuals (p.81).

Koschmann (2002) described knowledge as meaning-making through joint activity. For the purpose of this research, the third perspective combined with Koschmann's description of meaning-making through joint activity was used to define 'shared knowledge'. If a construct did not support collaborative knowledge building it was not included in the design model.

In establishing criteria for selecting theoretical constructs to build the instructional design model, the researcher turned to the literature for fundamental guiding principles for creating collaborative instruction. The following criteria were developed from the literature on instructional design, computer-supported collaborative learning, situated learning and different forms of anchored instruction. Specific criteria used for selecting theoretical constructs were:

(1) The construct must support discourse, negotiation and the sharing of ideas.

(2) The construct must support the co-construction of knowledge artifacts.

(3) The construct must support multiple perspectives.

(4) The construct must support individual and multi-level opportunities for reflection.

(5) The construct must support situativity. (Vygotsky, 1978; Brown, Collins & Duguid, 1989; Lave & Wenger, 1991; Scardamalia & Bereiter, 1994; Wenger, McDermott & Snyder, 2002; Stahl, 2006; Greeno, 2006; Krajcik & Blumenfeld, 2006; Stahl, Koschmann & Suthers, 2006). All five criteria were placed in a database titled "Filter Database" to act as a filter for selecting theoretical constructs and strategies to be used in the development of an instructional design model. For the purposes of this developmental project, all 5 criteria had to be satisfied for a theoretical construct to be included. In the following stages, the "Filter Database" was used as a repository for evaluating and selecting constructs, principles and strategies.

Stages Three Through Six: Creating and Implementing the Filter Database

In Stage Three, to determine what constructs matched the criteria, an analysis of CSCL (3A from Figure 1), Situated Cognition (3B from Figure 1), and the APA Learner-Centered Psychological Principles (3C from Figure 1) was conducted. The theoretical constructs were entered into the "Definition of Constructs" Table for establishing a theory-based definition for each identified construct (See Appendix E). Next, the identified constructs and the APA Learner-centered Psychological Principles were added to the "Filter Database" created in Stage Two. The identified criteria from Stage Two were implemented as the filter for determining the selection of theoretical constructs and strategies (See Appendix F). The identified APA Learner-centered principles were also included in the filtering process to affirm their alignment with the established criteria.

In Stage Four a survey of existing design models (4A from Figure 1) was conducted (See Appendix G). Each design model was analyzed to determine what collaborative components (4B from Figure 1) could be culled for possible use in the design of a new model. Stages and defining characteristics of each model were entered into the "Characteristics of Existing Design Models" table for comparative purposes. Based on the results of the comparative table, collaborative components were identified.

Next, in Stage Five, the collaborative components identified in the "Characteristics of Existing Design Models" were placed in the "Filter Database" for the purpose of determining alignment with the established criteria (See Appendix H). Each identified collaborative component from the reviewed design models was entered into the filter database to determine which ones aligned with the five criteria.

In Stage Six, based on alignment with the criteria, the collaborative components were then matched to the identified theoretical constructs. The "Filter Database" was used to filter out which collaborative components matched the criteria and also supported the identified theoretical constructs and principles identified in Stage Three. A summary of existing components matching the identified constructs and principles was created. Based on the results of the filter, seven theoretical constructs were included in the development of the Model (See Appendix F). The seven theoretical constructs included in this process include: knowledge building, conceptual agency, anchored instruction, expertise building, intersubjectivity, group cognition, and scaffolding.

Defining Theoretical Constructs

Knowledge Building

The construct of knowledge building was selected for inclusion. Knowledge building as defined by Scardamalia and Bereiter (1994) refers to the “production and continual improvement of ideas of value to a community, through means that increase the likelihood that what the community accomplishes will be greater than the sum of individual contributions and part of broader cultural efforts” (p. 1371). Knowledge building encourages discourse, dialogue negotiation and the exchange of ideas. It also supports the co-construction of knowledge artifacts. An example of how the construct of knowledge building would be implemented in the instructional design of a course is the inclusion of discussion forums, asynchronous and synchronous chats, blogs, wikis, and conferencing and presentation opportunities.

Conceptual Agency

Another CSCL construct included in the design model was supported in Greeno’s (2006) work. Greeno discusses the situative approach and the significance of activity systems: "Thinking is situated in physical and social contexts. Cognition, including thinking, knowing, and learning, can be considered as a relation involving an agent in a situation, rather than as an activity in an individual's mind" (Greeno, 2006, p.135). Learning in activity and the idea of participant structures were significant to this design model. Participants’ roles in interaction vary according to situations. Competence, authority and accountability are distributed differently and expectations and entitlements for initiating discussions, making assertions, and asking questions are influenced by these roles.

According to Pickering (1995) these different positions based on subject-matter domain, can be described as “a dance of agency, involving material agency, disciplinary agency, and conceptual agency” (p. 88). According to Greeno (2006), “Conceptual agency is involved when an individual or group interacts with the subject-matter constructively-interpreting meanings, formulating questions, choosing and adapting a method, designing an apparatus…” (p. 88). Conceptual agency met the criteria for the proposed design model and was included as a theoretical construct. An example of how the design model might facilitate conceptual agency into instruction would be to include unscripted activities that had to be negotiated in order to co-construct knowledge artifacts. Web 2.0 tools that would be appropriate for designing conceptual agency include blogs, wikis, shared white boards, conferencing software and other collaborative resources.

Anchored Instruction

Krajcik and Blumenfeld (2006) discuss project-based learning, a form of situated cognition and anchored instruction. Anchored instruction is based on two important principles. Learning and teaching activities are designed around an ‘anchor’ such as a specific problem or situation and resource materials require exploration on the part of the learners (Kearsley, 2004). Project-based learning begins with the formation of a driving question. After the group has developed a driving question, they explore the possibilities through situated and authentic inquiry. Based on their collaborative work, students develop shared artifacts that illustrate an understanding of the discipline as well as how to apply the knowledge.

A very similar form of anchored instruction is problem-based learning. As with project-based learning, problem-based learning is ‘anchored’ with a specific problem. Students are engaged in an authentic environment and must collaboratively solve a real-world problem (Savery & Duffy, 1996; Torp & Sage, 1998; Sage, 2000; Hmelo-Silver & Barrows, 2006; Savery 2006; Kumar & Natarajan, 2007). Problem-based learning concludes with a debriefing of the problem and a review of the process. Both Project-based learning and Problem-based learning are excellent techniques for engaging learners in collaborative knowledge building; therefore, these pedagogical practices are included in the strategies for the collaborative instructional design model. Both of these forms of anchored instruction meet the criteria for being included in this design model because they provide meaningful opportunities to examine tasks from a variety of perspectives, require social interaction to negotiate and debate meaning, and also require students to co-construct their understanding of the solution(s).

Expertise Building

Situated cognition explains why the situation co-produces knowledge through activity. According to Brown, Collins and Duguid (1989), approaches such as cognitive apprenticeship and anchored instruction where learning is embedded in activity and "make deliberate use of the social and physical context are more in line with the understanding of learning and cognition that is emerging from research" (p.32). They use a tool analogy where knowledge, like a tool, must be used in order to be fully understood. By actively working with knowledge, learners "build an increasingly rich implicit understanding of the world in which they use the tools and of the tools themselves. The understanding, both of the world and of the tool, continually changes as a result of their interaction (Brown, Collins, & Duguid, 1989, p.33). Life-long learning results from continually interacting with given situations. The emphasis on situated activity and expertise building is very important to this design model. Course Management Software (CMS) such as Sakai's Scholar program, Moodle, Joomla, Drupal WebCT or Blackboard offers an excellent environment for influencing expertise building. This design model incorporated the use of activities with real-world relevance, ill-defined problems, and complex tasks investigated over a sustained period of time. By designing instruction that incorporates the use of the collaborative tools included in the CMS, the designer can emphasize the importance of situated cognition, collaboration and expertise building. Also, CMS includes a component for keeping a persistent record of student discourse. Students can use this record as a reference resource as well as a reflection tool.

Intersubjectivity and Group Cognition

Based on the work of Stahl, Koschmann and Suthers (2006), intersubjectivity and group cognition are two other constructs that meet the criteria established for inclusion in this design model. CSCL embraces the importance of meaning negotiation that occurs through dialogue within a social group. Learning is viewed as socially organized meaning making (Lave & Wenger, 1991; Hicks, 1996; Stahl, Koschmann & Suthers, 2006). The goal for designing CSCL instruction is to create activities and artifacts in an environment that sustains group meaning making.

As intersubjectivity and group cognition are important foundational principles of CSCL, these constructs were included in the design model. An example of a strategy for facilitating group cognition is the use of negotiation as a learning activity. Also, providing opportunities for students to re-evaluate their individual work as well as the work of the group supports group cognition. Another important factor in the enhancement of group cognition is group size. Keeping group size small is significant to the development of intersubjectivity (Koschmann et al, 2003; Stahl, 2006; Scardamalia & Bereiter, 2004; Pea, 1993). Small groups "lie at the boundary of, and mediate between, individuals and a community. The knowledge building that takes place within small groups becomes 'internalized by their members as individual learning and externalized in their communities as certifiable knowledge'" (Stahl, 2006 as cited in Stahl, Koschmann & Suthers, 2006). Therefore, another strategy included in this design model was the formation of small groups to support the development of intersubjectivity and group cognition.

Scaffolding

As part of the strategy for developing small groups, an analysis of learners should be conducted as part of the design process. The results of this analysis are important to the formation of small collaborative groups. Vygotsky's (1978) Zone of Proximal Development (ZPD) refers to the difference between what a learner can do with support and what she/he can do without guidance. Scaffolding plays a key role in developing expertise. Based on the work of Nasir, Rosebery, Warren and Lee (2006) scaffolding involves the following design components:

> (1) organizing participation in activities in ways that address basic human needs for a sense of safety as well as belonging;
>
> (2) making the structure of the domain visible and socializing participants for dispositions and habits of mind necessary for expert-like practice;
>
> (3) helping novices understand possible trajectories for competence as well as the relevance of the domain to the learners; and
>
> (4) providing timely and flexible feedback (p. 491).

These basic components of scaffolding were included in the design model because expertise building is an important goal of computer-supported collaborative learning.

Stage Seven: Guideline One to Determine Appropriateness of Collaboration

The development of a two-fold guideline process was significant for this model. The guidelines were built on both a conceptual and empirical framework. It was necessary to determine as a first step whether a collaborative course design was appropriate for the specified instructional need. In analyzing the course goals and requirements, *Guideline One* evaluates whether the use of the model should be applied (See Appendix I). To determine whether a CSCL environment was appropriate, *Guideline One* contains 9 determining questions that must be addressed before moving forward in the design model. *Guideline One* questions were designed to determine the appropriateness of collaboration for any given instructional design need. If a majority of the answers to the questions were "Yes," the instructional design scenario was deemed appropriate for collaboration. If a majority of the responses were "No" a different instructional design model was considered for the development of the course.

Stage Eight: Guideline Two

Based on Hawkridge's (2002) principles, the identified theoretical components, and the appropriate key techniques selected from the reviewed existing models, the strategies were developed. According to Hawkridge (2002), in order to design an online course, the designer must have an understanding of the following components:

- The students for whom the site is intended;
- The structure of knowledge in that field;
- The objectives the students should be able to reach;
- The capabilities of the software, including streaming audio and video;
- Graphic design;
- Means of making the site interactive; and
- Evaluation criteria (p.274).

In the development process of "taking a course online," emphasis was on the theoretical principles that support and sustain group interaction, collaboration and the formation of communities of learners. Online instruction requires more than merely posting content such as a series of readings or a collection of lectures to the course structure (Oblinger & Hawkins, 2006; Sieber, 2005). In fact, content that works well in a face-to-face setting may be totally inappropriate for an online setting without being retooled (Ellis & Hafner, 2003; Koszalka & Ganesan, 2004; Zirkle & Guan, 2000; Henry & Meadows, 2008). Therefore, existing design models for creating collaborative online instruction were reviewed to analyze their processes. Key components of these models were described and matched with theoretical constructs. Next, a table, *Guideline Two,* was created for the simplicity of presenting the sequence of events as a reference card (See Appendix J).

Stage Nine: Operationalizing Constructs

Next, the selected components were also placed in the Filter Database with the identified theoretical constructs to see how the existing models aligned with the constructs. The table was used to filter and identify the most appropriate strategies and components for inclusion in the design guidelines. As a reference tool, the design table includes design principles and a variety of suggested resources for operationalizing the theoretical constructs (See Appendix K). Also, a procedure was established for creating collaborative online instruction. Based on the summary of traits from the theoretical constructs selected from the literature review as well as from the selected models that matched the collaborative components garnered from the literature, an initial prescriptive flow chart for the process was developed as well as a Strategies Table (See Appendix L & Appendix M). After developing the flow chart, a figure of the Collaborative Design model was developed (See Appendix N).

Strategies for Employing the Model

Once the Collaborative Design process was outlined, the next step was to develop strategies for employing the model. Instead of producing a mass packet of content for learners, online instruction must be deliberately and strategically designed to engage learners in activities and interaction (Koszalka & Ganesan, 2004; Sadik, 2004; Henry & Meadows, 2008). The included strategies were culled from existing design models and data from the literature review. For example, several models recommend during the design phase the first step should be to develop an overview of the course structure (Moallem, 2003; Bonk & Zhang, 2006). Therefore, one of the included strategies is to develop an overview of the course structure. Within this specific strategy are the following suggestions (Moallem, 2003; Bonk & Zhang, 2006):

- Requiring introductions at the beginning of the course encourages active student-to-student and student-to-faculty contact.
- Modeling good communication techniques encourages reciprocity and cooperation among students.
- Providing prompt feedback encourages reflection, revision, and quality time on tasks.
- Providing prompt feedback scaffolds students as they progress through their zones of proximal development.
- Establishing individual and group expectations and course goals and objectives encourages active involvement and successful group cognition.

Another suggested strategy for the employment of this Collaborative Design Model is to determine which pedagogical practice (project-based learning, problem-based learning, or some other form of situated learning) will best meet the needs of the defined course goals and objectives. Once the appropriate practice is selected, the problem or project is selected.

Once the form of authentic context is established, activities can be designed and resources selected. The foundational principles for making these types of decisions include the following: (1) Provide access to expert performances, (2) Provide authentic activities and assessments, (3) Provide frequent feedback, (4) Provide modeling of processes, (5) Provide access to shared common spaces, (6) Provide opportunities to experience multiple roles and perspectives, and (7) Provide opportunities for competing solutions and diversity of outcomes. Other types of activities that support the development of effective collaborative dialogue, intersubjectivity, expertise building and knowledge building include modeling, coaching, scaffolding at critical times and authentic assessment of learning tasks. These types of activity require time; therefore, the designer should plan opportunities for reflection to enable abstractions to be formed and time for articulation to enable tacit knowledge to be made explicit. Students should be given multiple opportunities to externalize and articulate unformed and developing understanding because discourse is an excellent technique for collaborative problem solving. Articulation and externalization also reinforces learning in a feedback loop. By maintaining a persistent record of discourse, students can review conversations and the record of discourse becomes another scaffolding tool. These were important design strategies included in the Collaborative Design Model for supporting the process of knowledge construction. Other specific instructional strategies for addressing various stages of the Collaborative Design Model were assembled from the review of literature. These strategies, drawn from an extensive literature review, were intended to provide guidance for developing collaborative online instruction through the implementation of the Collaborative Design Model.

In order to enhance collaboration, the design model also incorporated the use of intentional discourse as a means for collaborative problem solving (Lave & Wenger, 1991).

Through content specific discourse, students engage in the sharing of ideas and the negotiation of meaning. Tools that foster collaborative dialogue include discussion forums, chats (asynchronous and synchronous), email, and conferencing software. An example of a strategy for supporting the negotiation of meaning would be a weekly chat in which groups meet to discuss course content and the instructor/facilitator begins the session by modeling appropriate chat expectations. For example, if writing style were an important component of the session, the instructor would post the first comment as a well-written paragraph and state that comments should be thoughtful and include supporting details.

Other design principles that were included in the Collaborative Design Model include modeling, coaching, articulation, reflection, and opportunities for exploration. Based on the work of Brown, Collins and Duguid (1989), in order to foster expertise building, students must have access to expert performances. Cognitive apprenticeship encourages the master of a skill to reveal all components that make up the complex task. Cognitive apprenticeships "are designed, among other things, to bring these tacit processes into the open, where students can observe, enact, and practice them with help from the teacher" (Collins, Brown, & Newman, 1987, p. 4). Having an expert visit the chat room to address student questions and provide real world examples of solutions to problems is an instance of how expertise building and cognitive apprenticeships could be operationalized in the Collaborative Design model. Another example of intentionally designing this construct into the instruction is to have an expert model a performance for the class. This expert performance could be recorded and made available for review in the class resource folder. The recorded performance would become a scaffolding tool for those students who need the model to move forward in their zone of proximal development.

As technology continues to evolve, global collaboration becomes a viable option in course design: “Advances in technology also increase our ability to create more interactive and engaging learning environments, a goal of developers designing from virtually all theoretical perspectives” (Gustafson & Branch, 2002, p. 85). This instructional design model intended to encourage the designer to make appropriate pedagogical choices in selecting available tools for enhancing collaboration. Web 2.0 tools are an example of evolving collaborative tools:

> The latest evolution of the Internet, the so-called Web 2.0, has blurred the line between producers and consumers of content and has shifted attention from access to information toward access to other people. New kinds of online resources—such as social networking sites, blogs, wikis, and virtual communities—have allowed people with common interests to meet, share ideas, and collaborate in innovative ways. Indeed, the Web 2.0 is creating a new kind of participatory medium that is ideal for supporting multiple modes of learning” (Brown & Adler, 2008, p.16).

According to Wikipedia (2008), “Web 2.0 can refer to a trend in Web design and development, a perceived second generation of Web-based communities and hosted services ... which aim to facilitate creativity, collaboration, and sharing between users." Web 2.0 technologies continue to increase the list of collaborative tools as content creators develop Open Source Software. Incorporating Web 2.0 resources into the design principles of computer-supported collaborative learning may be an important component for the development of a new design model for creating collaborative online instruction.

It is important to note that in a collaborative online course created by the Collaborative Design model, the instructor's role transformed to a designer of student learning experiences and manager of the platform/course management system (Collins & Berge, 1996; Garrison, Anderson & Archer, 2000; Sieber, 2005; Staley, 2009). The instructor established rules and procedures that support and guide student learning. "Teachers must cede some of the control of the direction of the learning in such a classroom, since what is learned is oftentimes an emergent function of the quality of the students and the nature of their interactions, which cannot be fully planned or controlled by the teacher" (Staley, 2009, p. 2). Therefore, as a collaborative constructionist online course is being designed, the transformed role of the instructor must be emphasized. Based on the work of Henry and Meadows (2008) designing for the transformed role of the teacher requires the design and development of authentic learning activities that engage the learners and facilitates both social and cognitive immersion in the process.

Stage Ten: Presentation of Design Model

Once the constructs were put into operation, the Design Model was packaged with all of its component parts. The Model package included a figure of the model, a flow chart of the process, Guideline One, Guideline Two, and the Development and Instructional Strategies Table. Although already presented in this chapter, for ease of reference, the items provided to the reviewers in the Collaborative Design Model Package are illustrated in the Appendices (See Appendices I, J, L, M, N).

Stage Eleven: Review Process

The steps of this procedure were submitted for preliminary review to expert designers in the Instructional Design and Technology field. Using the defined theoretical components from the literature, the reviewers were asked to determine if the components were operationalized in the

Collaborative Design Model Packet. They were given a Review Package (See Appendices O, P, Q, R, S, T, U, V, W) which included a letter of introduction, an open-ended review form, the Collaborative Design Model, the Collaborative Design Process, a table containing the definitions of all constructs and credit to the appropriate theorists, Guideline One, Guideline Two and a Table of Developmental and Instructional Strategies. The instruction letter explained the process for reviewing the collaborative design package. The letter of introduction was emailed to the reviewers and the Review Package was included as an attachment. The reviewers were requested to complete the review process as their schedules allowed. A follow-up email was sent to reviewers after ten days to remind them to complete the process and requested that they return their responses by March 6th. Unfortunately, time constraints for one reviewer and medical issues for another reviewer prevented them from meeting the requested submission date of March 6th.

Three Reviewers evaluated the Collaborative Design Model package. Two reviewers completed the Open-ended Review form and the third reviewer completed the open-ended review form in the format of an interview to discuss his responses. The face-to-face interview occurred in the reviewer's office on March 9th and lasted 40 minutes. This dialogue resulted in a more detailed explanation of his opinion than his open-ended response form (See Appendix X). He had several requests for clarification of definitions and also provided detailed explanations for his initial responses. He questioned how collaborative knowledge would be measured and expressed his support of authentic assessment and collaborative projects. He also provided a face-to-face example of computer-supported collaborative learning from his own work experience. An important point was made in this interview. The interviewer raised a question about tools used to create the course: "Do you have an idea of the kinds of tools you would use to create a collaborative course?" This question indicated that the suggested design tools had not been included in the review package. It was a serious omission and would need to be included in the modifications. Clearly, it was an informative meeting and a helpful review process. Based on this review all identified theoretical constructs were operationalized.

A second reviewer completed the Open-ended Review form and emailed her response to the researcher (See Appendix Y). Her response stated that all identified theoretical constructs had been operationalized. However, this reviewer made several suggestions the researcher addressed during the modifications process. A third reviewer concurred the constructs had been operationalized, but due to health issues did not take time to make any other comments or suggestions (See Appendix Z).

Chapter 5: Discussions

This chapter discusses the revision process of the design, as well as the modifications made based on the outcomes of the reviews, my personal review, reflection of the literature and individual committee members' recommendations. Based on the outcomes of the expert review process, recommendations are made for future uses as well as potential modifications for the design guidelines.

Revision Process

Theoretical Constructs

Establishing the protocol for selecting theoretical constructs was a simple process built on Stahl's (2005, 2006) and Koschmann's (2002) definition of computer-supported collaborative learning. The criteria required a detailed review of literature to find fundamental guiding principles for creating collaborative instruction. The focus of the search was on computer-supported collaborative learning, situated learning and different forms of anchored instruction. The establishment of criteria was an important stage of the research and, once accomplished, provided the researcher with a tool for selecting theoretical constructs. However, matching theoretical constructs to the criteria was not a simple procedure. A trial and error matching was attempted using tables to align constructs with criteria. At first, this seemed to be an appropriate strategy; but developing a technique for finding constructs that aligned with the protocol and matched the criteria required more than trial and error. A database was created and entering the information into the database was not difficult, but coding proved to be much more challenging. Color codes did not work as filters; but they helped create a visual image of how constructs aligned with criteria. Number codes were used to align constructs with criteria and to determine which constructs matched the criteria.

Once a coding system was implemented, the alignment of theoretical constructs with the established criteria was a successful process. The database used the numeric codes to match constructs and strategies with the criteria. Based on the results of the filtering process, theoretical constructs and collaborative strategies were identified in the early stages of research. Incorporating these constructs into the design of a model was a much more intricate and difficult process.

Creating a Model

Several attempts were made to create one comprehensive model to incorporate all of the design components; yet, the process was far too complex for a single design model. Determining where in the model to situate all of the collaborative components proved to be an intriguing challenge. After several attempts at designing a simple model, it was determined that the collaborative components would need to be implemented in several stages and that a singular design model was not an achievable design. Based on the complexity of the process, it was determined that it would be more appropriate to create a collaborative design package that included guidelines and strategies, as well as a process for implementing the individual steps. Therefore, a collaborative design package was developed for clarity. The collaborative design package provided flexibility and adaptability to meet a variety of instructional design needs.

However, a major issue with creating a design package was determining how to organize the components for ease of use. It was determined that the components would be organized with a figure of the collaborative design model, and a flow chart of the collaborative design process. Next, Guideline One, Guideline Two, and the Strategies Table were included in the package. In order for the collaborative design model package to be useful, an instructional designer should be able to use it to design collaborative instruction by following the steps outlined in the model and illustrated in the flow chart. To determine if the theoretical constructs had been operationalized as stated by the researcher, the entire package was sent to the reviewers. The amount of material included in the package was unwieldy and cumbersome to evaluate.

Review Process

Once the packet was developed, the research methodology required it to be reviewed by expert instructional designers in the field of distance education. The methodology for the review process was limited. The review process provided confirmation that the theoretical constructs had been operationalized, but it also revealed that the “model” was complex and unwieldy.

The Review Packet contained a description sheet of materials enclosed in the package, as well as instructions for completing the process. In order to create a review process that would not take too much of the reviewers’ time, an open-ended review form with 12 questions related to the theoretical constructs was created. In order to avoid confusion and to be certain that the reviewers’ were using the same definitions of the constructs as were being applied in the research; a definitions table was added to the reviewers’ packet of information. The depth of this table made the review packet much larger and also extended the time required to complete the review process. It was sent to the reviewers via email on February 21, 2009 without a specified return date. On March 2, 2009 a reminder email was sent to the reviewers with a requested return date of March 6, 2009. Due to unforeseen circumstances, reviewers were unable to meet the requested return date.

Because one of the reviewers had serious health issues, an alternate reviewer was recruited to participate in the review process. He was sent the review package and later interviewed to discuss his responses to the open-ended review form (See Appendix W). This interview was a positive highlight of the review process and yielded more information than was actually given on the review form. It was very helpful to be able to discuss the different components included in the collaborative design package with the reviewer. It provided opportunities to clarify questions and to provide more detailed definitions of terms when explanations were needed. For example, Reviewer #1 asked for clarification regarding community knowledge advancement: "*I was grasping a little bit here to determine if community knowledge advancement is in the model. What does community knowledge advancement look like and how is it measured?*" The researcher was able to provide clarification for the reviewer and further enhance the communication related to the review process. Although the researcher's phone number and email address were included in the instructions sheet that was sent to the reviewers, no one emailed or called with questions that needed clarification or points of concern related to the process. Requests for clarification may be easier to express in an interview setting.

The researcher had limited interaction with the reviewers during the time that the collaborative design package was out for review. An improved methodology would include a scheduled face-to-face interview with each of the reviewers after they had been given time to review the collaborative design model packet. This format provided more structure to the process for the researcher as well as for the participant who completed the review process in this manner. Also, this would have allowed enough time to schedule a second meeting with each of the reviewers and would have been an excellent technique for discussing the modifications made based on the initial reviews. The interviewer could have explained the changes made with an illustration of how specific concerns or issues of individual reviewers were addressed. Also, an interview scenario would have helped to eliminate questions or misunderstandings; although, no questions or misunderstandings were indicated.

Stage Eleven: Modifications

Based on the recommendations of the reviewers, modifications were made to the Collaborative Design Model Package. One reviewer made the following comment: "*While your model is intended to be all-encompassing, there is so much going on that it tends to be overwhelming for the reader. Is there a way some of the aspects of it could be consolidated? My fear is that users may find it too complex to be feasible for use*." This excellent point highlights a significant problem. The complexity of the CSCL approach made it very difficult to design a more simple and clean design model. For this reason, the researcher developed a collaborative design package that included a visual model, a flow chart of the process, Guideline One and Guideline Two, and strategies for implementing it. However, based on the feedback, the researcher felt that the model should be revised.

Based on the recommendation of the reviewer, the collaborative design package needed to be simplified. Therefore, it was determined that the removal of the figure and flow chart of the design process was necessary. By removing these two items the total collaborative design package was less cluttered and easier to follow. In order to determine if an instructional need was appropriate for collaboration, Guideline One should be applied. If collaboration is deemed appropriate after applying Guideline One, the next step would be the application of Guideline Two. The steps of Guideline Two incorporate all of the stages of the design process. The Development and Instructional Strategies support the steps of the guidelines.

During the interview with Reviewer #1, he asked about possible tools for used with collaborative instruction: "*Do you have an idea of the kinds of tools you would use to create a collaborative course*?" Inadvertently, the tools had been omitted from the review package. Therefore, another important modification was to add suggested tools to the Strategies Table. In order to accomplish this change, the references were removed and the suggested tools were added. The tools were aligned with the strategies so that when specific strategies were selected, the suggested tools would be included as well.

Feedback from reviewers, literature reviews, individual committee members' comments, as well as personal reflection provided valuable guidance on this research journey. The review and revision process was a significant part of the methodology, and was an essential element for the development of a final product. Reviewers' detailed, reflective comments provided an excellent framework for making the modifications to the individual components that make up the Collaborative Design Process that have already been discussed in this chapter. However, for the purposes of this research, a significant problem was left unaddressed. Terminology included in the Collaborative Design Process was complex and required a "Definition of Terms" for the reviewers. One reviewer's comment provided an excellent point for a future change of the model if it is to be used by outside designers: *"I think it would be helpful to readers to include language that clearly conveys the concepts at hand without having to refer to other reference material for meaning or clarification."* Because the model was designed with the research intent of being theory-driven, the specific terms of the theoretical constructs were incorporated into the Collaborative Design Process. However, in the future, based on the words of one the reviewers, it would be important to include *"language that clearly conveys the concepts"* without the need for referencing a definition of terms. In order to be a helpful and useful design tool, this change will be significant to future use.

Another suggested change for the future would be to align the development and instructional strategies with the corresponding steps of the guidelines. This would streamline and simplify the instructional design process. And, it would have the potential to increase the usability of the collaborative design guidelines for future instructional designers searching for a tool to create collaborative online instruction. The guidelines, combined with the strategies table, would become a valuable, straightforward resource for instructional designers who need to create a computer-supported collaborative learning online environment.

Communication is a key component of the design process. Unfortunately, communication with the client or the design team was not specifically included in the guidelines and this was a major concern. Guideline Two should be revised to include the client throughout the process, but especially in the learner analysis and contextual analysis stages. According to Cennamo and Kalk (2004) techniques for communication should be a part of all instructional design projects and should include the following:

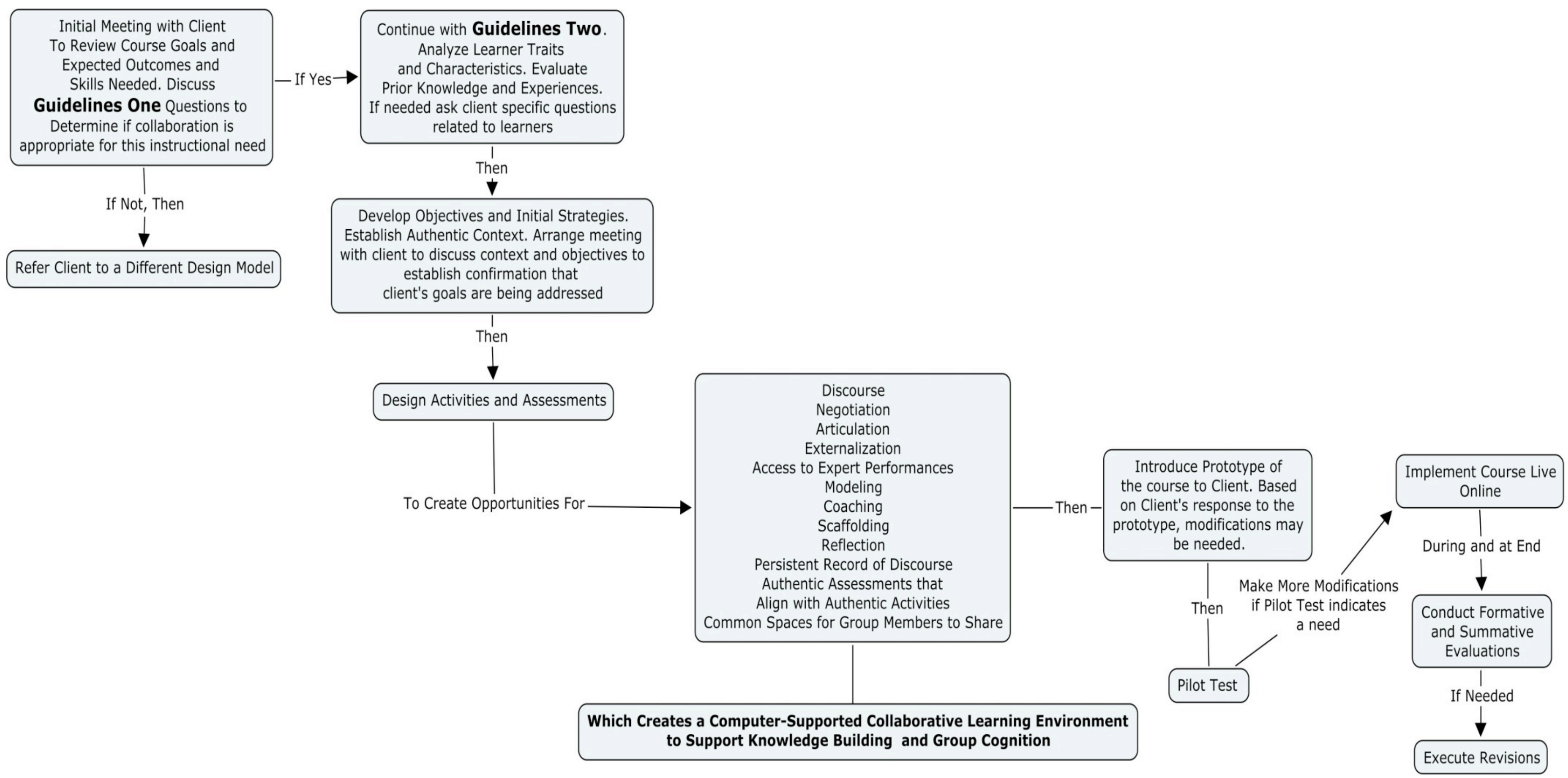
- Provide the project team with a list of contact information, including e-mail and phone numbers…
- Produce a weekly status report…
- Hold a regularly scheduled conference call or meeting to review the project's progress, the schedule for the upcoming week, and a list of any issues that need resolution
- Build in one complete review and revision cycle…
- Conduct a conference call or meeting to "review the reviews"
- Follow up each phone call with an e-mail or memo to participants summarizing decisions and action items…
- Report to your client every time you encounter a problem that you can't solve right away
- Discuss sensitive issues privately…

- Celebrate every important accomplishment… (p. 148).

Based on the above recommendations, a communication checklist should be added to the guidelines.

A final suggested change to the collaborative design process would be to include a flow chart of the actual instructional design scenario to share with the client. This flow chart could be used in the initial meeting with the client to familiarize him/her with the Collaborative Design Process and to initiate conversation about the appropriateness of collaboration to the stated instructional need (See Figure 2). Because this flow chart was not a part of the Collaborative Design Process, it was neither tested nor reviewed. It has been added as a suggestion for future modification to strengthen the usability of the Collaborative Design Process.

Figure 2: Flow Chart of the Collaborative Design Process for Clients



Stage Twelve: Presentation to Reviewers

After the modifications had been made, the Collaborative Design Process was emailed to the reviewers to illustrate how their evaluations had affected change in the final Collaborative Design Process. Guideline One and Guideline Two and the revised Table of Development and Instructional Strategies were emailed to the reviewers as evidence of revision and are illustrated in the following tables and these (Guideline One and Guideline Two and the revised Table of Development and Instructional Strategies) became the final design product for the collaborative design process product.

Table 1: Guideline One

Determining Factors	**References**
Ask the following questions to determine if collaboration is appropriate for the given assigned instructional need:	Sources used to Establish Guidelines
1. Is online access available for all students?	(Ahern & Repman, 1994; Moore & Kearsley, 1996; Kumar, 1996; Benbunan-Fich & Hiltz, 1997; Brooks & Brooks, 1999).
2. Will collaborative, problem-based or project-based instruction best meet the instructional goals of the course?	(Stahl, 2006; Scardamalia & Bereiter, 2006; Krajcik and Blumenfeld, 2006; Kearsley, 1996).
3. Will collaborative, problem-based or project-based instruction best meet the needs of the students?	(Stahl, 2006; Scardamalia & Bereiter, 2006; Savery & Duffy, 1995; Torp & Sage, 1998; Sage, 2000; Hmelo-Silver & Barrows, 2006; Savery 2006; Kumar & Natarajan, 2007).
4. Will time restraints permit collaboration?	(Nasir, Rosebery, Warren & Lee, 2006; Hawkridge, 2002)
5. Will the instructor have the time to model appropriate interpersonal interactions and expectations?	(Reeves, Herrington & Oliver, 2002; Garrison, Anderson & Archer, 2003; Shearer, 2003; Romiszowski & Mason, 2004; Browne, Warnock & Boykin, 2005; Brewer & Klein, 2006; Quintana et al, 2006; Stahl, 2006; Scardamalia & Bereiter, 2006; Githens, 2007).

6. Will the instructor have the time to provide frequent, appropriate feedback?	(Stahl, 2006; Scardamalia & Bereiter, 2006; Githens, 2007; Reeves, Herrington & Oliver, 2002; Anderson et al, 2003; Garrison, Anderson & Archer, 2003; Shearer, 2003; Romiszowski & Mason, 2004; Nasir, Rosebery, Warren & Lee, 2006).
7. Will the instructor be able to provide extrinsic rewards?	(APA, 1997; Anderson et al, 2003; Garrison, Anderson & Archer, 2003).
8. Will class size permit collaboration and the formation of small groups?	(Browne, Warnock & Boykin, 2005; Brewer & Klein, 2006; Quintana et al, 2006; Reio & Crim, 2006; Stahl, 2006; Scardamalia & Bereiter, 2006; Githens, 2007).
9. Will the instructor be able to participate/visit each small group several times throughout the duration of the course?	(Browne, Warnock & Boykin, 2005; Brewer & Klein, 2006; Quintana et al, 2006; Reio & Crim, 2006; Stahl, 2006; Scardamalia & Bereiter, 2006; Githens, 2007).

Table 2: Guideline Two

Guideline Two of a Two-fold Guideline Process
1. Analyze course goals, expected outcomes and skills needed to achieve them. 2. Analyze learner traits and characteristics. 3. Develop objectives and initial design strategy. Develop safe, supporting conditions and community identity. Develop scaffolding. Develop feedback expectations and strategies for community knowledge advancement in an authentic context. 4. Design collaborative activities, individual activities, group assessments and individual assessments. Design for authentic context, authentic activities, access to expert performances, modeling of processes, access to common shared spaces and multiple roles and perspectives; Design time for collaborative construction of knowledge, reflection to enable abstractions to be formed, articulation to enable tacit knowledge to be made explicit; Design activities that include coaching and scaffolding at critical times; Design authentic assessment of learning within the tasks; Design opportunities to externalize and articulate unformed and developing understanding, and include discourse as collaborative problem solving; Design opportunities to construct knowledge, and include opportunities for articulation and externalization to reinforce learning in a feedback loop with a persistent record of discourse; Design activities with real-world relevance, and include ill-defined problems embedded in rich contexts; Design meaningful opportunities to examine tasks from different perspectives. 5. Introduce CSCL prototype to client. If time allows, conduct a pilot test. 6. Implement the course. 7. Evaluate the course. Evaluations should include both formative and summative assessments. 8. Execute revisions. Based on the assessments, modifications may be necessary.

Table 3: Revised Strategies Table

Development Strategies	Suggested Tools	Instructional Strategies
(1) Develop an Overview of the Course Structure	Course/Learning Management System such as Sakai, Moodle, Blackboard, WebCT, FirstClass	Provide practical information about the collaborative tools for the course at the beginning of the session. Provide a detailed Syllabus. Align with course and/or institution's mission & goals.
(2) Develop an area for introductions at the beginning of the course to encourage active student-to-student and student-to-faculty contact.	Discussion Forum, Chat, Conferencing Software, Email, Shared Whiteboard Space, Wikis, Blogs	Provide ice-breaking sessions at the beginning of the course to build trust. Faculty should include a detailed introduction of him/her self
(3) Develop opportunities for Modeling of good communication techniques to encourage reciprocity and cooperation among students.	Presentation Software (Audacity, iMovie, MovieMaker, PPT) Shared White Boards, Conferencing Software	Provide direct instruction about working as collaborative teams. Provide examples of good communication techniques.

Development Strategies	Suggested Tools	Instructional Strategies
(4) Develop expectations for appropriate feedback as feedback encourages reflection, revision, and quality time on tasks.	Discussion Forum, Chat, Conferencing Software, Email,	Establish expectations for feedback at the beginning of the course.
(5) Develop different types of feedback to scaffold students as they progress through their zones of proximal development.	Blogs, Wikis, Journals, Shared White Boards, Conferencing Software	Provide coaching and scaffolding at critical times as needed throughout the course.
(6)Establishing individual and group expectations and course goals and objectives encourages active involvement and successful group cognition.	Word Processing, Spreadsheets, Draw Tools, Presentation Software, Shared White Board, Conferencing Software, Blogs, Wikis, Journals	Establish small groups to foster the development of intersubjectivity and group cognition. Provide practical information about the collaborative tools for the course at the beginning of the session. Provide direct instruction about working as collaborative teams

Development Strategies	Suggested Tools	Instructional Strategies
(7)Determine which pedagogical practice (project-based learning, problem-based learning, or some other form of situated learning) will best meet the needs of the defined course goals and objectives.	Course Management Software, Conferencing Software, Shared White Board, Online Libraries, Shared Resources, Blogs, Wikis, Email	Establish authentic context. Create course assignments that are as clear as possible with the acknowledgement that real world settings and project-based and problem-based learning include a considerable amount of ambiguity. The instructor should provide clarification as needed.
(8) Include expert performances and modeling of processes	Word Processing, Spreadsheets, Draw Tools, Presentation Software, Shared White Board, Conferencing Software, Course Management System/Learning Management System, Archiving Software	Provide coaching and scaffolding at critical times as needed. Provide opportunities to externalize and articulate unformed and developing understanding. Provide access to expert performances and modeling of processes as needed throughout the course.
(9) Develop authentic activities that have real-world relevance and are embedded in rich context.	Presentation Software, Shared White Board, Conferencing Software, Course Management System/Learning	Provide authentic assessments of learning Within the tasks. Provide opportunities to engage in discourse as a

Development Strategies	Suggested Tools	Instructional Strategies
	Management System, Archiving Software, Word Processing Software	collaborative problem- solving tool. Provide opportunities to construct knowledge within the group on problems/projects that have meaning for the students. Allow students to co-create knowledge artifacts.
(10) Provide Frequent Feedback and other forms of scaffolding as needed	Discussion Forums, Chats, Email, Conferencing Software, Shared White Boards, Journaling, Wikis	Provide opportunities to construct knowledge within the group. Provide continuous opportunities for articulation and externalization to reinforce learning in a feedback loop
(11) Develop a shared common space for groups to work in	Course Management System, Social Networking Software such as Ning, Web 2.0 Resources	Provide small group chat rooms. Provide access to small group wikis. Provide access to small group white boards.
(12) Develop Small Groups	Course Management System, Social Networking Software	Divide the class into small groups of 3 to 4 students.
(13) Develop activities that	PB Wiki, Course Management	Provide authentic activities with real-world relevance,

Development Strategies	Suggested Tools	Instructional Strategies
encourage reflection	System, Whiteboards, Blogs, Journals, and other Web 2.0 Resources	ill-defined problems embedded in rich contexts, and meaningful to the learners. Create course assignments that are as clear as possible with the acknowledgement that real world settings and project based and problem based learning include a considerable amount of ambiguity.

Summary

Creating a theory-driven collaborative design model was a difficult and time-consuming process. The researcher had little experience in such an endeavor and struggled with converting an intellectual understanding to a physical product. It took several attempts at creating a single visual representation of concepts (and multiple detailed critiques from Dr. Moore) to convince the researcher that a clean and simple model was out of reach. But eventually an acknowledgement of the need to change course was reached, and the intent to design a singular model was abandoned for a more practical and effective Collaborative Design Process.

This researcher addressed the complex problem of creating an instructional design process for creating computer-supported collaborative learning in an online environment. It integrated theoretical constructs and design principles with technological advances to create a possible solution to this multifaceted issue of designing computer-supported collaborative learning for web-based instruction. The researcher developed guidelines, as well as development and instructional strategies based on the theoretical constructs of computer-supported collaborative learning and situated cognition. This investigation employed rigorous and reflective inquiry to develop and refine innovative design guidelines and strategies. Because of the complexity of the original collaborative design package, it was determined that a more streamlined approach would provide a better tool for instructional designers. Therefore, the final design product evolved to include only Guidelines One and Two and the Table of Development and Instructional Strategies.

In conclusion, the Collaborative Design Process is a potential tool for creating collaborative online instruction. Strengths and weaknesses of the Collaborative Design Process have been identified through the expert reviewers' evaluations. Based on the reviews, revisions have been made to increase the usability of the product by simplifying the process. The final design product is grounded in research and theory and offers an added approach for creating computer-supported collaborative learning in an online environment to the field of instructional design.

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Appendices

Appendix A: Characteristics of Existing Design Models

Existing Design Model	**Overall Description: Defining Characteristics & Stages**
WisCom Gunawardena et al, 2006	Community Centered: common goal is wise community, reflective dialogue. Mentoring acts as mechanism for people supporting people. Mentoring aids: matching inexperienced with experienced: instructors assistants peers, experts, Protégés paired with mentors with common interest. Knowledge innovation purposeful creation sharing and preservation of meaningful, socially constructed ideas.
Collaborative Design Model, Moallem, 2003	Cyclic Process, but unfolds in 4 phases: 1. Create, 2. Record, 3. Access, 4. Enable—through interaction, archives, retrieval, making connections between concepts
R2D2 Model, Bonk & Zhang, 2006	Based on Kolb's (1984) effective learning phases of experiential learning: getting involved in concrete experiences; reflective listening and observations; creating an idea with an abstract conceptualization; and making decisions through active experimentations.

Existing Design Model	Overall Description: Defining Characteristics & Stages
	Different from other design models with same or similar names because this model focuses on the type of tasks, resources, and activities that one embeds in online course to address different human learning strengths and preferences or skills areas.
Implications For Design: Based on Principles of Situated Cognition & Vygotskian Thought, Hung & Chen, 2001	4 dimensions: Situatedness, Commonality, Interdependency, Infrastructure (fostered by rules, ratings or points system to motivate participation, accountability mechanisms, credibility of a contributors review and facilitating structures, information architecture facilitating the interdependencies)
Model of Effective Dimensions of Interactive Learning on the WWW. Reeves. 1998	Parts of Model include: 1. Cultural Habits of the Mind, 2. Attitude 3. Individual differences and 4. Origin of motivation Opportunity to construct learning, Task ownership, Sense of Audience, collaborative support, teacher support, meta cognitive support Knowledge and skills, Robust mental

Existing Design Model	Overall Description: Defining Characteristics & Stages
	models, and higher order outcomes.
Design & Use of a Rubric to Assess & Encourage Interactive Qualities in Distance Courses, Roller & Wiencke, 2003	3 prerequisites for learner engagement: 1. Definition of interaction based on relevant theory & research; 2. Course designs that go beyond replicating face-to-face methods and infuse interaction in ways that take advantage of the mediation possible between learner and technology; 3. Empirical assessments of interaction and measurement of effects on achievement
Interactivity: From Agents to Outcomes. Wagner, 1997	Wagner describes 12 specific instructional outcomes that are achievable through interaction
Instructional Design framework for Authentic Learning Environment Herrington & Oliver, 2000	Identifies critical characteristics of authentic learning environment; operationalize characteristics, investigate student perceptions
WisCom Gunawardena et al, 2006	5 Step Design 1. Learning Challenge, 2. Initial Exploration, 3. Resources, 4. Reflection, 5. Preservation

Existing Design Model	Overall Description: Defining Characteristics & Stages
Collaborative Design Model, Moallem, 2003	4 Stages 1. Establish individual accountability, 2. Encourage commitment to the group and its goals; 3. Provide Stability for groups; 4. Facilitate Smooth Interactions
	Types of Learning Activities
R2D2 Model, Bonk & Zhang, 2006	Reading/Listening Reflecting/Writing: (learning activities) Displaying Doing
Implications For Design: Based on Principles of Situated Cognition & Vygotskian Thought, Hung & Chen, 2001	4 Dimensions: 1. Situatedness, 2. Commonality, 3. Interdependency, 4. Infrastructure
Model of Effective Dimensions of Interactive Learning on the WWW. Reeves. 1998	Six Stages: 1. Opportunity to construct learning 2. Interaction as message transmission 3. Sense of social and psychological connections 4. Collaborative Support 5. Teacher Support 6. Metacognitive Support

Existing Design Model	**Overall Description: Defining Characteristics & Stages**
Design & Use of a Rubric to Assess & Encourage Interactive Qualities in Distance Courses, Roblyer & Wiencke, 2003	3 Concepts Permeate Interaction: Moore's 1989 identification of types of interaction: 1. learner-content, 2. learner-learner, 3. learner-instructor
Interactivity: From Agents to Outcomes. Wagner, 1997 Instructional Outcomes	12 Instructional Outcomes 1. Interaction to enhance elaboration and retention 2. Interaction to support learner control/self regulation 3. Interaction to increase motivation. 4. Interaction for negotiation of understanding 5. Interaction for team building. 6. Interaction for discovery. 7. Interaction for exploration. 8. Interaction for clarification of understanding 9. Interaction for closure. 10. Interaction to increase participation. 11. Interaction to develop communication. 12. Interaction to receive feedback
Instructional Design framework for Authentic Learning Environment Herrington & Oliver, 2000	9 Elements – Provide: 1. Authentic Context 2. Authentic Activities 3. Access to expect performances and modeling of processes

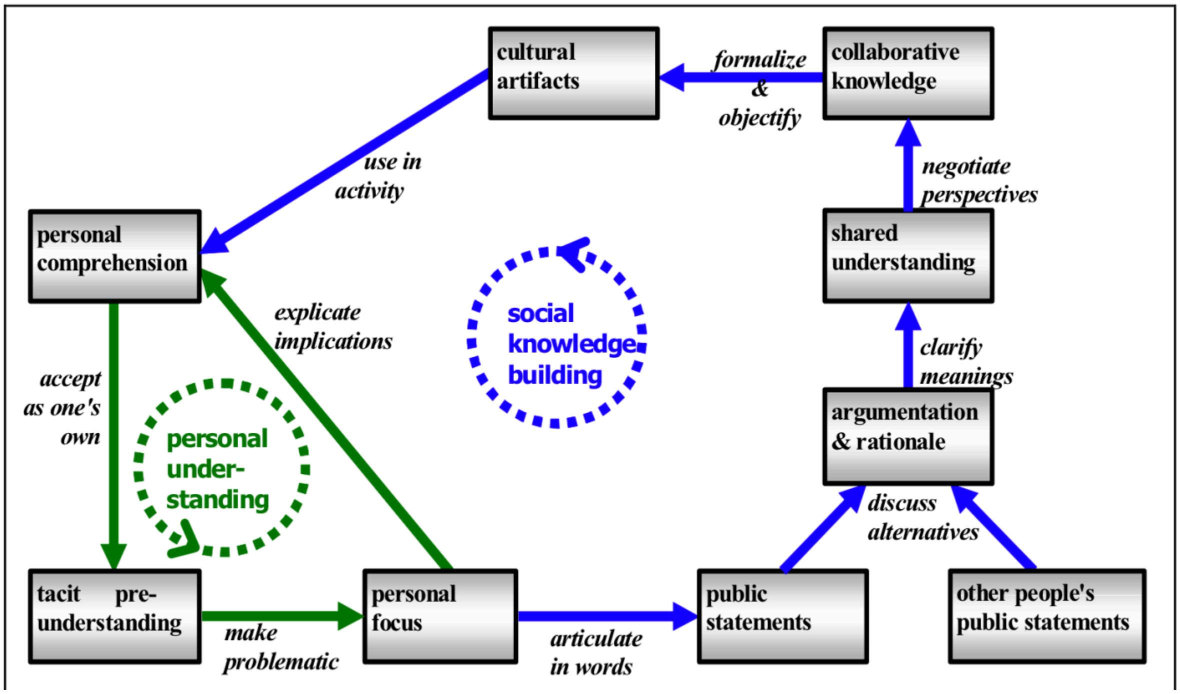
Existing Design Model	Overall Description: Defining Characteristics & Stages
	4. Multiple roles & Perspectives
	5. Collaborative construction of knowledge
	6. Reflection to enable abstractions to be formed
	7. Articulation to enable tacit knowledge to be made explicit
	8. Coaching and scaffolding at critical time
	9. Authentic Assessment of learning within the tasks

Appendix B: Adapted APA Learner-Centered Psychological Principles

Table 4: APA Psychological Principles (APA, 1997) Adapted	
Cognitive and Metacognitive Factors	
1. Nature of the learning process.	The learning of complex subject matter is most effective when it is an intentional process of constructing meaning from information and experience.
2. Goals of the learning process.	The successful learner, over time and with support and instructional guidance, can create meaningful, coherent representations of knowledge.
3. Construction of knowledge.	The successful learner can link new information with existing knowledge in meaningful ways.
4. Strategic thinking.	The successful learner can create and use a repertoire of thinking and reasoning strategies to achieve complex learning goals.
5. Thinking about thinking.	Higher order strategies for selecting and monitoring mental operations facilitate creative and critical thinking.
6. Context of learning	Learning is influenced by environmental factors, including culture, technology, and instructional practices.
Motivational and Affective Factors	
7. Motivational and emotional influences on learning	What and how much is learned is influenced by the motivation. Motivation to learn, in turn, is influenced by the individual's emotional states, beliefs, interests and goals, and habits of thinking.
8. Intrinsic motivation to learn	The learner's creativity, higher order thinking,

	and natural curiosity all contribute to motivation to learn. Intrinsic motivation is stimulated by tasks of optimal novelty and difficulty, relevant to personal interests, and providing for personal choice and control.
9. Effects of motivation on effort	Acquisition of complex knowledge and skills requires extended learner effort and guided practice. Without learners' motivation to learn, the willingness to exert this effort is unlikely without coercion.
Developmental and Social Factors	
10. Developmental influences on learning.	As individuals develop, there are different opportunities and constraints for learning. Learning is most effective when differential development within and across physical, intellectual, emotional, and social domains is taken into account.
11. Social influences on learning.	Learning is influenced by social interactions, interpersonal relations, and communication with others.
Individual Differences Factors	
12. Individual differences in learning.	Learners have different strategies, approaches, and capabilities for learning that are a function of prior experience and heredity.
13. Learning and diversity.	Learning is most effective when differences in learners' linguistic, cultural, and social backgrounds are taken into account.
14. Standards and assessment.	Setting appropriately high and challenging standards and assessing the learner as well as learning progress -- including diagnostic, process, and outcome .

Appendix C: Stahl's 2006 Model of Knowledge Building Processes



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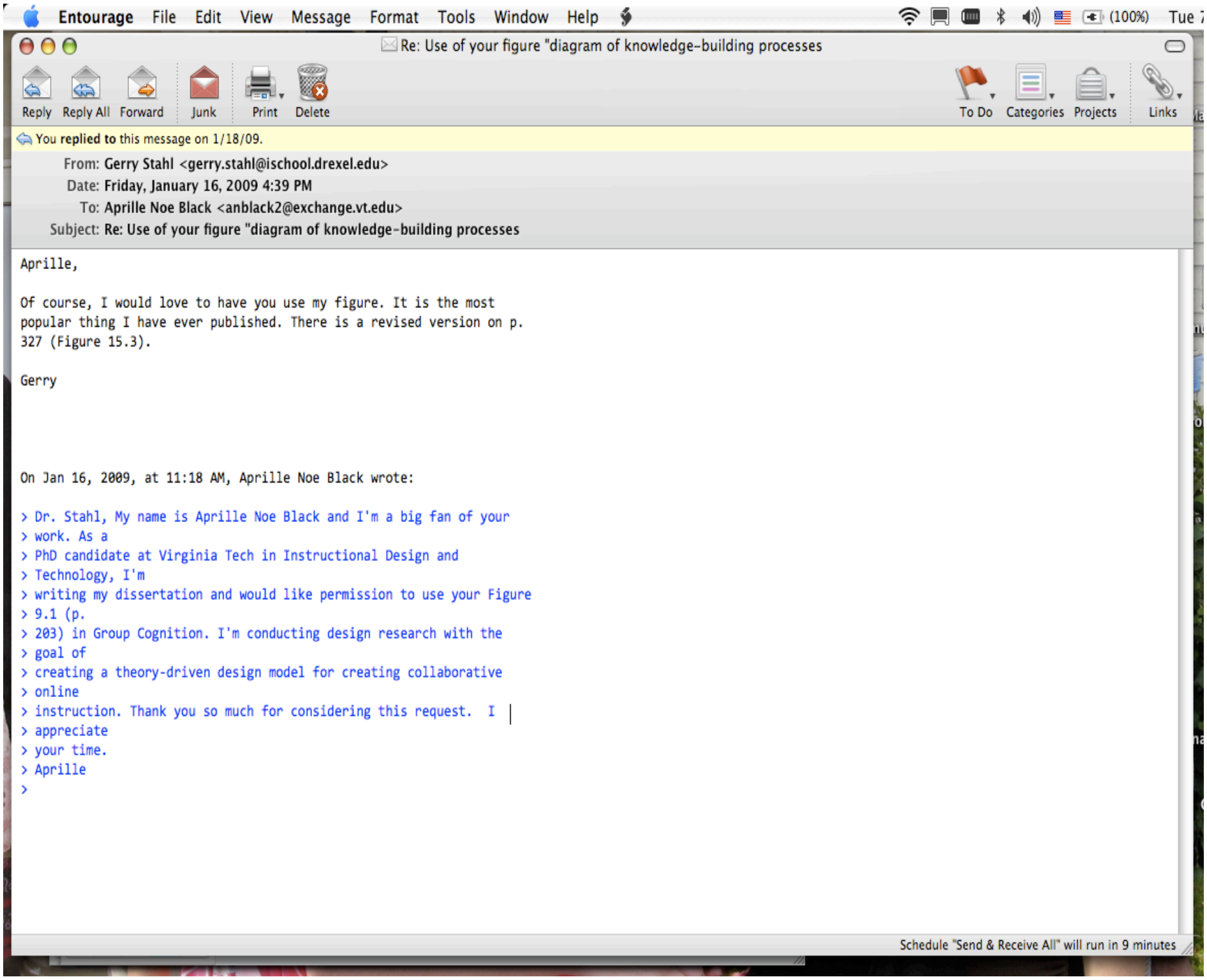
Appendix D: Stahl's Permission Email



Entourage File Edit View Message Format Tools Window Help

Re: Use of your figure "diagram of knowledge-building processes

Reply Reply All Forward Junk Print Delete To Do Categories Projects Links

You replied to this message on 1/18/09.

From: Gerry Stahl <gerry.stahl@ischool.drexel.edu>
Date: Friday, January 16, 2009 4:39 PM
To: Aprille Noe Black <anblack2@exchange.vt.edu>
Subject: Re: Use of your figure "diagram of knowledge-building processes

Aprille,

Of course, I would love to have you use my figure. It is the most
popular thing I have ever published. There is a revised version on p.
327 (Figure 15.3).

Gerry

On Jan 16, 2009, at 11:18 AM, Aprille Noe Black wrote:

> Dr. Stahl, My name is Aprille Noe Black and I'm a big fan of your
> work. As a
> PhD candidate at Virginia Tech in Instructional Design and
> Technology, I'm
> writing my dissertation and would like permission to use your Figure
> 9.1 (p.
> 203) in Group Cognition. I'm conducting design research with the
> goal of
> creating a theory-driven design model for creating collaborative
> online
> instruction. Thank you so much for considering this request. I
> appreciate
> your time.
> Aprille
>

Schedule "Send & Receive All" will run in 9 minutes

Appendix E: Definition of Constructs & Design Principles

Theory/Theorist	**Theorists**	**Construct Defined**	**Design Principle**
	Scardamalia & Bereiter;	*Knowledge Building* "The production and continual improvement of ideas of value to a community, through means that increase the likelihood that what the community accomplishes will be greater than the sum of individual contributions and part of broader cultural efforts"	Prior Knowledge, Community Advancement, Allow for discourse, negotiation and sharing of ideas, reinforces transforming personal perspective to group perspective
	Greeno	*Learning in Activity, Situative, Conceptual Agency* "The main focus of analysis is on activity systems: complex social organizations containing learners, teachers, curriculum materials, software tools and the physical environment." Learning is situated in its environment.	Participation Structures and Processes, activity is not scripted, but has to be negotiated and artifacts are actively constructed by participants
	Krajcik and Blumenfeld	*Encourages Anchored Instruction such as Project-Based Learning and Problem-based learning* Anchored instruction is an overall approach to the design of learning environments with 5 key features: Instruction	Meaningful opportunities to examine tasks from multiple perspectives, social interaction, active construction,

	Krajcik and Blumenfeld	*Encourages Anchored Instruction such as Project-*	Meaningful opportunities to

	Stahl; Koschmann; Suthers	*Intersubjectivity and Group Cognition: K*nowledge building through joint activity, Creation of Artifacts "The goal for design in CSCL is to create artifacts, activities and environments that enhance the practice of group meaning making"	Interactional Meaning-making, Shared goals, Provide opportunities for students to examine tasks from different perspectives using a variety of resources
Situated Cognition "Situations might be said to co-produce knowledge through activity. Learning and cognition, it is now possible to argue, are fundamentally situated"	Brown, Collins, & Duguid	*Situated Knowledge* Knowledge is situated. "Embed learning in activity and make deliberate use of the social and physical context"	Activities with Real-world Relevance, ill-defined and complex tasks investigated over a sustained period of time, embedded in rich contexts, persistent record of discourse
Zone of Proximal Development ZPD is the difference between what a child can do with help and what he or she can do without guidance.	Vygotsky	*Scaffolding* is the process through which a teacher or more capable peer gives support to the student in her/his ZPD as necessary and gradually removes the supports as they become unnecessary.	Structured support and peer interactions and student-faculty interactions, shared common space, small workgroups
Community of Learners/Community of Practice	Lave & Wenger; Wenger, McDermott & Snyder	*Collaboration*: "The community creates the social fabric of learning…a set of frameworks, ideas, tools, information, styles, language, stories, and documents that	Discourse as collaborative problem-solving, negotiation of meaning, sharing of ideas

Community of Learners/Community of Practice	Lave & Wenger; Wenger, McDermott & Snyder	*Collaboration*: "The community creates the social fabric of learning…a set of frameworks, ideas, tools, information, styles, language, stories, and documents that community members share."	Discourse as collaborative problem-solving, negotiation of meaning, sharing of ideas
Cognitive Apprenticeship /Anchored instruction	Brown, Collins, Duguid	*Expertise Building* Building expertise occurs as students work with experts through modeling, coaching, scaffolding, articulation, reflection and exploration	Modeling, Coaching, Scaffolding, Articulation, Reflection, Exploration

Appendix F: Protocol, Criteria and Theoretical Constructs

Table 8: Protocol, Criteria and Constructs					
Protocol	The construct must support the development of shared knowledge and group cognition.				
Criteria	The construct must support discourse, negotiation and the sharing of ideas.	The construct must support the co-construction of knowledge artifacts.	The construct must support Greeno's Situativity or Brown, Collins & Duguids Situated Cognition	The construct must support multiple perspectives.	The construct must support individual and multi-level opportunities for reflection.
Constructs Matching All Criteria	Knowledge Building	Knowledge Building	Knowledge Building	Knowledge Building	Knowledge Building
	Conceptual Agency	Conceptual Agency	Conceptual Agency	Conceptual Agency	Conceptual Agency
	Expertise Building	Expertise Building	Expertise Building	Expertise Building	Expertise Building
	Anchored Instruction	Anchored Instruction	Anchored Instruction	Anchored Instruction	Anchored Instruction
	Intersubjectivity	Intersubjectivity	Intersubjectivity	Intersubjectivity	Intersubjectivity
	Group Cognition	Group Cognition	Group Cognition	Group Cognition	Group Cognition
	Scaffolding	Scaffolding	Scaffolding	Scaffolding	Scaffolding

Appendix G: Aligning Reviewed Models with Constructs

Identified Theoretical Constructs	**Reviewed ID Models and Frameworks for Design**					
	WisCom, Gunawardena et al, 2006	Collaborative Design Model, Moallem, 2003	R2D2 Model, Bonk & Zhang, 2006	Model of Effective Dimensions of Interactive Learning on the WWW, Reeves, 1998	Design and Use of a Rubric to Assess & Encourage Interactive Qualities in Destance Courses, Roblyer & Wiencke, 2003	Interactivity: From Agents to Outcomes, Wagner, 1997	Bounded Community, Wilson et al, 2004
Activate Students' Prior Knowledge	√					√	
Community knowledge Advancement	√		√				√
Scaffolding: Add, Modify, Remove as needed	√			√	√	√	
Allow opportunities for students to Externalize and Articulate unformed and still developing understanding	√	√	√			√	√
Discourse as Collaborative Problem-solving	√	√	√	√	√	√	√

Identified Theoretical Constructs	**Reviewed ID Models and Frameworks for Design**						
Opportunities to Construct knowledge	√		√	√	√	√	√
Articulation and externalization reinforce learning in a feedback loop. Knowledge advancement as idea improvement	√	√	√		√	√	√
Activities have real-world relevance; ill-defined, complex tasks investigated over a sustained period of time; embedded in rich contexts, meaningful to learners; provide opportunities for students to examine the task from different perspectives using a variety of resources	√		√		√		

Appendix H: Criteria as Filter

Criteria as Filter	**Theoretical Constructs**	**APA Principles**	**Strategies from Existing Models**
1. The construct must support discourse, negotiation and the sharing of ideas.	1. Knowledge Building	1. Goals of the learning process	1. Learning challenge
2. The construct must support the co-Construction of knowledge artifacts.	2. Conceptual Agency	2. Construction of knowledge.	2. Initial Exploration
3. The construct must support multiple perspectives.	3. Expertise Building	3. Strategic Thinking.	3. Resources
4. The construct must support individual and multi-level forms of 4. Reflection.	4. Anchored Instruction	4. Thinking about thinking	4. Reflection
5. The construct must support situativity.	5. Intersubjectivity	5. Motivational and emotional influences on learning	5. Preservation

Criteria as Filter	Theoretical Constructs	APA Principles	Strategies from Existing Models
1. The construct must support discourse, negotiation and the sharing of ideas.	6. Group Cognition	6. Intrinsic motivation to learn	6. Provide opportunities to construct knowledge
2. The construct must support the co-Construction of knowledge artifacts.	7. Scaffolding	7. Effects of motivation on effort	7. Encourage task ownership
3. The construct must support multiple perspectives.	1. Knowledge Building	8. Developmental influences on learning	8. Create an awareness of audience
4. The construct must support individual and multi-level forms of Reflection.	2. Conceptual Agency	9. Social influences on learning	9. Collaborative Support
5. The construct must support situativity.	3. Expertise Building	1. Goals of the learning process	10. Teacher Support
1. The construct must support discourse, negotiation and the	4. Anchored Instruction	2. Construction of knowledge.	2. Initial Exploration

Criteria as Filter	Theoretical Constructs	APA Principles	Strategies from Existing Models
sharing of ideas.			
2. The construct must support the co-2. Construction of knowledge artifacts.	5. Intersubjectivity	3. Strategic Thinking.	1. Learning challenge
3. The construct must support multiple perspectives.	6. Group Cognition	4. Thinking about thinking	2. Initial Exploration
4. The construct must support individual and multi-level forms of Reflection.	7. Scaffolding	5. Motivational and emotional influences on learning	3. Resources
5. The construct must support situativity.	1. Knowledge Building	6. Intrinsic motivation to learn	4. Reflection
1. The construct must support discourse, negotiation and the sharing of ideas.	2. Conceptual Agency	7. Effects of motivation on effort	5. Preservation
2. The construct must support the co-	3. Expertise Building	8. Developmental	6. Provide opportunities to

Criteria as Filter	Theoretical Constructs	APA Principles	Strategies from Existing Models
Construction of knowledge artifacts.		influences on learning	construct knowledge
3. The construct must support multiple perspectives.	4. Anchored Instruction	9. Social influences on learning	7. Encourage task ownership
4. The construct must support individual and multi-level forms of Reflection.	5. Intersubjectivity	1. Goals of the learning process	8. Create an awareness of audience
5. The construct must support situativity.	6. Group Cognition	2. Construction of knowledge.	9. Collaborative Support
1. The construct must support discourse, negotiation and the sharing of ideas.	7. Scaffolding	3. Strategic Thinking.	10. Teacher Support
2. The construct must support the co-Construction of knowledge artifacts.	1. Knowledge Building	4. Thinking about thinking	3. Resources
3. The construct must support multiple	2. Conceptual Agency	5. Motivational and emotional	1. Learning challenge

Criteria as Filter	Theoretical Constructs	APA Principles	Strategies from Existing Models
perspectives.		influences on learning	
4. The construct must support individual and multi-level forms of Reflection.	3. Expertise Building	6. Intrinsic motivation to learn	2. Initial Exploration
5. The construct must support situativity.	4. Anchored Instruction	7. Effects of motivation on effort	3. Resources
1. The construct must support discourse, negotiation and the sharing of ideas.	5. Intersubjectivity	8. Developmental influences on learning	4. Reflection
2. The construct must support the co-Construction of knowledge artifacts.	6. Group Cognition	9. Social influences on learning	5. Preservation
3. The construct must support multiple perspectives.	7. Scaffolding	1. Goals of the learning process	6. Provide opportunities to construct knowledge
4. The construct must	1. Knowledge Building	2. Construction	7. Encourage task

Criteria as Filter	Theoretical Constructs	APA Principles	Strategies from Existing Models
support individual and multi-level forms of Reflection.		of knowledge.	ownership
5. The construct must support situativity.	2. Conceptual Agency	3. Strategic Thinking.	8. Create an awareness of audience
1. The construct must support discourse, negotiation and the sharing of ideas.	3. Expertise Building	4. Thinking about thinking	9. Collaborative Support
2. The construct must support the co-Construction of knowledge artifacts.	4. Anchored Instruction	5. Motivational and emotional influences on learning	10. Teacher Support
3. The construct must support multiple perspectives.	5. Intersubjectivity	6. Intrinsic motivation to learn	4. Reflection
4. The construct must support individual and multi-level forms of Reflection.	6. Group Cognition	7. Effects of motivation on effort	1. Learning challenge
5. The construct must	7. Scaffolding	8.	2. Initial Exploration

Criteria as Filter	Theoretical Constructs	APA Principles	Strategies from Existing Models
support situativity.		Developmental influences on learning	
1. The construct must support discourse, negotiation and the sharing of ideas.	Disciplinary Agency (not included)	9. Social influences on learning	3. Resources
2. The construct must support the co-Construction of knowledge artifacts.		1. Goals of the learning process	4. Reflection
3. The construct must support multiple perspectives.		2. Construction of knowledge.	5. Preservation
4. The construct must support individual and multi-level forms of Reflection.		3. Strategic Thinking.	6. Provide opportunities to construct knowledge
5. The construct must support situativity.	Material Agency (not included)	4. Thinking about thinking	7. Encourage task ownership
1. The construct must		5. Motivational	8. Create an

Criteria as Filter	**Theoretical Constructs**	**APA Principles**	**Strategies from Existing Models**
support discourse, negotiation and the sharing of ideas.		and emotional influences on learning	awareness of audience
2. The construct must support the co-Construction of knowledge artifacts.		6. Intrinsic motivation to learn	9. Collaborative Support
3. The construct must support multiple perspectives.		7. Effects of motivation on effort	10. Teacher Support
4. The construct must support individual and multi-level forms of Reflection.		8. Developmental influences on learning	5. Preservation
5. The construct must support situativity.		9. Social influences on learning	1. Learning challenge
1. The construct must support discourse, negotiation and the sharing of ideas.			2. Initial Exploration

Criteria as Filter	Theoretical Constructs	APA Principles	Strategies from Existing Models
2. The construct must support the co-Construction of knowledge artifacts.			3. Resources
3. The construct must support multiple perspectives.			4. Reflection
4. The construct must support individual and multi-level forms of Reflection.			5. Preservation
5. The construct must support situativity.			6. Opportunities to construct knowledge
1. The construct must support discourse, negotiation and the sharing of ideas.			7. Encourage task ownership
2. The construct must support the co-Construction of knowledge artifacts.			8. Create an awareness of audience

Criteria as Filter	Theoretical Constructs	APA Principles	Strategies from Existing Models
3. The construct must support multiple perspectives.			9. Collaborative Support
4. The construct must support individual and multi-level forms of Reflection.			10. Teacher Support
5. The construct must support situativity.			

Appendix I: Guideline One

Guideline One Ask the following questions to determine if collaboration is appropriate for the given assigned instructional need:	**Reference** Sources used to Establish Guidelines
1. Is online access available for all students?	(Ahern & Repman, 1994; Moore & Kearsley, 1996; Kumar, 1996; Benbunan-Fich & Hiltz, 1997; Brooks & Brooks, 1999).
2. Will collaborative, problem-based or project-based instruction best meet the instructional goals of the course?	(Stahl, 2006; Scardamalia & Bereiter, 2006; Krajcik and Blumenfeld, 2006; Kearsley, 1996).
3. Will collaborative, problem-based or project-based instruction best meet the needs of the students?	(Stahl, 2006; Scardamalia & Bereiter, 2006; Savery & Duffy, 1995; Torp & Sage, 1998; Sage, 2000; Hmelo-Silver & Barrows, 2006; Savery 2006; Kumar & Natarajan, 2007).
4. Will time restraints permit collaboration?	(Nasir, Rosebery, Warren & Lee, 2006; Hawkridge, 2002)

5. Will the instructor have the time to model appropriate interpersonal interactions and expectations?	(Reeves, Herrington & Oliver, 2002; Anderson et al, 2003; Garrison, Anderson & Archer, 2003; Shearer, 2003; Romiszowski & Mason, 2004; Browne, Warnock & Boykin, 2005; Brewer & Klein, 2006; Quintana et al, 2006; Reio & Crim, 2006; Stahl, 2006; Scardamalia & Bereiter, 2006; Githens, 2007).
6. Will the instructor have the time to provide frequent, appropriate feedback?	(Stahl, 2006; Scardamalia & Bereiter, 2006; Githens, 2007; Reeves, Herrington & Oliver, 2002; Anderson et al, 2003; Garrison, Anderson & Archer, 2003; Shearer, 2003; Romiszowski & Mason, 2004; Nasir, Rosebery, Warren & Lee, 2006).
7. Will the instructor be able to provide extrinsic rewards?	(APA, 1997; Anderson et al, 2003; Garrison, Anderson & Archer, 2003).
8. Will class size permit collaboration and the formation of small groups?	(Browne, Warnock & Boykin, 2005; Brewer & Klein, 2006; Quintana et al, 2006; Reio & Crim, 2006; Stahl, 2006; Scardamalia & Bereiter, 2006; Githens, 2007).
9. Will the instructor be able to participate/visit each small group several times throughout the duration of the course?	(Browne, Warnock & Boykin, 2005; Brewer & Klein, 2006; Quintana et al, 2006; Reio & Crim, 2006; Stahl, 2006; Scardamalia & Bereiter, 2006; Githens, 2007).

Appendix J: Guideline Two

Guideline Two of a Two-fold Guideline Process
1. Analyze course goals, expected outcomes and skills needed to achieve them. 2. Analyze learner traits and characteristics. 3. Develop objectives and initial design strategy. Develop safe, supporting conditions and community identity. Develop scaffolding. Develop feedback expectations and strategies for community knowledge advancement in an authentic context. 4. Design collaborative activities, individual activities, group assessments and individual assessments. Design for authentic context, authentic activities, access to expert performances, modeling of processes, access to common shared spaces and multiple roles and perspectives; Design time for collaborative construction of knowledge, reflection to enable abstractions to be formed, articulation to enable tacit knowledge to be made explicit; Design activities that include coaching and scaffolding at critical times; Design authentic assessment of learning within the tasks; Design opportunities to externalize and articulate unformed and developing understanding, and include discourse as collaborative problem solving; Design opportunities to construct knowledge, and include opportunities for articulation and externalization to reinforce learning in a feedback loop with a persistent record of discourse; Design activities with real-world relevance, and include ill-defined problems embedded in rich contexts; Design meaningful opportunities to examine tasks from different perspectives. 5. Introduce CSCL prototype to client. If time allows, conduct a pilot test. 6. Implement the course. 7. Evaluate the course. Evaluations should include both formative and summative assessments. 8. Execute revisions. Based on the assessments, modifications may be necessary.

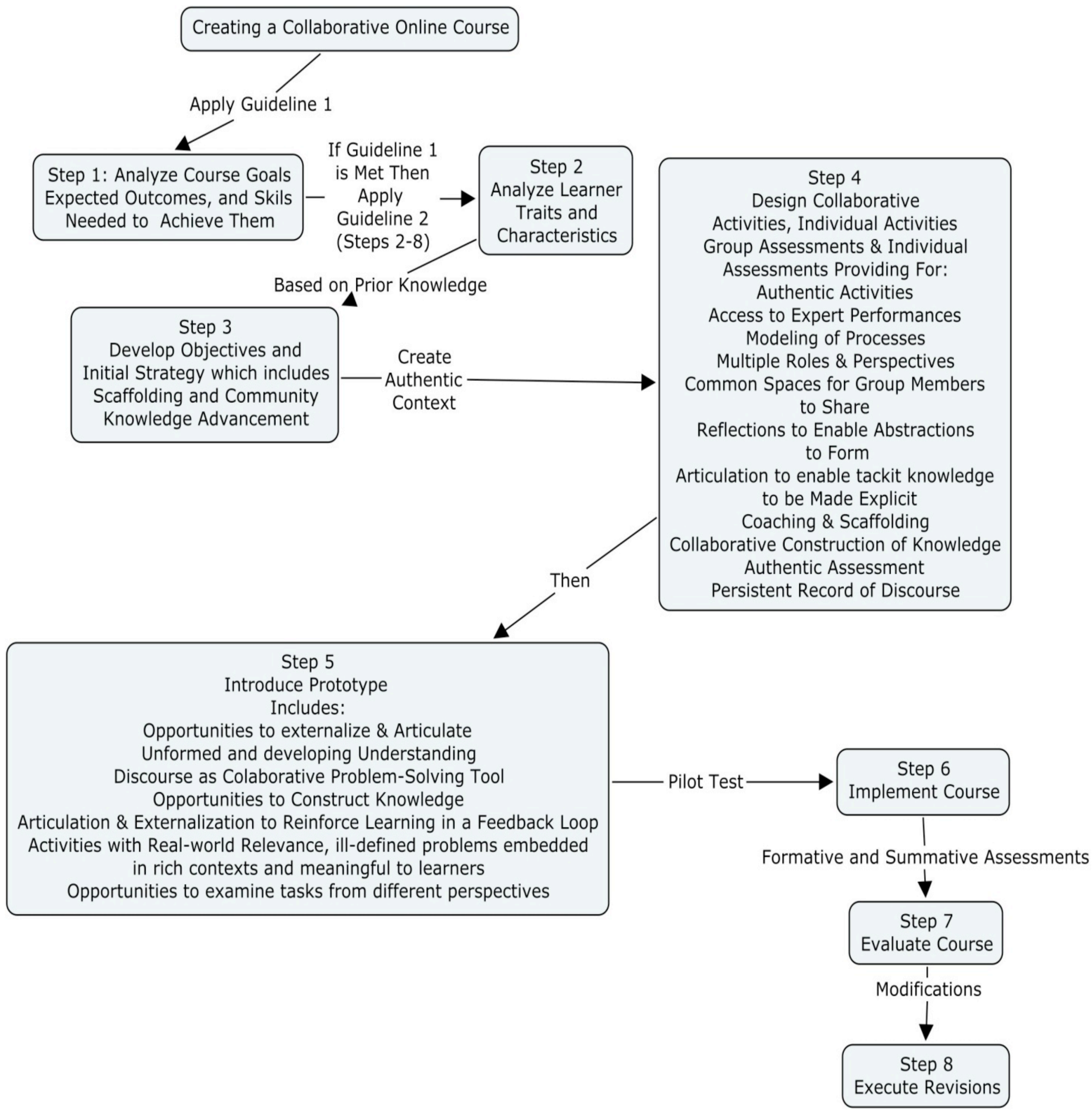
Appendix K: Design Principles and Tools for Operationalizing Constructs

Theory	**Theorists**	**Construct**	**Design Principle**	**Tools**
Computer-Supported Collaborative Learning (CSCL)	Scardamalia & Bereiter;	Knowledge Building	Prior Knowledge, Community Advancement, Allow for discourse, negotiation and sharing of ideas, reinforces transforming personal perspective to group perspective	Discussion Forum, Chat, Conferencing Software, Email, Shared Whiteboard Space, Wikis, Blogs
CSCL	Greeno	Learning in Activity, Situative, Conceptual Agency	Participation Structures and Processes, activity is not scripted, but has to be negotiated and artifacts are actively constructed by participants	Blogs, Wikis, Journals, Shared White Boards, Conferencing Software
CSCL	Krajcik and	Encourages	Meaningful opportunities to	Word Processing, Spreadsheets,

Theory	**Theorists**	**Construct**	**Design Principle**	**Tools**
	Blumenfeld	Pedagogical Practice, Project-Based Learning	examine tasks from multiple perspectives, social interaction, active construction,	Draw Tools, Presentation Software (Audacity, iMovie, MovieMaker, PPT) Shared White Boards, Conferencing Software
CSCL	Stahl; Koschmann; Suthers	Collaboration, knowledge building through joint activity, Creation of Knowledge Artifacts	Interactional Meaning-making, Provide opportunities for students to examine tasks from different perspectives using a variety of resources	Word Processing, Spreadsheets, Draw Tools, Presentation Software, Shared White Board, Conferencing Software, Blogs, Wikis, Journals
Situated Cognition	Brown, Collins, & Duguid	Expertise Building	Activities with Real-world Relevance, ill-defined and complex tasks investigated over a sustained period of time, problems are embedded in rich contexts, persistent record of	Word Processing, Spreadsheets, Draw Tools, Presentation Software, Shared White Board, Conferencing Software, Course Management System/Learning Management System, Archiving Software

Theory	Theorists	Construct	Design Principle	Tools
			discourse	
Zone of Proximal Development	Vygotsky	Scaffolding	Structured support and peer interactions and student-faculty interactions, shared common space, small workgroups	Course Management Software, Conferencing Software, Shared White Board, Online Libraries, Shared Resources, Blogs, Wikis, Email
Community of Practice/Learners	Lave & Wenger	Collaboration	Discourse as collaborative problem-solving, negotiation of meaning, sharing of ideas	Discussion Forums, Chats, Email, Conferencing Software, Blogs, Social Software, Online Libraries,
Cognitive Apprenticeship	Brown, Collins, Duguid	Expertise Building	Modeling, Coaching, Scaffolding, Articulation, Reflection, Exploration	Discussion Forums, Chats, Email, Conferencing Software, Shared White Boards, Journaling, Wikis,

Appendix L: Prescriptive Flow Chart



Appendix M: Development and Instructional Strategies

Development Strategies	Reference	Instructional Strategies
(1) Develop an Overview of the Course Structure	Moallem, 2003; Bonk & Zhang, 2006; Henry & Meadows, 2008	Provide practical information about the collaborative tools for the course at the beginning of the session. Provide a detailed Syllabus. Align with course and/or institution's mission & goals.
(2) Develop an area for introductions at the beginning of the course to encourage active student-to-student and student-to-faculty contact.	Moallem, 2003; Bonk & Zhang, 2006; Henry & Meadows, 2008	Provide ice-breaking sessions at the beginning of the course to build trust. Faculty should include a detailed introduction of him/her self
(3) Develop opportunities for Modeling of good communication techniques to encourage reciprocity and cooperation among students.	Moallem, 2003; Bonk & Zhang, 2006; Henry & Meadows, 2008	Provide direct instruction about working as collaborative teams. Provide examples of good communication techniques.
(4) Develop expectations for appropriate feedback as feedback encourages	Moallem, 2003; Bonk & Zhang, 2006	Establish expectations for feedback at the beginning of the course.

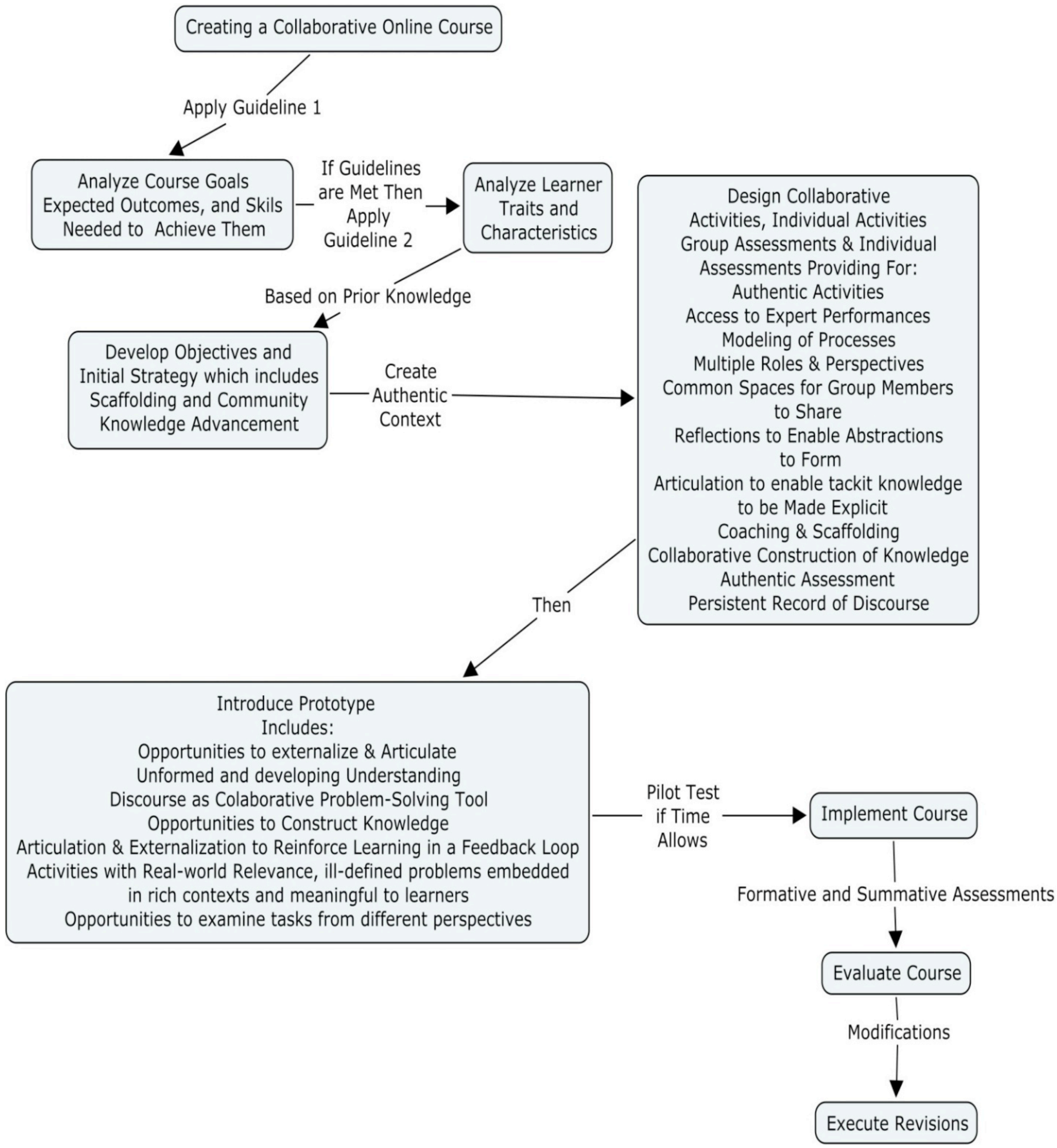
Development Strategies	Reference	Instructional Strategies
reflection, revision, and quality time on tasks.		
(5) Develop different types of feedback to scaffold students as they progress through their zones of proximal development.	Moallem, 2003; Bonk & Zhang, 2006; Vygotsky, 1978.	Provide coaching and scaffolding at critical times as needed throughout the course.
(6)Establishing individual and group expectations and course goals and objectives encourages active involvement and successful group cognition.	Moallem, 2003; Bonk & Zhang, 2006; Henry & Meadows, 2008	Establish small groups to foster the development of intersubjectivity and group cognition. Provide practical information about the collaborative tools for the course at the beginning of the session. Provide direct instruction about working as collaborative teams
(7)Determine which pedagogical practice (project-based learning, problem-based learning, or some other form of situated learning) will best meet the needs of the	Greeno, 2006; Krajck & Blemenfeld, 2006; Brown, Collins & Duguid, 1989; Lave & Wenger, 1991	Establish authentic context. Create course assignments that are as clear as possible with the acknowledgement that real world settings and project-based and problem-based learning include a considerable amount of ambiguity. The instructor

Development Strategies	Reference	Instructional Strategies
defined course goals and objectives.		should provide clarification as needed.
(8) Include expert performances and modeling of processes	Gunawardena et al, 2006; Hung & Chen, 2001; Herrington & Oliver, 2000; Henry & Meadows, 2008	Provide coaching and scaffolding at critical times as needed. Provide opportunities to externalize and articulate unformed and developing understanding. Provide access to expert performances and modeling of processes as needed throughout the course.
(9) Develop authentic activities that have real-world relevance and are embedded in rich context.	Herrington & Oliver, 2000; Roblyer & Wiencke, 2003; Gunawardena et 1l, 2006, Bonk & Zhang, 2006 Lave & Wenger, 1991; Brown, Collins & Duguid, 1989	Provide authentic assessments of learning Within the tasks. Provide opportunities to engage in discourse as a collaborative problem- solving tool. Provide opportunities to construct knowledge within the group on problems/projects that have meaning for the students. Allow students to co-create knowledge artifacts.

Development Strategies	Reference	Instructional Strategies
(10) Provide Frequent Feedback and other forms of scaffolding as needed	Vygotsky, 1978; Moallem, 2003; Hung & Chen, 2001; Greeno, 2006; Krajck & Blemenfeld, 2006;	Provide opportunities to construct knowledge within the group. Provide continuous opportunities for articulation and externalization to reinforce learning in a feedback loop
(11) Develop a shared common space for groups to work in	Greeno, 2006; Krajck & Blemenfeld, 2006; Herrington & Oliver, 2000	Provide small group chat rooms. Provide access to small group wikis. Provide access to small group white boards.
(12) Develop Small Groups	Greeno, 2006; Krajck & Blemenfeld, 2006; Herrington & Oliver, 2000	Divide the class into small groups of 3 to 4 students.
(13) Develop activities that encourage	Greeno, 2006; Krajck &	Provide authentic activities with real-world relevance, ill-

Development Strategies	Reference	Instructional Strategies
reflection	Blemenfeld, 2006; Herrington & Oliver, 2000; Henry & Meadows, 2008	defined problems embedded in rich contexts, and meaningful to the learners. Create course assignments that are as clear as possible with the acknowledgement that real world settings and project based and problem based learning include a considerable amount of ambiguity.

Appendix N: Figure of Collaborative Design Model



Appendix O: Letter to Reviewers

(page 1 of review packet)

The Collaborative Design Model is an instructional design model built on the theoretical constructs of Computer-Supported Collaborative learning and Situated Cognition. The purpose of this design model is to assist designers in developing collaborative online instruction. The Collaborative Design Model process illustrates how a designer would progress through the Collaborative Design Model. A figure of the Collaborative Design Model (p. 4) and a figure of The Collaborative Design Process (p. 5) are enclosed. Also, a "Definition of Constructs" (pp. 6-8) is included. This table includes the theoretical components selected to develop the model and a definition of how each construct has been defined for the purpose of this research. Three other tables are also included in the Review Packet: Guideline One, Guideline Two, and Development and Instructional Strategies.

Guideline One is the first set of Guidelines and it determines whether the instruction is appropriate for collaboration or not and the second set of Guidelines (Guideline Two) are the actual stages of developing instruction. "Strategies: Development and Instructional" (pp. 13-16) includes the development strategies and instructional strategies as well as where they were culled from the literature. Please review the Collaborative Design Model as well as the accompanying material prior to completing the Open-ended Review Form (p. 3). However, you may find it helpful to read the questions on the review form, before reviewing the rest of the packet. Please answer the questions in as much detail as you feel is necessary. If you have questions or need clarification, please contact me by email or phone (anblack2@VT.edu; 336-324-1510)

Once you have reviewed the cited materials, please complete the Open-ended Review Form. When the form is completed, please return it to me as an attachment in email. Once I have received your comments, I will make revisions. When modifications are completed, I will send you the revised model and strategies for a final review to determine if your suggestions or modifications have been implemented.

Thank you for your thoughtful comments. I appreciate the time and effort you will devote to completing this process.

Sincerely,

Aprille Noe Black

PhD Candidate

Virginia Tech

Appendix P: Open-ended Review Form

(Page 3 of Review Packet)

Do you feel the Collaborative Design Model (p. 1) fosters the development of knowledge building? If not please describe the weakness.

Do you think the Collaborative Design Model (p. 1) fosters learning in activity, situativity and conceptual agency? If not please describe the weakness.

Do you think the Collaborative Design Model (p. 1) supports anchored instruction?
If not please describe the weakness.

Do you think the Collaborative Design Model (p. 1) supports community knowledge advancement? If not please describe the weakness.

Do you think the Collaborative Design Model (p. 1) fosters intersubjectivity and group cognition? If not, please describe the weakness.

Do you think the Collaborative Design Model (p. 1) fosters the use of scaffolding?

Do you think the Collaborative Design Model (p. 1) fosters discourse and articulation to construct knowledge? If not, please describe the weakness.

Do you think the Collaborative Design Model (p. 1) fosters expertise building? If not, please describe the weakness.

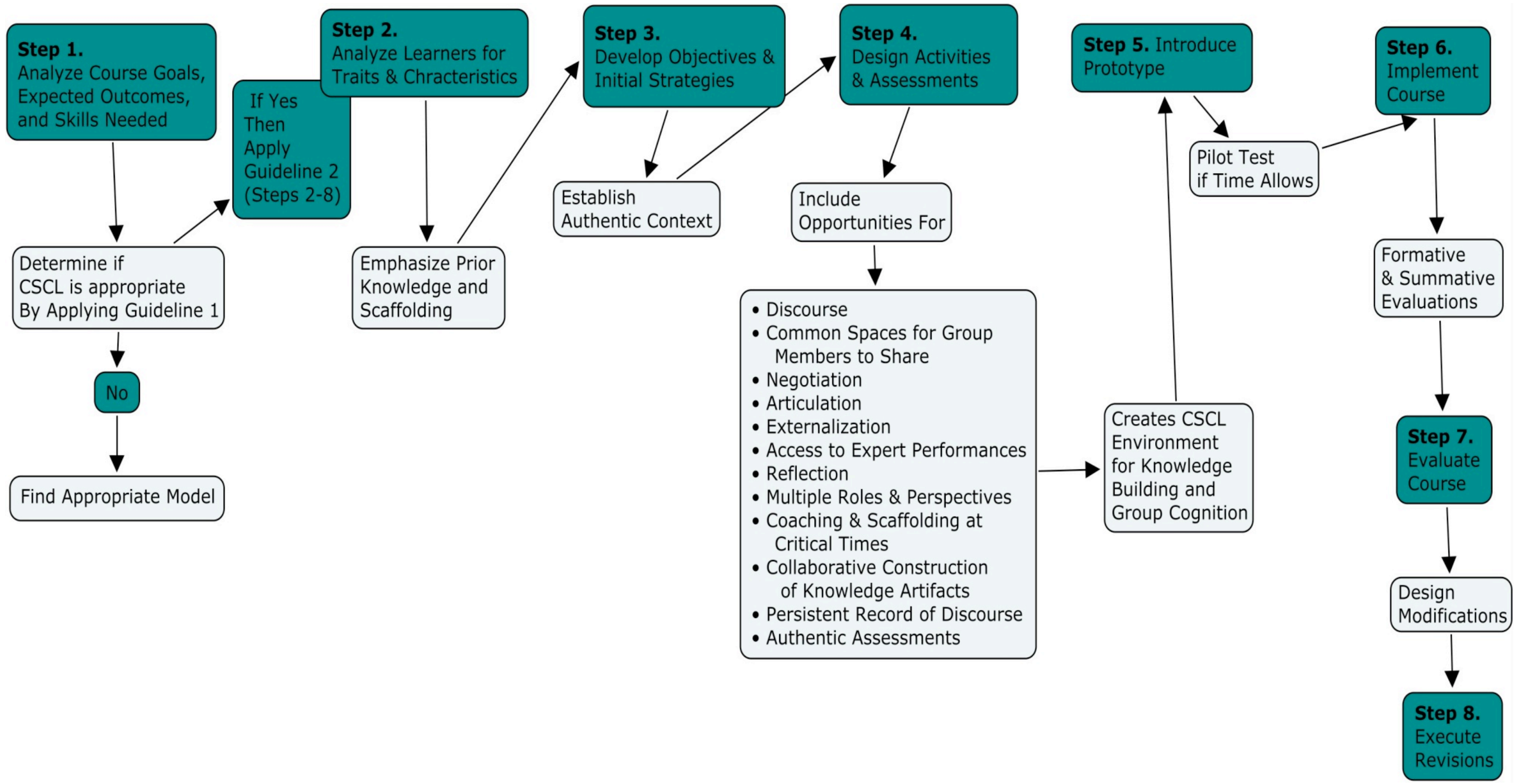
Do you think the Collaborative Design Model (p. 1) fosters reflection in the learning process? If not, please describe the weakness.

Do you think the Collaborative Design Model (p. 1) fosters interactivity to promote collaborative problem-solving? If not, please describe the weakness.

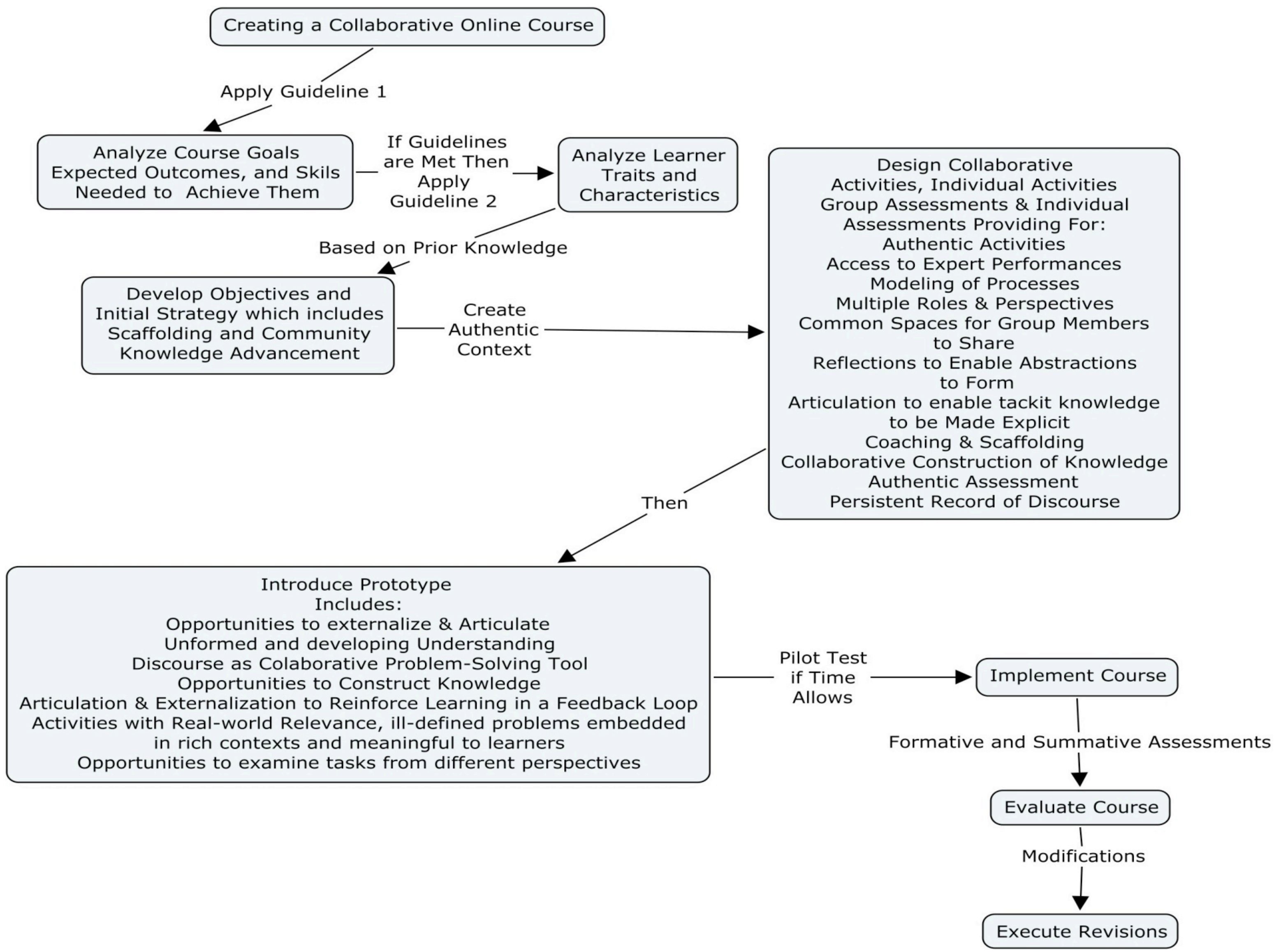
Do you think the Collaborative Design Model (p. 1) supports authentic assessment? If not, please describe the weakness.

Appendix Q: Collaborative Design Model on CSCL Constructs

(Page 4 of Review Packet)



Appendix R: The Collaborative Design Model Process (Page 5 of Review Packet)



Appendix S: *Definition of Constructs (page 6 of Review Packet)*

Theory/Theorist	Theorists	Construct Defined	Design Principle
	Scardamalia & Bereiter;	1. *Knowledge Building* "The production and continual improvement of ideas of value to a community, through means that increase the likelihood that what the community accomplishes will be greater than the sum of individual contributions and part of broader cultural efforts"	Prior Knowledge, Community Advancement, Allow for discourse, negotiation and sharing of ideas, reinforces transforming personal perspective to group perspective
Computer-Supported Collaborative Learning (CSCL) "CSCL is a field of study centrally concerned with meaning and the practices of meaning-making in the context of joint activity, and the	Greeno	*2. Learning in Activity, Situative, Conceptual Agency* "The main focus of analysis is on activity systems: complex social organizations containing learners, teachers, curriculum materials, software tools and the physical	Participation Structures and Processes, activity is not scripted, but has to be negotiated and artifacts are actively constructed by

Appendix S: Definition of Constructs (page 6 of Review Packet)

Theory/Theorist	Theorists	Construct Defined	Design Principle
ways in which these practices are mediated though designed artifacts"	Greeno	environment"	participants
4 Selected Constructs	Krajcik and Blumenfeld	*3. Encourages Anchored Instruction such as Project-Based Learning and Problem-based learning* Anchored instruction is an overall approach to the design of learning environments with 5 key features: Instruction Starts with a driving question or a problem to be solved; Students explore the driving question or problem by participating in authentic, situated-inquiry. As students explore the question, they develop an understanding of the discipline and also how to apply their understanding; Students, teachers, and community members	Meaningful opportunities to examine tasks from multiple perspectives, social interaction, active construction,

Theory/Theorist	Theorists	Construct Defined	Design Principle
		engage in collaborative activities to find answers to the question or problem; During the inquiry process, students are scaffolded with learning technologies that allow them to perform activities normally beyond their individual ability; Students create a set of products to address the needs of the question or problem. These results and products are shared artifacts that represent the learning of the class	
	Stahl; Koschmann; Suthers	2. *Intersubjectivity and group cognition* Collaboration, knowledge building through joint activity, Creation of Knowledge Artifacts "The goal for design in CSCL is to create	Interactional Meaning-making, Shared goals, Provide opportunities for students to examine tasks from different

Theory/Theorist	Theorists	Construct Defined	Design Principle
		artifacts, activities and environments that enhance the practice of group meaning making"	perspectives using a variety of resources
Situated Cognition "Situations might be said to co-produce knowledge through activity. Learning and cognition, it is now possible to argue, are fundamentally situated"	Brown, Collins, & Duguid	*Situated Knowledge* Knowledge is situated. "Embed learning in activity and make deliberate use of the social and physical context"	Activities with Real-world Relevance, ill-defined and complex tasks investigated over a sustained period of time, problems are embedded in rich contexts, persistent record of discourse
Zone of Proximal Development ZPD is the difference between what a child can do with help and what he	Vygotsky	*Scaffolding* *Scaffolding* is the process through which a teacher or more capable peer gives support to the	Structured support and peer interactions and student-faculty

Appendix S: Definition of Constructs (page 6 of Review Packet)

Theory/Theorist	**Theorists**	**Construct Defined**	**Design Principle**
or she can do without guidance.		student in her/his ZPD as necessary and gradually removes the supports as they become unnecessary.	interactions, shared common space, small workgroups
Community of Practice/ Community of Learners	Lave & Wenger; Wenger, McDermott & Snyder	*Collaboration* "The community creates the social fabric of learning… The practice is a set of frameworks, ideas, tools, information, styles, language, stories, and documents that community members share."	Discourse as collaborative problem-solving, negotiation of meaning, sharing of ideas
Cognitive apprenticeships are designed to bring tacit processes into the open, where students can observe, enact, and practice them with help from the teacher	Brown, Collins, Duguid	*Expertise Building* Building expertise occurs as students work with experts through modeling, coaching, scaffolding, articulation, reflection and exploration	Modeling, Coaching, Scaffolding, Articulation, Reflection, Exploration

Appendix T: Guideline One

(Page 9 of Review Packet)

Guideline One Ask the following questions to determine if collaboration is appropriate for the given assigned instructional need:	**Reference** Sources used to Establish Guidelines
1. Is online access available for all students?	(Ahern & Repman, 1994; Moore & Kearsley, 1996; Kumar, 1996; Benbunan-Fich & Hiltz, 1997; Brooks & Brooks, 1999).
2. Will collaborative, problem-based or project-based instruction best meet the instructional goals of the course?	(Stahl, 2006; Scardamalia & Bereiter, 2006; Krajcik and Blumenfeld, 2006; Kearsley, 1996).
3. Will collaborative, problem-based or project-based instruction best meet the needs of the students?	(Stahl, 2006; Scardamalia & Bereiter, 2006; Savery & Duffy, 1995; Torp & Sage, 1998; Sage, 2000; Hmelo-Silver & Barrows, 2006; Savery 2006; Kumar & Natarajan, 2007).
4. Will time restraints permit collaboration?	(Nasir, Rosebery, Warren & Lee, 2006; Hawkridge, 2002)

5. Will the instructor have the time to model appropriate interpersonal interactions and expectations?	(Reeves, Herrington & Oliver, 2002; Anderson et al, 2003; Garrison, Anderson & Archer, 2003; Shearer, 2003; Romiszowski & Mason, 2004; Browne, Warnock & Boykin, 2005; Brewer & Klein, 2006; Quintana et al, 2006; Reio & Crim, 2006; Stahl, 2006; Scardamalia & Bereiter, 2006; Githens, 2007).
6. Will the instructor have the time to provide frequent, appropriate feedback?	(Stahl, 2006; Scardamalia & Bereiter, 2006; Githens, 2007; Reeves, Herrington & Oliver, 2002; Anderson et al, 2003; Garrison, Anderson & Archer, 2003; Shearer, 2003; Romiszowski & Mason, 2004; Nasir, Rosebery, Warren & Lee, 2006).
7. Will the instructor be able to provide extrinsic rewards?	(APA, 1997; Anderson et al, 2003; Garrison, Anderson & Archer, 2003).
8. Will class size permit collaboration and the formation of small groups?	(Browne, Warnock & Boykin, 2005; Brewer & Klein, 2006; Quintana et al, 2006; Reio & Crim, 2006; Stahl, 2006; Scardamalia & Bereiter, 2006; Githens, 2007).
9. Will the instructor be able to participate/visit each small group several times throughout the duration of the course?	(Browne, Warnock & Boykin, 2005; Brewer & Klein, 2006; Quintana et al, 2006; Reio & Crim, 2006; Stahl, 2006; Scardamalia & Bereiter, 2006; Githens, 2007).

Appendix U: Guideline Two of a Two-fold Guideline Process

1. Analyze course goals, expected outcomes and skills needed to achieve them.

2. Analyze learner traits and characteristics.

3. Develop objectives and initial design strategy. Develop safe, supporting conditions and community identity. Develop scaffolding. Develop feedback expectations and strategies for community knowledge advancement in an authentic context.

4. Design collaborative activities, individual activities, group assessments and individual assessments. Design for authentic context, authentic activities, access to expert performances, modeling of processes, access to common shared spaces and multiple roles and perspectives; Design time for collaborative construction of knowledge, reflection to enable abstractions to be formed, articulation to enable tacit knowledge to be made explicit; Design activities that include coaching and scaffolding at critical times; Design authentic assessment of learning within the tasks; Design opportunities to externalize and articulate unformed and developing understanding, and include discourse as collaborative problem solving; Design opportunities to construct knowledge, and include opportunities for articulation and externalization to reinforce learning in a feedback loop with a persistent record of discourse; Design activities with real-world relevance, and include ill-defined problems embedded in rich contexts; Design meaningful opportunities to examine tasks from different perspectives.

5. Introduce CSCL prototype to client. If time allows, conduct a pilot test.

6. Implement the course.

7. Evaluate the course. Evaluations should include both formative and summative assessments.

8. Execute revisions. Based on the assessments, modifications may be necessary.

Appendix V: Protocol, Criteria and Constructs (Page 12 of Review Packet)					
Protocol	The construct must enhance the development of shared knowledge and group cognition.				
Criteria	The construct supports discourse, negotiation and the sharing of ideas.	The construct supports the co-construction of knowledge artifacts.	The construct supports Greeno's Situativity or Brown, Collins & Duguids Situated Cognition	The construct supports multiple perspectives.	The construct supports individual and multi-level opportunities for reflection.
Selected Constructs	Knowledge Building	Knowledge Building	Knowledge Building	Knowledge Building	Knowledge Building
	Conceptual Agency	Conceptual Agency	Conceptual Agency	Conceptual Agency	Conceptual Agency
	Expertise Building	Expertise Building	Expertise Building	Expertise Building	Expertise Building
	Anchored Instruction	Anchored Instruction	Anchored Instruction	Anchored Instruction	Anchored Instruction
	Intersubjectivity	Intersubjectivity	Intersubjectivity	Intersubjectivity	Intersubjectivity
	Group Cognition	Group Cognition	Group Cognition	Group Cognition	Group Cognition
	Scaffolding	Scaffolding	Scaffolding	Scaffolding	Scaffolding

Appendix W: Development Strategies and Supporting Instructional Strategies (Page 13 of Review Packet)

Development Strategies	Reference	Instructional Strategies
(1) Develop an Overview of the Course Structure	Moallem, 2003; Bonk & Zhang, 2006	1. Provide practical information about the collaborative tools for the course at the beginning of the session. 2. Provide a detailed Syllabus. 3. Align with course and/or institution's mission & goals.
(2) Develop an area for introductions at the beginning of the course to encourage active student-to-student and student-to-faculty contact.	Moallem, 2003; Bonk & Zhang, 2006	1. Provide ice-breaking sessions at the beginning of the course to build trust. 2. Faculty should include a detailed introduction of him/her self
(3) Develop opportunities for Modeling of good communication techniques to encourage reciprocity and cooperation among students.	Moallem, 2003; Bonk & Zhang, 2006	1. Provide direct instruction about working as collaborative teams. 2. Provide examples of good communication techniques.

Development Strategies	Reference	Instructional Strategies
(4) Develop expectations for appropriate feedback as feedback encourages reflection, revision, and quality time on tasks.	Moallem, 2003; Bonk & Zhang, 2006	1. Establish expectations for feedback at the beginning of the course.
(5) Develop different types of feedback to scaffold students as they progress through their zones of proximal development.	Moallem, 2003; Bonk & Zhang, 2006; Vygotsky, 1978.	1. Provide coaching and scaffolding at critical times as needed throughout the course.
(6)Establishing individual and group expectations and course goals and objectives encourages active involvement and successful group cognition.	Moallem, 2003; Bonk & Zhang, 2006	1. Establish small groups to foster the development of intersubjectivity and group cognition. 2. Provide practical information about the collaborative tools for the course at the beginning of the session. 3. Provide direct instruction about working as collaborative teams
(7)Determine which pedagogical practice	Greeno, 2006; Krajck &	1.Create course assignments that are as clear as

Development Strategies	Reference	Instructional Strategies
(project-based learning, problem-based learning, or some other form of situated learning) will best meet the needs of the defined course goals and objectives.	Blemenfeld, 2006; Brown, Collins & Duguid, 1989; Lave & Wenger, 1991	possible with the acknowledgement that real world settings and project based and problem based learning include a considerable amount of ambiguity. 2.The instructor should provide clarification as needed.
(8) Include expert performances and modeling of processes	Gunawardena et al, 2006; Hung & Chen, 2001; Herrington & Oliver, 2000.	1. Provide coaching and scaffolding at critical times as needed. 2. Provide opportunities to externalize and articulate unformed and developing understanding.
(9) Develop authentic activities that have real-world relevance and are embedded in rich context.	Herrington & Oliver, 2000; Roblyer & Wiencke, 2003; Gunawardena et 1l, 2006, Bonk & Zhang, 2006 Lave & Wenger, 1991;	1. Provide authentic assessments of learning Within the tasks. 2. Provide opportunities to engage in discourse as a collaborative problem- solving tool. 3. Provide opportunities to construct knowledge

Development Strategies	Reference	Instructional Strategies
	Brown, Collins & Duguid, 1989	within the group on problems/projects that have meaning for the students.
(10) Provide Frequent Feedback and other forms of scaffolding as needed	Vygotsky, 1978; Moallem, 2003; Hung & Chen, 2001; Greeno, 2006; Krajck & Blemenfeld, 2006;	1. Provide opportunities to construct knowledge 2. Provide opportunities for articulation and externalization
(11) Develop a shared common space for groups to work in	Greeno, 2006; Krajck & Blemenfeld, 2006; Herrington & Oliver, 2000	1. Provide small group chat rooms. 2. Provide access to small group resources
(12) Develop Small Groups	Greeno, 2006; Krajck & Blemenfeld, 2006; Herrington & Oliver, 2000	1. Divide the class into groups of 3 to 4 students.
(13) Develop activities that encourage reflection	Greeno, 2006; Krajck & Blemenfeld, 2006; Herrington	1. Provide authentic activities with real-world relevance, ill-defined problems and meaningful

Development Strategies	Reference	Instructional Strategies
	& Oliver, 2000	2. Create course assignments that are as clear as possible given that real world settings and project based and problem based learning include a considerable amount of ambiguity.

Appendix X: Interview With Reviewer #1

Reviewer's Comments are in Italics

Do you feel the collaborative design model packet includes the development of knowledge building?

In the case of …since you're defining the appropriate content, that is knowledge building. You're analyzing the course goals, the course content, knowledge building can happen because students will be working with the appropriate content to develop the needed skills or knowledge. The design promotes knowledge building.

OK, good. Do you think learning in activity, situativity and conceptual agency are covered?

I'm not sure what situativity means. I've never heard that term before.

Greeno prefers this term and it's a CSCL term for situated learning. Learning is situated in real-world experiences and in the context of the culture.

Oh, yes, like situated cognition. I don't keep up with the literature as much any more and am not that familiar with CSCL.

Exactly. Situated cognition is the term we're more familiar with and I actually researched both terms.

Yes learning in activity and situational and conceptual agency is fostered because the learning environment is developed based on the analysis of students' needs and requirements of the learning goals and objectives. I think this is OK.

Do you think the CDM includes anchored instruction?

Students are situated in authentic activity and the design model states that a form of anchored instruction should be used so yes, I think that anchored instruction is embedded in the model.

Do you think the CDM includes community knowledge advancement?

This one I thought was the weakest. Well, I think this is done through the shared common group spaces for group members to share, but I was grasping a little bit here to determine if Community knowledge advancement is in the model. What does community knowledge advancement look like and how is it measured.

I believe that community knowledge advancement is working together to move the whole group forward and the knowledge of the group is greater than the knowledge of individuals within the group.

I believe this is true. I watch groups of students work in the atrium and it is amazing to watch them work together. Is your group spaces like the atrium spaces?

Yes, I intended this as a group work space where students could work together on their shared and individual assignments. My intent was to provide space and time for students to work together in their groups to foster group knowledge advancement.

Do you think the collaborative design model packet includes intersubjectivity and group cognition?

I wasn't familiar with intersubjectivity, but Yes, the model requires collaborative learning and joint activities so I would say that it does include intersubjectivity and group cognition.

Do you think the CDM includes the use of scaffolding?

Because of the coaching required in the model, I would say yes, that it provides scaffolding. The instructor or the coach would provide that scaffolding for the student. So far I was able to find all the constructs in your model. (Laughter)

Great. That was my intent. I hope everyone can find the constructs in the model.

Do you think the CDM includes discourse and articulation to construct knowledge?

Your model includes problem-solving and group work , which requires discourse. In order to construct knowledge students would, by problem-solving that would force students to dialogue and articulate their thinking so they would be constructing knowledge.

Do you think the Collaborative Design Model includes expertise building?

It does provide expertise building because of the modeling of processes. That is they were seen.. I assume that through the course design there was some modeling of processes and expert performances so students could build up their expertise.

Do you think the Collaborative Design Model includes reflection in the learning process?

Yes, reflection time is designed into the model because time is provided for reflection to enable abstractions to form. Time is provided for them ahhh…yes, there's time provided to enable these abstractions to form. Multiple opportunities for discourse and dialogue and time to reflect on their own thinking.

Right, I think reflecting allows them time to adjust and refine their own understanding.

Uhhh. Well, right then. Reflection is included in the model.

Do you think the Collaborative Design Model includes interactivity to promote collaborative problem-solving? *Uhm, I felt that worked because you are providing feedback in a loop to reinforce learning. That feedback loop provides authentic assessment and includes student and faculty interaction and student-student interaction. Uhhm and the faculty could provide more information if it is needed, like a lecture or some other piece of information that the students might need.*

Do you think the Collaborative Design Model provides authentic assessment?

Authentic context is described and the course is designed to give authentic context and the assessment is described as authentic assessment. So yes, it includes authentic assessment.

I was a K-12 teacher so I may need to include some other forms of assessment.

I have a question about the Design components. Have you adapted the ADDIE model to make it collaborative for online instruction?

I think we've decided that it's going to be Collaborative Design Guidelines. I wanted to design a model, but it was so complex that I decided that I needed to design a Collaborative Design Model packet and we're going to call it Collaborative Design Guidelines because it's not really a model, because I couldn't create a clean model that included all the constructs and strategies.

Well, it was a worthy goal and your packet or whatever you're calling it is good. Do you have an idea of the kinds of tools you would use to create a collaborative course?

I was planning to use Scholar to test my model. I included a list of tools in my research, but inadvertently left those tools out of the Collaborative Design Model Package. Thank you so much for pointing out that these resources aren't included. I hadn't realized it. I can show you that table. It's in my appendices.

Oh no, that's not necessary. I was just curious as to what tools you were planning to use. Will they be similar to what we use in our courses at FDI?

Yes, I will use the same tools as I've seen implemented in the courses I've taken at FDI. I'll use Scholar, and the tools in scholar as well as some other Web 2.0 tools, like maybe PBwiki.

Does this answer your questions?

Yes, that was really all I wanted to ask.

Well, thank you again so much for your time. I really appreciate. I couldn't have asked for a better review.

Well, you can have my notes if you'd like.

I definitely want your comments. Thank you so much.

Appendix Y: Email Response from Reviewer #2

Hi Aprille,

I have reviewed your model this evening, again my apologies for the delay. I'm headed out of town again tomorrow, so thought I would pass along my two cents before leaving so you can get this wrapped up. The answer to all of your questions is "yes", all of those items appear to be included in your model. I'm not sure if you can consider other commentary, but if so, I think it's important to note a couple of issues. First, one of the challenges I encountered is how to interpret some of the terminology in the model. I found on a couple of occasions that the definition table did not really clarify the meaning of what you are trying to convey (intersubjectivity being one instance, learning in activity, situativity and conceptual agency being another). I think it would be helpful to readers to include language that clearly conveys the concepts at hand without having to refer to other reference material for meaning or clarification.

The second issue is that I think that while your model is intended to be all-encompassing, there is so much going on that it tends to be overwhelming for the reader. Is there a way some of the aspects of it could be consolidated? My fear is that users may find it too complex to be feasible for use. These are just my thoughts, not really related to the specific questions you have asked of me, but related to the potential efficacy of the model itself. Please feel free to use as you see fit, or to ask me additional questions if need be.

Take care, good luck, and hang in there!!! Please let me know if you need anything more from me.

-Barbara

Appendix Z: Email Response From Reviewer #3

Aprille,

I do not want to hold you up any more. My intentions have been good to complete the review process, but my good intentions won't get you graduated. I have reviewed your materials, but not at the depth I would have liked. I do not have any issues with your work, but I don't have any constructive criticism either which would be helpful to you. If you need to remove me from the process to move forward, please do so as it will not hurt my feelings. I don't want to hold you up and it appears I won't be fully back up to speed for a couple more weeks. My interest is in seeing you complete your work and graduate. I am comfortable with however, you want to proceed, but I cannot get you anything for at least 2-3 weeks, which is not fair to you. If Dr Moore considers my qualified statement as seeing no problems with your work as ok, then I am fine with that. You will need to discuss that with him.

I apologize if this has caused you any problems.

Best,

Tom