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EFFECTS OF INDIVIDUAL VERSUS ONLINE COLLABORATIVE CASE STUDY LEARNING STRATEGIES ON CRITICAL THINKING OF UNDERGRADUATE STUDENTS

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by

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DEDICATION

I dedicate this dissertation to my parents, Anita and Don N. Lee, who taught me from an early age the value of education.

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EFFECTS OF INDIVIDUAL VERSUS ONLINE COLLABORATIVE CASE STUDY LEARNING STRATEGIES ON CRITICAL THINKING OF UNDERGRADUATE STUDENTS

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In support of constructivist student-centered learning in higher education, this dissertation examined the effects of individual versus online collaborative case study learning on the development of critical thinking skills in undergraduate students. Case study learning was integrated into *EDP 1350: Effective Learning*, an undergraduate course designed to improve students' potential for academic success. A technology readiness survey was administered to participants prior to the case study learning to assess their readiness to participate in the online component of the learning. Case studies related to self-regulation of behavior, motivation, and cognition for academic tasks were used as stimulus prompts. Facione & Facione's (1996) holistic critical thinking rubric was used to measure the change in participants' critical thinking over the completion of the case study learning analyses.

A nonequivalent (pretest and posttest) control-group design was used to obtain statistical, quantitative results from the sample of eighty undergraduate students, and a process satisfaction questionnaire was used to survey students'satisfaction with various aspects of the case study learning analyses. Between-group repeated measures analysis detected no significant mean differences in critical thinking between the treatment group (online collaborative discussion) and the comparison group (traditional individual assignment) as measured by the holistic critical thinking scoring rubric. Repeated measures within-group analysis showed significant gains in critical thinking within both the treatment and comparison groups. A between-group technology readiness survey analysis showed no significant differences in technology readiness between the groups, and a between-groups process satisfaction questionnaire analysis showed no significant differences in process satisfaction between the groups. Overall, participants in both groups reported feeling satisfied with the case study learning analyses.

The purpose of this research was to explore the use of asynchronous computer-mediated collaborative case study learning to promote critical thinking in undergraduate students and contribute to the field of instructional technology as a tool to enrich classroom learning.

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Introduction

21ST CENTURY SKILLS AND CRITICAL THINKING

The ability to think critically is needed now more than ever in this revolutionary age of technological change. “The rapid computerization and networking of American businesses, industries, and homes has been called a ‘microprocessor revolution.’ That revolution is fundamentally transforming the way and the speed with which people think, connect, collaborate, design and build, locate resources, manipulate tools, conduct research, analyze and forecast, reach markets, present themselves and their wares, move and track products, make transactions — in short, do business” (U.S. Department of Labor, 1999). Although the use of various technologies such as laptops, pagers, cell phones, and instant messaging are commonplace for many young people today, they unequivocally need critical thinking skills to responsibly and effectively work within today’s sophisticated technological environments. They must be able to cognitively manage the increasingly complex ways to communicate, collaborate, and work with others, even possibly in geographically disparate locations (Halpern, 1995).

For the purpose of this project, critical thinking is characterized by six elements derived from Facione & Facione's Holistic Critical Thinking Scoring Rubric (1994). Critical thinkers (1) accurately interpret evidence, statements, graphics, and questions; (2) identify salient arguments (reasons and claims) and counterarguments; (3) thoughtfully analyze and evaluate major alternative points of view; (4) draw warranted, judicious, and non-fallacious conclusions; (5) justify key results and procedures (explaining assumptions and reasons; and (6) fair-mindedly follows where evidence and reasons lead (Facione & Facione, 1994).

Educators must equip students with the higher order reasoning skills to be a productive and vital member of our rapidly changing world. An amazing mix of instructional tools are currently used in education ranging from textbooks, paper and pencils, blackboards, erasers and chalk, to laptop or handheld computers for student use, as well as computer stations with high-resolution projectors capable of displaying wall-sized text, images, animations, sound, video, and three-dimensional simulations. Today many classrooms engage in traditional face-to-face instruction whereas others may be globally connected to students and educators in distant geographical locations creating "virtual communities of practice" (Johnson, 2001). Some classes do not meet face-to-face and are conducted solely online. Some classes are hybrids, offering a mix of face-to-face and online components.

Today basic literacy refers not only to the ability to read and write, but also includes the ability to extract meaning and communicate ideas through multimedia. “A literate person must not only excel in reading and writing text, but also must be able to listen and speak, and read and write fluently through text, images, motion video, charts and graphs, and hypertext across a wide range of media” (North Central Regional Educational Laboratory, 2000, p. 2).

Adults need flexible ways to manage the complex nature of functioning effectively in today’s world. Twenty-first century proficiencies include–

- Digital-Age Literacy

  Basic, scientific, and technological literacies

  Visual and information literacies

  Cultural literacy and global awareness

- Inventive Thinking

  Adaptability/managing complexity

  Curiosity, creativity, and risk taking

  Higher-order thinking and sound reasoning

- Effective Communication

  Teaming, collaboration, and interpersonal skills

  Personal and social responsibility

  Interactive communication

- High Productivity

  Prioritizing, planning and managing for results

  Effective use of real-world tools

  Relevant, high-quality products (North Central Regional Educational Laboratory , 2001)

As one can see, the ability to think well--to think critically-- is necessary to thrive in today's world. For example, individuals must be able to filter through a large volume of information and discern well founded from unsound information. Individuals must be able to manage a vast array of resources within complex network systems. "The sheer magnitude of human knowledge, world globalization, and the accelerating rate of change due to technology necessitates a shift in our children's education—from plateaus of knowing to continuous cycles of learning" (NCREL, 2001, Executive Summary). Teaching for "continuous cycles of learning" requires the exploration and implementation of instructional strategies that facilitate lifelong learning–the development of critical thinking skills, which are flexible and transferable across situations.

DEFINITION & STRATEGIES FOR DEVELOPING CRITICAL THINKING SKILLS

Critical thinking is "the ability to use acquired knowledge in flexible and meaningful ways, through understanding the problem or issue, evaluating evidence, considering multiple perspectives, and taking a position" (Vanderstoep & Pintrich, 2003, p. 275). Guidelines for thinking critically include the following:

1. Critical thinkers are flexible–they can tolerate ambiguity and uncertainty.
2. Critical thinkers identify inherent biases and assumptions.
3. Critical thinkers maintain an air of skepticism.
4. Critical thinkers separate facts from opinions.
5. Critical thinkers don't oversimplify.
6. Critical thinkers use logical inference processes
7. Critical thinkers examine available evidence before drawing conclusions. (Smith, 2002, pp. 2-6)

The critical thinking movement began with the influential work of John Dewey (Streib, 1992). In 1916, John Dewey, in *Democracy and Education*, emphasized the philosophy of doing and its indisputable link to thinking. "No one doubts, theoretically, the importance of fostering in school good habits of thinking…The initial stage of that developing experience which is called thinking is *experience*" (pp. 152-153). Dewey further explained the essential components of providing opportunities for 'good habits of thinking':

> Processes of instruction are unified in the degree in which they center in the production of good habits of thinking. While we may speak, without error, of the method of thought, the important thing is that thinking is the method of an educative experience. The essentials of method are therefore

> identical with the essentials of reflection. They are first that the pupil have a genuine situation of experience—that there be a continuous activity in which he is interested for its own sake; secondly, that a genuine problem develop within this situation as a stimulus to thought; third, that he possess the information and make the observations needed to deal with it; fourth, that suggested solutions occur to him which he shall be responsible for developing in an orderly way; fifth, that he have opportunity and occasion to test his ideas by application, to make their meaning clear and to discover for himself their validity. (p. 163).

In Jerome Bruner's (1960) classic work *The Process of Education,* he also described the importance of fostering thinking in education and described "the shaping of learning episodes for children" in his concept of a "spiral curriculum" (p. 52). According to Bruner, children's intuitive thinking should be fostered at an early age and be complemented with analytic thinking as they grow and mature:

> The complementary nature of intuitive and analytic thinking should, we think, be recognized. Through intuitive thinking the individual may often arrive at solutions to problems which he would not achieve at all, or at best, more slowly, through analytic thinking. Once achieved by intuitive methods, they should if possible be checked by analytic methods, while at the same time being respected as worthy hypotheses for such checking.

> Indeed, the intuitive thinker may even invent or discover problems that the analyst would not. But it may be the analyst who gives the problems the proper formalism. (p. 58)

Robert Gagne known for his work, *The Conditions of Learning and Theory of Instruction* (1985), also agreed with Dewey and Bruner in that experience "is the great teacher. This means that the events the developing person lives through—at home, in the geographical environment, in school, and in various other social environments—will determine what is learned and therefore to a large extent what kind of person he or she becomes" (p. 1). Gagne purported that providing students the opportunity to solve problems is a powerful way to promote learning. Gagne (1966) defined problem-solving as "an inferred change in human capability that results in the acquisition of a generalizable rule which is novel to the individual, which cannot have been established by direct recall, and which can manifest itself in applicability to the solution of a class of problems (p. 132). Gagne further defined learning as "a change in human disposition or capability that persists over a period of time and is not simply ascribable to processes of growth" (p. 2).

Since developing "good habits of thinking" has been a long held objective of education over the years, finding a comprehensive, agreed upon definition of critical thinking and its components is difficult (Pellegrino, 1995; Erwin, 1998; Underwood & Wald, 1995). In response to policymakers demanding greater accountability from higher education institutions, T. D. Erwin for the Council of the National Postsecondary Education Cooperative Working Group on Student Outcomes, Panel on Cognitive Outcomes, for the U.S. Department of Education, National Center for Education Statistics, produced a sourcebook *Definitions and Assessment Methods for Critical Thinking, Problem Solving, and Writing*. Erwin (1998) stressed the complexity of the task of defining critical thinking and distinguishing it from problem solving in his introduction:

> **Problem solving** is defined as a step-by-step process of defining the problem, searching for information, and testing hypotheses with the understanding that there are a limited number of solutions. The goal of problem solving is to find and implement a solution, usually to a well-defined and well-structured problem. **Critical thinking** is a broader term describing reasoning in an open-ended manner, with an unlimited number of solutions. The critical thinking process involves constructing the situation and supporting the reasoning behind a solution. Traditionally, critical thinking and problem solving have been associated with different fields: critical thinking is rooted in the behavioral sciences, whereas problem solving is associated with the math and

> science disciplines. Although a distinction is made between the two concepts, in real life situations the terms critical thinking and problem solving are often used interchangeably. (p. 1)

When reviewing the literature on critical thinking, references are customarily made to Benjamin Bloom's (1956) widely accepted classification of educational objectives. "The six categories [within the cognitive domain] are arranged on scale of difficulty, meaning that a learner who is able to perform at the higher levels of the taxonomy, is demonstrating a more complex level of cognitive thinking" (Martin, 2001).

> **Knowledge** is a starting point that includes both the acquisition of information and the ability to recall information when needed.
>
> **Comprehension** is the basic level of understanding. It involves the ability to know what is being communicated in order to make use of the information.
>
> **Application** is the ability to use a learned skill in a new situation.
>
> **Analysis** is the ability to focus on parts of informational material and their relationships to the whole.

Synthesis is the ability to combine existing elements in order to create something original.

Evaluation is the ability to make a judgment about the value of something by using a standard. (Martin, 2001)

Although the taxonomy was originally created to improve educational assessment including the creation of sound educational objectives (Woolfolk, 2004), it is often used to distinguish higher order reasoning levels (critical thinking) from lower order thinking. The levels above knowledge and comprehension are generally considered to be "critical thinking" (Martin, 2001).

In his recent review of the research literature on critical thinking in higher education, Pithers (2000) emphasized the scarcity of published research measuring attainment of critical thinking in undergraduate students. Although the research is scarce, several significant findings that may be gleaned from the literature are discussed below.

Students do not necessarily develop critical thinking as part of their college experience. In a study conducted by Pithers & Sodden (1999), a Critical Reasoning Test (CRT) was administered to 256 undergraduate students majoring in education. No significant between-group CRT differences were found for graduate vs. non-graduate students or for students in various stages of the course.

Transfer of critical thinking may be problematic from one discipline domain to another (Pithers, 2000). In a review on the transfer of learning Garnham & Oakhill (1994) concluded that "any transfer is usually within the domain in which the thinking was learned" (Pithers, 2000, p. 245). Pithers questioned whether the lack of transfer is inherent in thinking or if the skill is not transferred due to lack of opportunities for students to practice critical thinking in other domains. The lack of transfer may due to poor pedagogical practices that do not emphasize the transfer of skills. In fact, Cowan (1994) described a teaching approach in which "the central task of the tutor, working with a pair of students, was to help each student to unearth from their experiences of studying science a list of examples of relevant transferable skills taken from past and future studies" (p. 57). Good pedagogical practices emphasizing the generalizability of critical thinking skills to a new context may transform the problem of transfer of skills into a moot point.

Broad learner dispositions necessary for critical thinking have been identified. Good thinking involves the ability to tolerate ambiguity and the ability to regulate one's own thinking (metacognition). Teaching critical thinking also requires that it be stated explicitly as an educational goal and reconceptualization of learning by both teachers and students (Pithers, 2000).

Critical thinking has been appropriately categorized as a “mystified concept.” Mystified concepts become “mindnumbing either because they are worn smoothly into platitudes or because they are fraught with emotion and/or taboo and confusion” (Minnich, 1990, p. 56 as cited by Halonen, 1995)). Halonen attempted to “demystify” critical thinking by “providing a framework for organizing critical-thinking scholarship into meaningful dimensions” (p. 75). Of particular interest are “cognitive and propensity elements” which influence critical thinking. Halonen cited the cognitive elements in Wales & Nardi’s (1984) three-stage hierarchical framework for problem-solving: basic, high-level, and complex thinking skills. Propensity elements are identified as physiological readiness, attitude, emotion, and metacognition.

To facilitate higher order cognitive skills in education, it is necessary to explore how people learn and the instructional practices that support those epistemological assumptions.

LEARNING MORE ABOUT HOW PEOPLE LEARN

There is a move in education from the traditional viewpoint of learning as the ability of students to receive and reproduce information to the ability of students to critically evaluate and synthesize knowledge within contextual and relevant learning environments (Gagnon & Collay, 2001).

Learning is social by nature. Students may be thought of as "cognitive apprentices" learning through sharing in communities of practice within academic disciplines. Communities of practice are characterized by the following:

1) Meaning: a way of talking about our (changing) ability–individually and collectively–to experience our life and the world as meaningful.
2) Practice: a way of talking about the shared historical and social resources, frameworks, and perspectives that can sustain mutual engagement in action.
3) Community: a way of talking about the social configurations in which our enterprises are defined as worth pursuing and out participation is recognizable as competence.
4) Identity: a way of talking about how learning changes who we are and creates personal histories of becoming in the context of our communities. (Wenger, 1998, p. 5)

Individuals are naturally participants in a variety of community of practices, from work to home to hobbies. Learning may be thought of as situated within a "landscape of community membership" (Lave & Wenger, 1991, p. 37).

Not only is learning a social phenomenon, but it also involves individual cognitive transformations. "Learning is understood as a constructive process of conceptual growth, often involving reorganization of concepts in the learner's understanding, and growth in general cognitive abilities such as problem-solving strategies and metacognitive processes" (Greeno, 1996, p. 11).

Constructivist learning theory embraces the idea that knowledge is not transmitted from teacher to student but is actively constructed as students engage in meaningful learning experiences. "Constructivist refers specifically to the assumption that humans develop by engaging in the personal and social construction of knowledge…Thus, humans construct knowledge; we do not receive and internalize predigested concepts without simultaneously reacting to them and engaging them within our own mental maps and previous experience" (Schmuck, 2001, p. x). Constructivists emphasize the dynamic nature of learning and the active construction of knowledge as students engage in authentic tasks situated within relevant learning contexts. The emphasis is "on learning rather than teaching, and on facilitative environments rather than instructional goals" (Collins, 1996, p. 347).

"Constructivism is fundamentally nonpositivist . . . Rather than behaviors or skills as the goal of instruction, concept development and deep understanding are the foci; rather than stages being the result of maturation, they are understood as constructions of active learner reorganization" (Fosnot, 1996, p. 10). Designing a learning environment to support students' construction of knowledge as they actively participate in authentic complex tasks requires the use of innovative instructional strategies. Problem-based, project-based, and case-based learning are among the creative constructivist strategies being utilized in many of today's classrooms.

CONSTRUCTIVIST LEARNING STRATEGIES

Among instructional strategies that support constructivist learning are problem-based learning, project-based learning, and case study learning. Although they are based on the similar principle of providing students the opportunity to construct knowledge as they engage in authentic learning tasks, some distinct differences exist as well. Defining each strategy and examining each strategy's distinctive characteristics is helpful when considering instructional design principles related to these various pedagogies.

Problem-based learning is a fast-growing instructional strategy used in K-16 education. Problem-based learning is eloquently defined in Torp & Sage's (2002) guide created to assist educators in the implementation of problem-based learning in the classroom:

> Problem-based learning is focused, experiential learning
> (minds-on, hands-on) organized around the investigation
> and resolution of messy, real-world problems.

> Problem-based learning—which incorporates two complementary processes, curriculum organization and instructional strategy—includes three main characteristics:
>
> - Engages students as stakeholders in a problem situation.
> - Organizes curriculum around a given holistic problem, enabling student learning in relevant and connected ways.
> - Creates a learning environment in which teachers coach student thinking and guide student inquiry, facilitating deeper levels of understanding (p. 15).

In problem-based learning, the problem provides the context for learning. Learning occurs "on demand" as the problem is investigated and resolved (Rodgers, Cross, Tanenbaum, & Wilson, 1997). Often the problem presented is designed to be complex and ill-structured. Ill-structured means a problem may not be solved with a high degree of certainty and requires a complex reasoning process, involving analysis and interpretation from multiple perspectives. Ill-structured problems are preferable in assessing critical thinking skills in adults, because they are more similar to "real-world problem solving of adults" (King & Kitchener, 1994, p. 11). Resolution of the problem requires higher order reasoning skills such as application, analysis, synthesis, and evaluation. Students are active learners engaged in real-world problem-solving. Teachers play a dual role; they are both a participant in learning and a cognitive coach (Torp & Sage, 2002).

Problem-based learning's most distinctive feature is that the problem initiates the learning process spurring students to creatively and critically investigate the problem and construct a resolution based on various criteria. In contrast, the instructional strategy, project-based learning, is centered around the completion of a project. Due to their similarities, problem-based learning and project-based learning are often confused (Esch, 1998).

To clarify the distinctions between problem-based learning and project-based learning, Esch (1998) explained their similarities and differences. Project-based learning is most often associated with K-12 classrooms. Students engage in tasks associated with the completion of a product, learning content knowledge and skills within the production process. The end product (completion of project) is the driving force. It is assumed problems will occur as students complete the project, providing them the opportunity to problem-solve and learn core concepts relevant to the discipline.

Although problem-based learning may be used in K-12 classrooms, it is more often associated with higher education, having originated in medical education and professional practices. In problem-based learning students research and learn various concepts "on demand" as they grapple with the presenting problem. Problem-based learning is based on a method of inquiry, whereas project-based learning is based on a production method (Esch, 1998).

Barron, Schwartz, Vye, Moore, Petrosino, Zech, Bransford, and The Cognition and Technology Group at Vanderbilt (1998) distinguished between project-based learning and problem-based learning by describing a project-based learning study conducted by Petrosino (1995). In the study, the learning effectiveness of a commonly used project in classrooms--model rocketry—was explored. The students' task was to build and launch rockets. A common assumption in project-based learning is that students will learn scientific concepts by completing the rocket project. Petrosino found that little conceptual learning actually took place. The focus, as perceived by the students, tended to be on how high the rocket would fly. Petrosino transformed the rocket project into an inquiry-based problem (problem-based learning) by reframing and redesigning the project with explicit instructional goals requiring the use of scientific methods such as experimentation and measurement. A learning-appropriate goal was added to the task to see if that component would deepen the students' learning without decreasing student motivation and engagement. The rocket project was reframed requiring the sixth grade students to design and develop a rocket *kit* for NASA to be used in classrooms. This task required several "driving questions" to meet the rocket design specifications. Beginning the task with a problem and driving questions focused the learning and increased the students' depth of conceptual learning.

To rectify the tendency of students and teachers to get so "caught up" in the "doing" and losing sight of the learning principles and overlooking the need for appropriate reflection, Barron et al. (1998) recommended pairing problem-based learning with project-based learning. Pairing the two instructional strategies helps to maintain the focus of the learning goals, reinforce deep conceptual learning, and sustain student motivation. Initiating a learning task with a problem (problem-based learning) "sets the stage" for the learning goals and helps to direct and focus the students' learning. The problem prepares the students for the project. The problem thus becomes a *scaffold* for the project. Scaffolding is considered that which provides "the child with hints and props that allow him to begin a new climb, guiding the child in next steps before the child is capable of appreciating the significance on his own. It is the loan of the [adult's] consciousness that gets the child through the zone of proximal development" (Bruner, 1986 as cited by Fosnot, 1996, p. 21). Effective instructional design requires thoughtful consideration of way the problem is presented, as well as the motivation afforded through the learning task.

Effective learning and instruction requires the integration of motivation and thinking and learning. Blumenfeld, Soloway, Marx, Krajcik, Guzdial, & Pallincsar (1991) emphasized the "critical links among student motivation, student cognition, instruction and learning" and reported that "students are afforded *few* opportunities to represent knowledge in a variety of ways, pose and solve real problems, or use their knowledge to create artifacts" (p. 370). Problem-based learning and project-based learning are both designed to motivate and engage students in authentic learning experiences and are well-suited to the disciplines of science and mathematics.

Case-based learning is another powerful constructivist strategy designed to motivate and engage students in problem-solving and deep conceptual learning as they grapple with real-life issues relevant to today's world. Although case-based learning is rooted in legal education (Williams, 1992) and has been most often used in the teaching of law, business, and medicine (Gibson, 1998) it may be incorporated in virtually any discipline to promote critical thinking processes used in problem-solving and to facilitate deep learning of the subject domain. Case-based instruction is defined as "the practice of using real or imagined scenarios, critical incident analyses, case studies, vignettes, or anecdotal accounts as pedagogical tools in fields such as law, business, medicine, and education" (ERIC, 2002 as cited by Rourke & Anderson, 2002, p. 1). Case-based instruction may also be defined as an "active-learning pedagogy designed for problem analysis and problem-solving, stressing a variety of viewpoints and potential outcomes" (Cranston-Gingrass, Raines, Paul, Epanchin & Roselli, 1996 as cited by Andrews, 2002, p. 2).

Barrows (1986) purported, "The increasingly popular term 'problem-based learning' does not refer to a specific educational method. It may have many different meanings depending on the design of the educational method employed and the skills of the teacher" (p. 481). Barrows created a taxonomy in an effort to identify the differences among various problem-based learning (PBL) methods and to facilitate comparison of the educational value of the various designs. "All descriptions and evaluations of any PBL method must be analyzed in terms of the type of problem used, the teaching-learning sequences, the responsibility given to students for learning and the student assessment methods used" (p. 485).

The design and format of the problem used is an important variable. According to Barrows, cases used may come in various forms: the complete case or case vignette, a partial problem simulation, or a full problem simulation (free inquiry). For example, students may be given a full problem and must "assemble the important facts through free inquiry, as occurs in the real world, using clinical reasoning" (p. 482). This exemplifies a full-problem simulation requiring free inquiry. In other instruction, students may be given a case history which presents relevant facts of the case in an organized manner, requiring students to decide what must be done based on the information given. Another variation would be a partial problem simulation, in which the students are given a number of facts and "the students have to decide on a limited number of inquiry actions or decisions...or to choose actions and decisions from alternatives presented" (p. 482).

"The degree to which learning is teacher-directed or student-directed is another important variable" as well as "the sequence in which problems are offered and information is acquired" (Barrows, 1986, p. 482). Some commonly used permutations have been identified: lecture-based cases, case-based lectures, case method, modified case-based, problem-based, and closed-loop or reiterative problem-based. These commonly used varieties may be further delineated according to the educational objectives important specifically in medical education. Those objectives are structuring of knowledge for use in clinical contexts (SCC), the developing of an effective clinical reasoning process (CRP), the development of effective self-directed learning skills (SDL), and increased motivation for learning (MOT).

Considering the aforementioned review of the literature, a synthesis of the information assists in identifying the characteristics these constructivist learning strategies share. Problem-based learning, project-based learning, and case-based learning are student-centered. They share the assumption that humans construct knowledge as they engage in meaningful and contextual learning. The strategies are designed to motivate students and sustain cognitive engagement by using meaningful, authentic real world problems as an organizing feature of learning. This contextual learning is designed to enhance deep learning of subject content and facilitate the use of critical thinking skills by students engaged in the learning tasks. These learning tasks may vary in complexity and scope; however, most often their implementation requires extended classroom time and always requires thorough and thoughtful planning by the teacher, as well as a change in the role of teacher from being an information provider to becoming a facilitator of knowledge construction and a cognitive coach.

RATIONALE FOR CASE-BASED LEARNING

Within the context of teaching undergraduate students in higher education and a fifteen-week time constraint, case-based learning is appealing. Using cases to motivate and engage students as they synthesize course content and critically analyze various issues from multiple perspectives reinforces student ownership of learning and provides an opportunity to practice critical thinking skills. Another indisputable benefit of case-based learning is the flexibility that its design offers in the ability to link “theory with practice” in a variety of disciplines. What is the potential effectiveness of case-based learning for undergraduate students?

Case-based learning has been proven effective in the professional contexts of law (Williams, 1992), business (Benbunan-Fich, 1999), and medicine (Rodgers, Cross, Tanenbaum, & Wilson, 1997). Teacher educators are also using this instructional strategy to provide preservice teachers the opportunity to explore and discuss various teaching issues within rich and complex case scenarios, moving knowledge from theory to practice (Andrews, 2002; Dawson, Mason, & Molebash, 2000; Putnam & Borko, 2000).

The benefits of case study learning are many. For example, case study learning supports an adult model of experiential learning. According to Kreber (2000) case study learning provides students the opportunity to become involved in all four phases of Kolb's experiential learning cycle—concrete experience, active experimentation, abstract conceptualization, and reflective observation. The greater the involvement within these four levels, the greater the learning. Kreber proposed that experiential learning through case study learning is "likely to foster students' learning on a higher-order level, such as their critical thinking ability and propensity for self-direction in learning" (p. 217).

Within a special issue on critical thinking in *Teaching of Psychology*, McDade (1995) professed the power of case study learning:

1. It models critical thinking and provides a laboratory in which students can practice and advance their critical thinking skills.

2. It emphasizes the process of analyzing information.
3. It is contextually based; that is, students must understand contextual nuances and make references and analyses accordingly.
4. It challenges students to identify and challenge assumptions about situations and about their own beliefs.
5. It encourages students to imagine alternatives and explore these for strengths and weaknesses.
6. It helps students to integrate learning by incorporating theory into practice and practice into theory.
7. It enables students to develop critical listening skills because listening to and understanding the nuances and diversity of the thinking processes of others is as important as developing one's own thinking.
8. It provides opportunities for students to develop and test theories about how people and organizations function.
9. It helps students to develop teamwork and collaborative learning as students work together in small groups and in the classroom to solve the problems presented by the case with the best means possible to serve the most goals.
10. It helps students to experience, explore, and test alternative ways of thinking.

11. It facilitates the consideration of different perspectives as other students present ideas, analyses, and solutions that no one student may have thought of (p. 10).

Case study learning affords students the opportunity to explore case studies within a social context–learning collaboratively in knowledge-building discourse. “The essence of collaboration is the construction of shared meanings for conversations, concepts, and experiences” (Roschelle, 1992 as cited by Palincsar & Herrenkohl, 2002, p. 27).

Cases employed in the teaching of law are considered *case-based instruction*. Cases have been edited and chosen for the particular issues and laws represented. Students are assigned to individually read and analyze the case. Students are directed to prepare and then present a “brief” of the appellate court case in class. The instructor emphasizes features of the case by challenging the students’ point of view, as well as questioning and commenting on various aspects of the case. The adversarial atmosphere in the classroom mimics the environment of a courtroom (Williams, 1992).

Cases used in the teaching of medicine are used to stimulate and initiate student learning—the distinguishing feature of *problem-based learning*. Cases used in medical education are designed from actual patient records. Students are randomly assigned to work in small groups under the guidance of a tutor. The students work together to analyze the case and diagnose the illness. Students rely on multiple sources of information during self-directed study as they gain knowledge related to the medical case scenario (Williams, 1992).

Both problem-based learning and project-based learning are often cooperative in nature and support the idea that learning takes place within a social context; whereas, case-based learning has traditionally and primarily been an individual student's analytical process followed by a teacher-led Socratic dialogue in a large group classroom situation. Does the opportunity to collaborate with peers enhance the quality of student learning? Is collaborative learning a critical component of effective instructional design?

COLLABORATIVE LEARNING

Gokhale (1995) conducted a study comparing individual learning vs. collaborative learning in improving effectiveness of learning in an industrial technology course. Forty-eight undergraduate students were learning about series and parallel dc circuits. The investigator found no significant differences in learning effectiveness on drill and practice exercises between individual and collaborative conditions; however, he did find improved significant gains in critical thinking skills in students participating in the collaborative learning condition. According to Gokhale, the peer support offered through collaborative learning improved learning effectiveness because "group diversity in terms of knowledge and experience contributes positively to the learning process" (p. 6) and allows for the consideration of multiple interpretations of the issue being studied. "The peer support system makes it possible for the learner to internalize both external knowledge and critical thinking skills and to connect them into tools for intellectual functioning" (p. 6).

Klemm (2002) employed the use of case studies based on journal articles to assist his students in learning the analytical processes involved in reading and interpreting research articles in a neuroscience course for senior-level undergraduate students. Heterogeneous small-group teams were created. "Using the group approach when examining case studies enables students to help each other surmount the difficulties" (p.2). Over the course of four semesters, Klemm reported "work quality distinctly improved with each successive journal article assignment, as students learned how to help each other" (p. 8). Klemm emphasized the benefits of using technology to support the students' knowledge building discourse as they follow a step-by-step analytical process. His students used an asynchronous computer conferencing environment to support their collaborative analysis of the case studies.

Collaborative learning is effective within the context of computer-mediated communication. Veerman & Veldhuis-Diermanse (2001) reported that "from a constructivist perspective, collaborative learning can…support learners to elaborate, explain and evaluate information in order to re- and co-construct (new) knowledge or to solve the problems (Scardamailia & Bereiter, 1994; Baker, 1994; Dillenbourgh & Schneider, 1995; Erkens, 1997; Veerman, 2000; Veldguis-Diermanse & Biemans, submitted)" (p. 1).

In summary, collaborative learning effectively strengthens the depth of learning. Collaborative learning enhances critical thinking by providing students multiple perspectives and social support as they are cognitively challenged to analyze theory and concepts related to issues being studied. The collaborative dialogue supports students in the process of reconstructing their previous knowledge and co-constructing a more refined conceptualization of the ideas being studied. Working collaboratively affords students the opportunity to grow in the skills and competencies necessary to function effectively in the 21st century.

INCREASED USE OF TECHNOLOGY IN LEARNING

Technology in education may be used in a variety of ways. Technology may be function as a medium to transmit knowledge or tutor the learner in particular skills or competencies. It may also be used as a *tool* to assist students as they construct knowledge while participating in meaningful and relevant learning experiences. Jonassen (1995) argued "students should learn *with* technology, not *from* it" (p. 41). He posited that often the instructional designer learns more from the technology than do the students for whom the instructional materials were created. He contended that students should become the designers, using "databases, spreadsheets, semantic networks, expert systems, [and] multimedia/hypermedia construction…as computer-based cognitive tools that function as intellectual partners with learners to expand and even amplify their thinking, thereby changing the role of learners in college classrooms to knowledge constructors rather than information reproducers" (Jonassen, 1995, p. 40). Technology may best be contemplated as a cognitive tool designed to support learners in the process of learning.

Technology may facilitate the process of critical thinking in collaborative problem-solving through the communication support it offers. Dialogue and collaboration are supported through the use of computer conferencing technologies allowing students to "examine their joint assumptions and share mental models of thought" (Pellegrino, 1995, p. 12). Computer conferencing technologies also help in managing the complexities of collaborative analysis by providing a written transcript of the dialogue, easing the cognitive load involved in referencing, searching, and updating the conversation. The act of writing provides the opportunity for deep reflection and revision of ideas. The written format also makes the students' tacit knowledge public. Faulty thinking, naïve conceptions, and errors in understanding are likely to be found and corrected. (Klemm, 2002).

Asynchronous learning networks expand the time and space limitations of the classroom, allowing the opportunity for student discourse outside of the classroom, virtually at any time. "Asynchronicity is one of the strengths of distance education in that it offers learning at 'anyplace and anytime.' Students can learn anywhere they have computer access and do not have to be online at the same time as the instructor and other students" (Kemery, 2000, p. 240). The asynchronous aspect also provides for extended think time, encouraging deep reasoning and thoughtful responses. The written dialogue provides documentation of student participation in the forum, easing the assessment process (Kemery, 2000) and makes students' participation and contributions public, promoting pride of ownership (Klemm, 2002).

COMPUTER-SUPPORTED COLLABORATIVE CASE-BASED LEARNING AND CRITICAL THINKING

Higher education is failing in its goal of teaching critical thinking to undergraduate students (Pithers & Sodden, 1999; de Sanchez, 1995). The necessity to explore innovative ways to promote critical thinking remains a priority, yet the dearth of critical thinking research in undergraduate education leaves many questions unanswered.

Of particular interest to this examiner is the use of case-based learning to engage and motivate undergraduate students enrolled in a learning frameworks course designed to increase students' potential for academic success. The majority of students enrolled in the fall semester course are first-semester freshman students who have been conditionally admitted to the university and are required to take the course. Case-based learning seems well suited to help these students link learning theory and self-regulation issues with practice through analysis of hypothetical cases designed to mimic various self-regulation issues many college students face.

Providing a collaborative learning environment to support students who are novices to case study analysis provides a social support from their peers as they develop their confidence and competence in the problem solving process (Klemm, 2002). Working collaboratively builds interpersonal and communication skills (McDade, 1995). The social context afforded through collaborative learning may help to sustain motivation in learning. Collaborative learning allows students to view various issues from multiple perspectives.

Due to the time constraints of a fifteen-week semester, supporting students' collaborative analyses of cases with asynchronous computer-mediated communication technology extends the learning community beyond the classroom walls and allows for student interaction virtually anywhere and anytime, thus eliminating these common group work barriers. Asynchronous learning networks also afford students the opportunity to interact within an "environment of participation in social practices of inquiry and learning…involving social interaction and discourse practices" (Greeno, Collins, & Resnick, 1996, p. 31). The asynchronous web-based environment allows students extended think time, encouraging deep reasoning and thoughtful responses. The technology provides a record of the ongoing dialogue, making students' thinking visible and available for refinement. Computer-supported collaborative learning technology emphasizes the positive interdependence of students to "maximize their own and others' learning" (Harasim, 2000, p. 12) and enhances students' skills and competencies necessary to function effectively within the 21^{st} Century.

Will computer-supported collaborative case-based learning effectively advance the critical thinking skills of undergraduate students enrolled in a learning frameworks course? The following questions and hypotheses guided this investigation.

Research question #1: Will there be a significant difference in depth of critical thinking in case study analysis between students learning individually and students learning collaboratively using asynchronous computer-mediated communication?

Research question #2: Will there be a significant difference in depth of critical thinking in case study analysis within students learning individually and students learning collaboratively using asynchronous computer-mediated communication?

Research question #3: How will students' perception of the critical analysis process differ between students working individually and students learning collaboratively using an asynchronous learning network technology?

Hypothesis #1: The depth of critical thinking will be significantly higher in students analyzing case studies collaboratively using asynchronous CMC than in students analyzing case studies individually.

Rationale for Hypothesis #1: The benefits of collaborative learning including the opportunity to dialogue among peers will enhance learning effectiveness, as well as the extended think time for deep reasoning and reflecting upon the analytical process afforded by the asynchronous technology. The architecture and collaborative nature of the discussion forum technology promotes metacognitive and reasoning processes as students type their thoughts and ideas and respond to and critique others' ideas.

Hypothesis #2: The depth of critical thinking will significantly improve within students analyzing case studies collaboratively using asynchronous computer-mediated communication and within students analyzing case studies individually.

Rationale for Hypothesis #2: Case study learning will significantly increase the depth of critical thinking within both treatment groups. Students working individually and students working collaboratively on the cases will significantly improve their critical thinking skills through the instruction and practice they will receive on critical thinking processes, including the use of a problem-solving template designed to scaffold the cognitive processes involved in analyzing the cases.

Hypothesis #3: Students' perception of computer-supported collaborative analysis will be more positive than students' analyzing case studies individually.

Rationale for Hypothesis #3: This hypothesis is supported by the motivational aspect afforded to students working together and supporting each other as they engage in critical analysis of case studies. Using technology in a novel way may also motivate students as well.

CHAPTER II

Literature Review

The current need for critical thinking is compelling, particularly in this age of revolutionary change. “The rapid computerization and networking of American businesses, industries, and homes has been called a ‘microprocessor revolution.’ That revolution is fundamentally transforming the way and the speed with which people think, connect, collaborate, design and build, locate resources, manipulate tools, conduct research, analyze and forecast, reach markets, present themselves and their wares, move and track products, make transactions—in short, do business” (U.S. Department of Labor, 1999). This fundamental shift in the way people conduct business has great implications for higher education. Educators have the responsibility to prepare individuals to function effectively in the 21st Century.

“The 21st century thus begins with a paradigm shift in attitudes towards online education…Our new understanding of the very nature of learning has affected the definition, design, and delivery of education. It will alter global civilization as educators and learners worldwide adopt and adapt networked collaborative learning” (Harasim, 2000, p. 43). The ability to think critically and analyze information intelligently must be an explicit and deliberate goal of higher education (Lonka & Aloha, 1995 as cited by Pithers, 2000) if educators seriously take the responsibility of preparing graduates for life. What is critical thinking and what instructional strategies support its development?

CRITICAL THINKING

The definition of critical thinking has been debated for years; consequently, finding an agreed upon definition is daunting. Critical thinking has become a "mystified concept" due to its abstract nature and lack of common understanding. "Ask twelve psychology faculty members to define the term *critical thinking*, and you may receive twelve overlapping but distinct definitions (Halonen, 1995, p. 75). The mystification of critical thinking has led to a multitude of definitions, as well as a host of lists composed of traits, characteristics, dispositions, and cognitive elements, to name a few.

When reviewing the literature on critical thinking, reference is customarily made to Bloom's taxonomy of educational objectives (1956). Bloom's taxonomy continues to be widely accepted and taught. Benjamin Bloom and a group of educational psychologists developed a list of educational objectives in three overlapping learning domains: cognitive (knowledge), psychomotor (skills), and affective (attitude) at the American Psychological Association in 1948 (Anderson & Krathwohl, 2001; Bloom & Krathwhol, 1956; Gronlund, 1970 as cited by Kearsley, 2003). The hierarchical levels of the cognitive domain with definitions and examples of descriptive verbs are as follows:

Knowledge – recalling previously learned data - arrange, define, describe, duplicate, enumerate, identify, label, list, locate, match, memorize, name, order, read, recall, recognize, select, state, view

Comprehension – understanding the meaning of information - classify, convert, demonstrate, describe, discuss, explain, express, generalize, identify, indicate, locate, paraphrase predict, relate, summarize

Application – using previously learned information in new ways to solve problems - apply, change, choose, construct, demonstrate, dramatize, employ, illustrate, interpret, make, produce, put together, solve, translate

Analysis – taking apart information into component parts and examining their function within the whole – analyze, appraise, calculate, categorize, compare, contrast, criticize, differentiate, distinguish, examine, interpret, question, subdivide, test

Synthesis – putting parts together to produce a new and original whole - add to, arrange, assemble, collect, combine, compose, construct, create, design, develop, forecast, hypothesize, imagine, invent, originate, plan

Evaluation – making value judgments based upon information - appraise, argue, assess, choose, compare, criticize, critique, defend, estimate, evaluate, predict, recommend, select, value, weigh (Bloom, 1956;

Kearsley, 2003; Krumme, 2001; Martin, 2001; University of Victoria, 1996)

The cognitive levels above knowledge and comprehension are generally considered to be higher order reasoning skills, components of critical thinking.

Forty-five years after the publication of Bloom's taxonomy, Anderson, Krathwohl, Airasian, Cruikshank, Mayer, Pintrich, Raths, & Wittrock (2001) revised the taxonomy into a two-dimensional framework: a Knowledge dimension forms the vertical axis and a Cognitive Process dimension forms the horizontal. Within the Knowledge dimension, "a fourth, and new category, Metacognitive Knowledge [was created and] . . . involves knowledge about cognition in general as well as awareness of a knowledge about one's own cognition." Within the Cognitive Process dimension, "three dimensions were renamed, the order of two was interchanged, and those category names retained were changed to verb form to fit the way they are used in objectives" (Krathwohl, 2002, p. 214). Figure 1 below is a replication of the table which may be used to "classify objectives, activities, and assessments [to] provide a clear, concise, visual representation of a particular course or unit" (Krathwohl, 2002, p. 218).

The Cognitive Process Dimension

The Knowledge Dimension	1. Remember	2. Understand	3. Apply	4. Analyze	5. Evaluate	6. Create
A. Factual Knowledge						
B. Conceptual Knowledge						
C. Procedural Knowledge						
D. Metacognitive Knowledge						

Figure 1. Revised Taxonomy (Krathwohl, et al., 2001)

In 1990 forty-six critical thinking experts were brought together to "work toward a consensus on the role of critical thinking in educational assessment and instruction" (Facione, 1990, abstract). Gleaning information from this panel of experts participating in the Delphi Method, Facione & Facione (1994) developed a holistic critical thinking scoring rubric. See *Appendix B*.

According to Facione, the ideal critical thinker:

> Is habitually inquisitive, well-informed, trustful of reason, open-minded, flexible, fair-minded in evaluation, honest in facing personal biases, prudent in making judgments, willing to reconsider, clear about issues, orderly in complex matters, diligent in seeking relevant information, reasonable in the selection of criteria, focused in inquiry, and persistent in seeking results which are as precise as the subject and circumstances of inquiry permit (ERIC Document Reproduction Service, No. ED 315 423)

In a recent review of the literature, Astleitner (2002) defined critical thinking as "a higher-order thinking skill which mainly consists of evaluating arguments. It is a purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanations of the evidential, conceptual, methodological, or contextual considerations upon which the judgment is based" (p. 53).

Richard Paul & Michael Scriven defined critical thinking for the *National Council for Excellence in Critical Thinking*: "Critical thinking is the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action" (draft statement, accessed online 2003). The continuation and persistence of Bloom's theory is clearly illustrated.

Although Bloom's taxonomy endures as the general definition of critical thinking, notable aspects of critical thinking have been identified and are worthy of consideration when designing learning environments to promote critical thinking skills. Several aspects of critical thinking are particularly relevant to teaching and learning in higher education. It is helpful to explore the incidence of critical thinking in college students, the challenge of transferring critical thinking skills across domains, and general dispositions required for higher order reasoning. Exploring the role of metacognition in the development of thinking skills is helpful when designing effective instruction. In addition, it is useful to explore general teaching approaches which tend to inhibit or promote critical thinking, the use of scaffolds to support students' reasoning, and the social dimension of critical thinking (Pithers, 2000).

Incidence of Critical Thinking in Undergraduate Students

Because of the complex nature of critical thinking and difficulty in assessing it, few empirical studies investigating critical thinking development in undergraduate students exist (Pithers, 2000) . The few studies that do exist are not promising in relation to higher education's success in promoting critical thinking in students. According to the literature, students do not necessarily develop critical thinking skills as part of their college experience. In a study assessing the critical thinking skills of 256 university students through the use of the Critical Reasoning Test (CRT), Pithers & Soden (1999) found no significant between-group differences in critical thinking for graduate versus nongraduate students or for the stage of the course the students were within the program. According to the authors the lack of significance is likely due to a lack of clarity surrounding the construct of critical thinking and reliable methods to assess it, as well as a primary instructional focus on subject-matter content. Similar findings are supported within a *Teaching of Psychology* special issue on critical thinking. "A majority of students still demonstrate characteristics that correspond to a concrete thinking level rather than use formal-reasoning principles that Piaget ascribed to adult thinkers" (de Sanchez, 1995, p. 72).

Jean Piaget (1896-1980) created what is considered the most established theory of cognitive development. According to Piaget, humans go through four stages of cognitive development. The developmental stages are nativistic (biological) and hierarchical and represent states through which each individual must pass (Huitt, W. & Hummel, J., 2003; Sandwell, J., 2003):

Sensorimotor stage (0-2). During this infancy stage, behavior is reflexive and goal-directed (mobility). Around 7 months of age, children acquire *object* *permanence*—the ability to know that physical objects remain in existence even when out of view (memory). At the end of this stage, symbolic abilities develop (language).

Preoperational stage (2-7). During this toddler and early childhood stage, the child acquires *representational* skills and is able to use symbols to represent knowledge. Language and imagination develop. Thinking is primarily egocentric; the child is able to view the world only from her perspective.

Concrete operational stage (7-12). A child in this stage develops a number of conservation tasks—number, length, liquid, mass, weight, area, and volume. Egocentric thought diminishes; the child is able to take another point of view. Operational thinking develops which means the child is able to understand concrete problems, but is not able to think abstractly.

Formal operational stage (adolescence and adulthood). At this stage, formal reasoning is the ability to think abstractly, theoretically, logically, and systematically. In the formal operational stage, one is able to imagine possibilities.

According to Huitt & Hummel (2003) Piaget's theory has been criticized on the following issues:

1. The abilities of children are underestimated due to limitations of Piaget's methodology (descriptive case studies). Some children

are able to reach pre-operational or concrete operational stages earlier than Piaget originally formulated.

2. Data does not support that children automatically move from one developmental stage to another as they naturally (biologically) mature.
3. He overestimated the abilities of some adults. Some adults never reach the formal operational stage. Only 30-35% of adults reach formal operations (Kuhn, Langer, Kohlberg & Haan, 1977 as cited by Huitt & Hummel, 2003).

Other studies also support the view that adults do not necessarily develop critical thinking skills as a natural part of development. According to de Sanchez (1995), Arons (1979) and Whimbey & Lochhead's (1986) studies found that students "have difficulty in defining and resolving problems, changing focus, considering alternatives, and defining strategies" (p. 73). The deficiencies in thinking skills may be attributed to instruction emphasized by memorizing unrelated and disconnected bits of information, resulting in superficial learning, which is easily forgotten. Students conditioned in this type of learning often build "weak, rigid, and stereotyped thinking schemata, which results in stagnation, routine and superficial intellectual designs, and low cognitive levels" (de Sanchez, 1995, p. 73).

Transfer of critical thinking to other domains

Transfer of critical thinking is problematic from one discipline domain to another (Garnham & Oakhill, 1994). Generalization of cognitive abilities is rare; transfer usually occurs within the field it was originally learned (Garnham & Oakhill, 1994). Difficulty in transfer may be due to poorly planned instruction which has not been designed to facilitate such transfer (de Sanchez, 1995; Pithers, 2000). An instructional emphasis on generalizability of critical thinking skills to other tasks will enhance the transfer of good thinking across a variety of disciplines (Cowan, 1994). Programs promoting critical thinking should "regard critical thinking as a general skill that must be deepened within different subject matters or contexts" (Astleitner, 2002, p. 55). With appropriate emphasis on transfer of skills across domains, the problem of critical thinking transfer becomes a moot point. In fact, several empirical studies support the conclusion that critical thinking is transferable across academic domains when instructional design includes and emphasizes transferability (Hermstein, Nickerson, de Sanchez, & Swets, 1986; Mayer, 1992; Mestre, Dufresne, Gerace, Hardiman, & Tougher, 1992 as cited by Halpern & Nummedal, 1995, p. 82).

Dispositions needed for critical thinking

Students do not necessarily "come to the table" with the propensity to be critical thinkers. Traditionally classroom teachers have rewarded the quiet, compliant non-thinker (Pithers, 2000); however, a *critical spirit* is needed to "initiate, sustain, and improve critical thinking activities and make them habitual" (Passmore, 1967 as cited by Halonen, 1995, p. 77). Certain propensity elements enhance good thinking.

The disposition to question is an attitudinal factor which influences critical thinking. Some students have expressed they feel they need permission to be critical due to social conditioning which teaches that being critical of others is socially impolite. Other attitudinal factors or "intellectual and moral virtues" which promote critical thinking include intellectual humility, intellectual courage, integrity, empathy, perseverance, fairmindedness, and confidence in reason" (Paul, 1990 as cited by Halonen, 1995, p. 77). The ability to persist at a task, monitor the thinking process, maintain an open mind, and work cooperatively with others is also necessary (Halpern & Nummedal, 1995, p. 82). Drawing unwarranted assumptions carefully and weighing credibility of evidence are broad dispositions conducive to critical thinking (Ennis, 1993 as cited by Pithers, 2000). The ability to tolerate ambiguity is also necessary (Langer, 1997 as cited by Pithers, 2000; Wade, 1995). Critical thinking also involves affect. During the cognitive process, critical thinkers may feel anxiety, fear, and confusion which may facilitate the disequilibrium necessary for triggering critical thought. Conversely, critical thinkers may feel relief and exhilaration when they learn to think in novel ways (Brookfield, 1987 as cited by Halonen, 1995). Physiological readiness is required for students to become engaged in the learning task. The state of critical thinking may be influenced positively or negatively by physiological factors such as hunger and fatigue (Halonen, 1995). In collaboratived conference-style learning, students have the opportunity to experience the interpersonal context as they learn to respect the thoughts of others. "The best critical thinking requires not only questioning, judging, and arguing, but also respecting the impact of one's own intuitions and those of others" (Underwood & Wald, 1995, p. 18).

In summary, several dispositions enhance critical thinking; these items should be explicitly addressed in an undergraduate curriculum designed to promote critical thinking (Halonen, 1995). Figure 2 below represents a summary of these aforementioned elements:

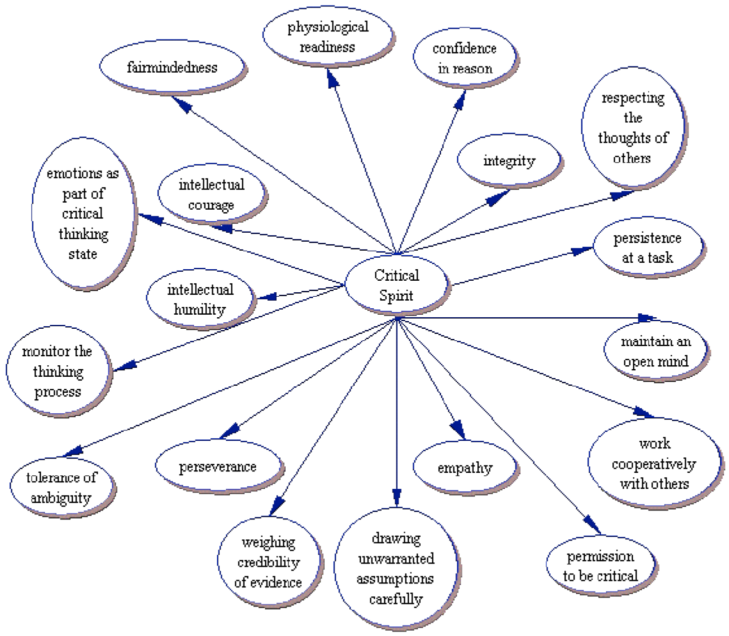

Figure 2. Dispositions for Critical Thinking

Metacognition

Self-regulation of thinking is another important element of critical thinking discourse (Schunk & Zimmerman, 1994 as cited by Pithers, 2000). Metacognition should be explicitly addressed in a curriculum designed to promote critical thinking. "Metacognition is the capacity to monitor the quality of critical thinking process, product, and changes in the thinker through developmental self-assessment" (Halonen, 1995, p. 80). In addition to content goals, process goals must also be explicitly established and evaluated to emphasize the learning benefits and effectiveness of being aware of and refining one's thinking processes (Blakey & Spence, 1990). Basic metacognitive strategies include the following:

1. Connecting new information to former knowledge.
2. Selecting thinking strategies deliberately.
3. Planning, monitoring, and evaluating thinking processes. (Dirkes, 1985 as cited by Blakey & Spence, 1990, p. 1)

Specific strategies for developing metacognitive behaviors are as follows:

1. Identifying "what you know" and "what you don't know."
2. Talking about thinking.
3. Keeping a thinking journal.
4. Planning and self-regulation.
5. Debriefing the thinking process.
6. Self-evaluation. (Blakey & Spence, 1990, pp.1-2)

Emphasizing metacognitive strategies within an environment designed to foster critical thinking not only improves students' thinking skills but also prepares students with a lifelong proclivity to help them successfully manage new situations in our rapidly changing world. Having the opportunity to observe experts as they expressly model cognitive processes and then incorporating some of those same processes within one's cognitive framework may ease the student's journey from novice to expert. "The importance of metacognition for education is that a child is, in effect, a universal novice, constantly confronted with novel learning tasks…It is possible to teach children metacognitive skills and when to use them. If we can do this, we will be able to help children become intelligent novices; we will be able to teach them how to learn" (Bruer, 1993, p. 38).

Teaching Approaches to Inhibit or Promote Critical Thinking

Some teaching behaviors may inhibit critical thinking. Raths, Wasserman, Jonas, & Rothstein (1966) purported that the opportunity for students to think well is hindered when a teacher--

- Simply agrees or disagrees with students
- Just demonstrates and explains
- Cuts off student responses
- Uses reproof rather than praise
- Shakes learner's confidence in the value of new ideas
- Uses mostly retrieval or recall types of questions (Pithers, 2000)

The opportunity for students to think well is furthered when a teacher—

- Presents content mindfully
- Teaches from multiple perspectives
- Explores themes in wider perspectives
- Focuses on linkages and similarities of content
- Promotes student discussion
- Models ways of thinking
- Emphasizes verbalization of metacognitive strategies

- Makes students thought processes explicit and visible
- Challenges students' ideas
- Questions students' assumptions
- Encourage students to reflect on strengths and weakness of thinking processes they are using
- Provides an active student-centered learning environment
- Emphasizes problem-solving
- Scaffolds students' attempts to understand and use concepts
- Provides students the opportunity to work collaboratively (Bliss, Askey & Macrae, 1996; De Corte, 1996; Langer, 1997; Perkins, 1993; and Raths et al., 1966 as cited by Pithers, 2000)

Scaffolding

Successful teachers of higher level cognitive strategies frequently employ the use of scaffolds to support students as they learn and practice new cognitive strategies (Rosenshine & Meister, 1992). "Scaffolds are forms of support provided by the teacher (or another student) to help students bridge the gap between their current abilities and the intended goals" (Rosenshine & Meister, 1992, p. 26). Examples of scaffolds are checklists, concrete prompts, cue cards, hints, guided practice, think-alouds, simplified problems, and models. The use of scaffolds supports Vysgotsky's (1978) "zone of proximal development."

> Vygotsky [a well-renowned Soviet psychologist] identified this zone as a sort of gap or the difference between what a learner cannot do alone yet can do with help from a teacher or more capable peer. The basic tenet of this construct is that tasks that learners can initially do only with assistance, they come to do independently as they incorporate the structure or the scaffolding of the assistance. Scaffolding suggests moveable and malleable supports that are faded when superfluous" (McCaslin & Hickey, 2001, p. 236).

Concrete prompts or procedural facilitators (McCaslin & Hickey, 2001) scaffold students as they are learning a new cognitive strategy and are general enough to transfer to other learning contexts. Scaffolds should be "at a middle level of specificity…they provide support for the student, but they do not specify each and every step to be taken… [This middle level] lies somewhere between the specificity of behavioral objectives that seemed overly demanding to some, and the lack of instruction that many criticized in discovery learning setting. Perhaps it is the beginning of a synthesis" (Rosenshine & Meister, 2001, pp. 32-33). Providing question stems scaffolds students as they learn the strategy of generating questions. Providing a list of procedures for students to follow as they learn the strategy of problem-solving is another example of scaffolding4.

Scaffolds are faded as students become more proficient in the cognitive strategy being taught. "Thus, the responsibility for learning shifts from the teacher to the student. This gradual decrease in supports and gradual increase in student responsibility has been described as a shift in the teacher's role from that of coach to that of supportive and sympathetic audience (Palincsar & Brown, 1984 as cited by Rosenshine & Meister, 1992, p. 31).

Social Dimension

"Critical thinking and problem-solving in the workplace, or in life, are not isolated activities. Usually it is influenced by the context and culture in which it is 'situated'" (Pithers, 2000, p. 247). Designing learning environments to facilitate the development of high level cognitive skills requires the consideration of social dimensions. For example, Notar, Wilson, & Ross (2002) describe thirteen interdependent design factors crucial for consideration when designing a collaborative networked environment for the development of higher-level cognitive skills.

1. Embed learning activities in an overarching scenario.
2. Employ rich learning activities.
3. Use pictures, not text, to the extent possible.
4. Embed the data needed to solve problems in the learning context.

5. Have students provide ‘story’ resolutions before they are exposed to ‘expert’ solutions.
6. Support multiple links among concepts.
7. Present knowledge from multiple perspectives.
8. Use active learning techniques.
9. Stimulate the collaborative process by presenting problems so complex that students must work together to solve them.
10. Support continual self-assessment.
11. Provide support at critical junctures to push students past current limitations.
12. Expose students to expert performance.
13. Provide pairs of related stories (vignettes) to learning to establish transfer outside the macrocontext. (pp. 642-647)

These design factors are based on a constructivist approach to learning where the teacher “must become a facilitator, collaborator, and guide who makes instruction learner centered” (Notar et al., 2002, p. 643).

CONSTRUCTIVISM

Constructivist learning theorists, researchers, and practitioners embrace the concept of active learning and emphasize the dynamic nature of learning and construction of knowledge. “Constructivism is fundamentallynonpositivist…Rather than behaviors or skills as the goal of instruction, concept development and deep understanding are the foci; rather than stages being the result of maturation, they are understood as constructions of active learner reorganization" (Fosnot, 1996, p. 10).

Constructivist learning is based on the pioneer work of psychologists Jean Piaget and Lev Vygotsky:

> In brief, these men maintained that learners construct their own knowledge and that teachers don't just transfer knowledge to learners…Piaget (1976) focused on the personal construction of knowledge in works such as *To Understand is to Invent,* and Vygotsky (1986) emphasized the social construction of meaning with *Thought and Language*. They both accepted the intimate relationship of individual and interpersonal learning and recognized the power of "reflective abstraction" and "shared reflection" (Gagnon & Collay , 2001, p. xiv).

Driscoll (2000) further demonstrated the complex origin of constructivism by referring to the influences of "the cognitive and developmental perspectives of Piaget, the interactional and cultural emphases of Bruner and Vygotsky, the contextual nature of learning [situated cognition]…[the] philosophies of Dewey

(1933) and Goodman (1984), and the ecological psychology of Gibson (1977)" as well as the influences of "Ernst von Glasersfeld (1984, 1991, 1995) and the work of Thomas S. Kuhn on scientific revolutions and paradigms" (p. 375). Driscoll further illustrates the complexity of constructivism as follows:

> There is no single constructivist theory of instruction. Rather, there are researchers in fields from science education to educational psychology and instructional technology who are articulating various aspects of a constructivist theory. Moreover, constructivism is only one of the labels used to describe these efforts. Its use probably stems from Piaget's reference to his views as 'constructivist' and Bruner's conception of discovery learning as 'constructionist'. Other labels include generative learning (CTGV, 1991a, 1991b; Wittrock, 1985a, 1985b), embodied cognition (Johnson, 1986; Lakoff, 1987), cognitive flexibility theory (Spiro, et al., 1991, 1995), and postmodern and poststructural curricula (Hlynka, 1991; Culler, 1990) [as well as] situated cognition (pp. 375-376).

As one can see, constructivist learning theory encompasses a number of epistemological positions. In an attempt to "construct order out of the chaos in the literature," Kanuka & Anderson (1999) reviewed the narrative literature on constructivism and categorized constructivist learning theory along two continuums. One continuum is the reality dimension, with reality being viewed as objective on one end and with reality being defined subjectively on the other end. The other continuum is the knowledge dimension, with knowledge viewed as a social construction on one end and an individual construction on the other end of the continuum. Based on these continuums, Kanuka & Anderson further categorized constructivism into four distinct identities: co-constructivism (social constructivism), cognitive constructivism, situated-constructivism, and radical constructivism. Each of the 'constructivisms' are defined as follows:

> Co-constructivism – knowledge is negotiated through conversation and conversation, in turn, is the external reality (Vygotsky's social constructivism).
>
> Cognitive constructivism – knowledge is an external reality that is constructed through internal conflicts within the individual (Piaget's assimilation and accommodation).
>
> Situated-constructivism – knowledge is constructed socially, though everyone has different social experiences

resulting in multiple realities conflicts (Spiro's cognitive flexibility theory).

Radical constructivism – knowledge is constructed individually based on an individual's unique experiences; there is no one objective reality. (Kanuka & Anderson, 1999, Figure 1)

Another author also attempted to clarify the complex nature of constructivist learning theory. Heath (2000) synthesized information gleaned from her literature review of the following experts of constructivism: Brown, Collins & Duguid, 1989; Duffy and Jonassen, 1992; Brooks & Brooks, 1993; Duffy & Cunningham, 1996; Jonassen, 1996; and Maddux et. al 1997. She identified six basic principles of constructivist learning.

1. Learners bring unique prior knowledge, experience, and beliefs to a learning situation.
2. Knowledge is constructed uniquely and individually, in multiple ways, through a variety of authentic tools, resources, experiences, and contexts.
3. Learning is both an active and reflective process.

4. Learning is a developmental process of accommodation, assimilation, or rejection to construct new conceptual structures, meaningful representations, or new mental models.
5. Social interaction introduces multiple perspectives through reflection, collaboration, negotiation, and shared meaning.
6. Learning is internally controlled and mediated by the learner. (p. 654)

Jonassen (2003) contended that for learning to be meaningful, a constructivist learning environment should be active, constructive, collaborative, intentional, complex, contextual, conversational, and reflective. Individuals learn when they are *actively* engaged in a learning task and are responsible for their own learning. They learn through negotiation and manipulation of tools and objects encountered in the learning situation. Individuals *construct* knowledge as they integrate new concepts with existing ideas. They continuously renegotiate meaning as their learning becomes more and more complex. Individuals naturally look to others for support during learning. *Collaborative* learning environments promote deep learning. "All human behavior is goal directed" (Schank, 1994 as cited by Jonassen, 2003). Individuals should be supported in clearly identifying their cognitive goal or *intention* of learning. Individuals naturally learn within the context of an experience. Authentic, real world problems are most often *complex* and ill-structured. These problems require investigation and scrutiny from multiple perspectives. Acknowledging and facilitating the *contextual* nature of problems helps to avoid conceptual oversimplifications by the learner and promotes transfer of knowledge (cognitive flexibility). "Learning is inherently a social dialogical process" (Duffy & Cunningham, 1996 as cited by Jonassen, 2003). Individuals naturally look to others as they learn, seeking multiple perspectives and viewpoints. Knowledge is negotiated within *conversations*. Technologies can afford individuals the opportunity to converse with others within a knowledge building community. Monitoring one's cognitive processes and cognitive strategies enhances meaningful learning. This *reflective* process assists individuals in transferring their knowledge to new situations.

Implementing a well-designed collaborative learning experience is a powerful way to accommodate the complex processes involved in constructivist learning (Gagnon & Collay, 2001). Constructivism emphasizes the importance of assessing students' prior knowledge to identify students' preconceptions and misconceptions. This critical information, consequently, influences the design of the learning activity (Driscoll, 2000; Gagnon & Collay, 2001). Constructivism also emphasizes the contextual nature of learning and stresses that the source of knowledge lies in real-world contextual experience (Bednar, Cunningham, Duffy, & Perry, 1992). "Case studies provide one such opportunity to enhance learning through the examination of real life situations tailored to raise those issues that are important for learners to consider" (Boyd, 1980 and Dixon, 1991 as cited by Kanuka & Anderson, 1999, p. 8).

CONSTRUCTIVIST LEARNING STRATEGIES

Popular constructivist learning strategies include problem-based learning, project-based learning, and case study learning. These contemporary instructional strategies share the assumption that individuals construct knowledge as they actively engage in complex and relevant learning environments and socially negotiate meaning and view issues from multiple perspectives (Driscoll, 2000). Problem-based, project-based, and case-based learning are terms that are often used interchangeably, although there are discernible differences in these instructional strategies. It is helpful to examine their differences, particularly when considering instructional design principles related to these instructional strategies.

Problem-based learning is rooted in medical education. In its traditional form, students work collaboratively in small groups to practice the skills of inquiry they will be using in a clinical setting. Students learn "on demand" as they are exposed to the content for the first time as they attempt to solve a patient's case (real or hypothetical). The analytical cognitive processes involved are the focus of learning and instruction (Rodgers, Cross, Tanenbaum & Tilson, 1997).

Project-based learning is centered on the completion of a project and is most often associated with K-12 classrooms. The assumption is that students will naturally encounter problems as they complete a project related to the subject being studied, affording them the opportunity to problem-solve and learn theoretical concepts associated with the project (Esch, 1998). One disadvantage of project-based learning is that often teachers and students get so "caught up" in the doing of the project, they lose sight of the learning objectives. To avoid this tendency, Barron et al. (1998) recommend pairing project-based learning with problem-based learning. Initiating the learning episode with a problem *anchors* the instruction and maintains focus on the learning objectives. The problem "sets the stage" for the project.

Case-based learning and problem-based learning are instructional pedagogy approaches that are often confused. Although cases are often used in both case-based and problem-based learning, their primary distinction lies in the sequencing of the case and the course content. In problem-based learning, students are exposed to the case *before* they've learned the content. The case problem initiates the learning. Students investigate, research, and learn information "on demand" as they grapple with issues related to the case. In contrast to problem-based learning, in case-based learning, students are exposed to the problem case *after* they've received instruction (Rodgers, et al., 1997).

Case-based instruction is rooted in legal education and has most often been used in the teaching of law (Williams, 1992), business (Benbunan-Fich, 1999), and medicine (Rodgers et al., 1997; Thomas, O'Connor, Albert, Boutain, & Brandt, 2001) in higher education. Case-based learning is being used more frequently in teacher education to allow preservice teachers the opportunity to link theory with practice (Andrews, 2002; Gibson, 1998; Levin, 1996). "Case teaching equips pre-service students for teacher roles that require higher levels of confidence, resourceful team players, and competent problem solvers" (Gibson, 1998, p. 346).

Traditionally case-based learning in legal education involves teacher-led, large group discussion of adjudicated cases organized around the basic laws being studied in class (Williams, 1992); however, case-based instruction may be employed in virtually any discipline to engage students in higher order reasoning and deep learning of theoretical principles. Within the broader context of using case based learning in a variety of disciplines, case-based instruction may be appropriately defined "as an active-learning pedagogy designed for problem analysis and problem-solving, stressing a variety of viewpoints and potential outcomes" (Cranston-Gingrass, Raines, Paul, Epanchin, & Roselli, 1996 as cited by Andrews, 2002, p. 28). Well-designed case-based learning (CBL) promotes higher order reasoning skills (Andrews, 2002; Benbunan-Fich, 1999; Klemm, 2002; Levin, 1996; McDade, 1995) and supports the main tenets of constructivist learning theory according to Jonassen's (2003) aforementioned components: active, constructive, collaborative, intentional, complex, contextual, conversational, and reflective.

Case-based learning provides a relevant context for student learning and is supported by two contextual learning theoretical models: cognitive apprenticeship and anchored instruction. Cognitive apprenticeship (Collins, Brown, & Newman, 1989) "emphasizes the social context of instruction and draws its inspiration from traditional apprenticeships" and anchored instruction (Bransford, Sherwood, Hasselbring, Kinzer, & Williams, 1990) "provides a model for creating problem contexts that enables students to see the utility of knowledge and to understand the conditions for its use" (Williams, 1992, p. 367).

Case study learning affords students the opportunity to apply their content knowledge as they analyze authentic and complex real-world problems. Case studies provide complex ill-structured problems to stimulate critical thinking and focus student thinking. According to King & Kitchener's Reflective Judgment Model (1994), consideration of the "problem structure" is essential when designing contexts for learning. Problems may be defined as being either well-structured or ill-structured. Well-structured problems may be solved with a high degree of certainty; whereas, ill-structured problems may not be solved with such a high degree of certainty and require a more complex reasoning process. Ill-structured problems are preferable in assessing critical thinking skills in adults, because they are similar to "real-world problem solving of adults" (King, 1994, p. 11). King & Kitchener (1994) "endorse Dewey's (1933, 1938) contention that true reflective thinking is uncalled for unless real uncertainty exists about the possible solution(s) to a problem" (p. 11).

Well-designed case study learning promotes reflection, a critical component of adult learning (Daudelin, 1996 and Siebert, 1999 as cited by Rosier, 2002). Requiring students to write reflective reports *after* individual case analysis and group discussion of the case deepens the adult learning experience and encourages transfer of learning to other settings. Writing reflective reports encourages independent learning and shifts the responsibility of finding "real world" relevance to the student (Rosier, 2002).

Case-based learning is appealing within the context of undergraduate students in higher education and a fifteen-week time constraint. Case-based learning promotes "higher cognitive skills of application, analysis, synthesis, evaluation, metacognition, conscientization, and reflection…[and] can help students learn to grow and become proactive in a dynamic environment. Critical theorists state that students and teachers should develop their own voice, be empowered to think, and learn to question—in a process called conscientization" (Wink, 2000, p. 37 as cited by Wood & Anderson, 2001, p. 1).

The cases used in this study were a blending of case-based instruction and problem-based learning according to Williams' (1992) criteria. Similar to traditional case instruction found in legal education, the cases were organized around basic concepts studied in class and were initially teacher-led as a way of modeling the critical thinking process. The cases followed the content. Like problem-based learning, the analytic process used in examining the cases was circular— with the students hypothesizing various resolutions to the problem and evaluating the effectiveness of the resolutions individually (control group) or within their student-directed collaborative groups (treatment group). Student reasoning was tracked and documented through the use of a web-based problem-solving template. Similar to both case-based instruction and problem-based learning, the cases were used to motivate, focus and initiate students' learning, as well as to teach thinking skills in a contextualized way.

Case-based instruction allows for design flexibility in a variety of disciplines. Real or hypothetical cases may be used to link theory with practice. To stimulate critical thinking in this study, case studies from *Handbook of Academic Learning: Construction of Knowledge* (Phye, 1997) were modified and used to simulate students' problem-solving cognitive processes, as well as case studies in *Motivation and Learning Strategies for College Success: A Self-Management Approach* (Dembo, 2000). The modified case studies correlated with the learning frameworks course content and were specifically related to the concepts and strategies being studied: self-motivational techniques, self-regulatory methods and time management, self-regulation of performance, and regulating one's physical and social environment. These case studies are considered "ill-formed" problems according to King & Kitchener (1994). They are common self-regulation issues faced by many undergraduate students, and they provide the students an authentic opportunity to think critically about the subject content. "The goal of authenticity is to prepare students to do the kinds of complex tasks that occur in life" (Collins, 1996, p. 348). Case study examples may be found in *Appendix E.*

COLLABORATIVE LEARNING

Collaborative learning may be defined as "a learning process that emphasizes groups of cooperative efforts among faculty and students. Collaborative learning stresses active participation and interaction on the part of both students and instructors" (Hiltz, 1997 as cited by Clark, 2001, p. 120).

Barron (2000) eloquently referred to collaborative learning as "perhaps one of our most important human resources" (p. 19). Barron explained how this “central form of human activity” is being “capitalized on more explicitly in school and work settings” (p. 2) and explained the complexity of various processes involved in group problem solving. “By asking learners to make sense of a problem together, they are faced with challenges of establishing common frames of reference, resolving discrepancies in understanding, negotiating issues of individual and collective action, and coming to joint understanding” (Miyake, 1986; Roschelle, 1992 as cited p. 2).

Students working collaboratively towards a common goal may be considered a “community of practice” (Johnson, 2001). The benefits of developing communities of practice are notable. Within communities of practice, groups of individuals with different levels of expertise work simultaneously on a common goal. The individuals working within communities of practice progress from novice to expert as they participate in authentic tasks and communication. “The sum of community knowledge is greater than the sum of individual participant knowledge (Gherardi & Nicolini, 2000). Bielaczyc & Collins (1999) acknowledge this symbiosis by noting that the collective knowledge of the group advances, while simultaneously advancing the individual’s knowledge” (Johnson, 2001, p. 4).

Gokhale (1995) found significant gains in the critical thinking skills of forty-eight industrial technology students who worked collaboratively compared to students who learned about series and parallel dc circuits individually, although both groups performed equally well on drill and practice exercises. According to Gokhale, "the group interaction helped students to learn from each other's scholarship, skills, and experiences. The students had to go beyond mere statements of opinion by giving reasons for their judgments and reflecting upon the criteria employed in these judgments" (p. 6).

Klemm (2002) purported the advantages of group-based case studies. In his neuroscience class, senior-level undergraduate students collaboratively analyze research articles in heterogeneous small-group teams. "For each case study, a group grade provided incentive to do good work….Work quality distinctly improved with each successive journal article assignment, as students learned how to help each other" (p. 301). Klemm's students used an asynchronous computer conferencing environment to support their collaborative analysis process.

In a study comparing the effectiveness of synchronous with asynchronous computer mediated communication technologies, Veerman & Velduis-Diermanse (2001) contended that "from a constructivist perspective, collaborative learning can be viewed as one of the pedagogical methods that can stimulate students to negotiate information and discuss complex problems from different perspectives" (p. 1). The authors found that asynchronous computer-mediated communication systems “provide student groups with more options to think and reflect on information, to organize and keep track of discussions and to engage in large-group discussions compared to synchronous media” (p. 1).

Within their examination of the design of collaborative learning contexts, Palincsar & Herrenkohl (2002) emphasized the usefulness of cognitive tools and intellectual roles (CTIR) in support of managing the complexities of collaborative learning. Herrenkohl & Guerrs (1998) and Herrenkohl, Palincsar, DeWater, & Kawasaki (1999) have indicated that the use of these tools accomplished the following:

1. supported classroom dialogue
2. advanced student theorizing
3. influenced student thinking about the nature of scientific problem-solving, and
4. promoted conceptual understanding (Palincsar & Herrenkohl, 2002, p. 5).

INCREASED USE OF TECHNOLOGY IN EDUCATION

Computer-based technology is being used more frequently to support learning in education. Traditionally technology in education has been used to transmit information or tutor students. Jonassen (1995) contended that technology is most effectively used in education when students learn *with* technology, not *from* it:

> Applications such as databases, spreadsheets, semantic networks, expert systems, multimedia/hypermedia construction, can function as computer-based cognitive tools that function as intellectual partners with learners to expand and even amplify their thinking, thereby changing the role of learners in college classrooms to knowledge constructors rather than information reproducers (p. 40).

Jonassen (1995) further posited that using computers as cognitive tools facilitates the development of critical thinking skills and higher order learning, as well as supports the tenets of constructivism.

According to Pellegrino (1995), technology serves three roles in the support of critical thinking. First, as an *information source*, technology provides "information embedded in multiple representation forms" requiring students to "use information intelligently to support their search through the parameters of a problem in order to navigate their way to a desired goal" (p. 11). Second, as a *generative tool*, students may "use technology to relieve complex processing demands so that they can focus on finding solution paths, instead of using their limited information-processing resources to maintain information in working memory" (p. 11). Third, as *communication support*, various technologies "such as electronic networks, shared data base systems, electronic mail, bulletin boards, desktop videoconferencing, and other dialogue and information exchange systems” support the expression of students in “the fundamental focus in problem-solving process…and make their thinking ‘visible’ to others as well as to themselves” (p. 12).

Edelson, Gordin, & Pea (1999) emphasized how technology supports inquiry-based learning by referring to Blumenfeld et al. (1991) six contributions of technology to learning:

1. Enhancing interest and motivation
2. Providing access to information
3. Allowing active, manipulable representations
4. Structuring the process with tactical and strategic support
5. Diagnosing and correcting errors
6. Managing complexity and aiding production. (p. 4)

Current networked technology supports the management of complex collaborative learning. For example, online discussion boards provide students a virtual space to dialogue with others as they solve complex problems and construct knowledge through negotiation. “Constructive discussions in this context involve information exchanges in which information is constructed through addition, explanation, evaluation, transformation or summarizing” (Veerman, Andriessen, & Kanselaar, 1999, p. 1). Threaded discussions provide students with a written transcript of their conversation. Having a text-based record of the discussion eases the cognitive load involved in referencing, searching, and updating the conversation. The written format of the conversation allows for deep reflection and revision of ideas. “Because most collaboration is text-based, norms are reduced, enabling introverted participants to share their ideas on an equal footing with extroverts” (Johnson, 2001, abstract). The text-based record also makes students’ tacit knowledge public. Faulty thinking, naïve conceptions, and errors in understanding are likely to be found and corrected (Klemm, 2002).

Asynchronous learning networks, such as discussion boards, also allow students the flexibility to collaborate with others outside of the classroom, virtually at any time. The asynchronous component provides students extended think time as they compose and type their conversations, favoring deep reasoning and thoughtful responses. The record of the discussion eases the assessment process, providing documentation of student participation (Kemery, 2000). The written dialogue promotes pride of ownership (Klemm, 2002).

COMPUTER-SUPPORTED COLLABORATIVE CASE-BASED LEARNING AND CRITICAL THINKING

The following studies explored the use of technology as a communication tool to support complex collaborative learning. These studies raise several issues that are important to consider when investigating case study learning environments. For example, the following study illustrated the importance of careful instructional design to maximize the benefits of computer-mediated communication in support of case based learning.

Levin (1996) compared face-to-face (FTF) case discussions with computer-mediated discussions using Group Decision Design Software (GDSS) with twenty-six undergraduate preservice teachers, all of whom were experienced with case study learning. GDSS software was “originally designed for decision-making in the business world” (p. 20) and was designed for anonymous and synchronous communication among participants. According to the author, content analysis of the controversial case study analyses revealed that FTF discussions were more beneficial than the computer-based discussions. According to her findings, the author concluded that leaderless case discussions may actually become miseducative, and the anonymous aspect of the GDSS software may be detrimental to learning. “The opportunity to express one’s beliefs without question or challenge, and without having to explain and take ownership of these ideas, may be too seductive and also miseducative in this situation” (p. 22). This study illustrated the importance of ensuring individual accountability in the design of a learning task to prevent potential negative influences of anonymity in a discussion, particularly involving controversial issues. What if students had used a conferencing technology that supports threaded discussion that visually documents and identifies each individual’s contributions to the forum? How would the study's key results been influenced if students had been clearly instructed in appropriate online dialogue etiquette?

Ocker & Yaverbaum (1999) also compared face-to-face (FTF) with computer-mediated collaborative case study analysis (CSCL). The investigators assessed learning effectiveness and student satisfaction among forty-three Harvard graduate business students. Assessment of learning effectiveness included grading of a group case analysis report, and assessment of student satisfaction was measured with a post experience questionnaire. The investigators found no difference in learning effectiveness between the FTF and CSCL groups, yet students' process satisfaction was greater with FTF. Based on these findings, the authors recommended several ways to increase student satisfaction with CSCL:

1. Increase students' exposure to the use of asynchronous technologies.
2. Better educate students regarding the benefits of using asynchronous technologies.
3. Increase technical support for computer-mediated communication.

This study poses several interesting questions. Would the results be different if the participants had been undergraduate students, instead of more mature working graduate students? Would the investigators have found a difference in the learning effectiveness under the two conditions if assessment of learning effectiveness had been based on individual participant's learning instead of based on a group case analysis report?

Another study addressed the learning effectiveness of computer-supported collaborative case-based learning among thirty-six geographically disparate undergraduate social studies education students. Dawson, Mason, & Molebash (2000) analyzed the content of the computer-mediated threaded discussions, student reflections, and instructor reflective journals. "Findings suggest that this activity fostered the development of knowledge related to general and content-specific teaching issues, helped expand the learning community of geographically disparate educators, provided a bridge between theory and practice, and fostered reflection" (p. 1). This study was conducted with students who had elected to take the course solely online. Would the results have been different if the students were participating in a traditional face-to-face class and using computer-mediated collaborative case study learning to reinforce class concepts?

Another study also found computer-supported collaborative case-based learning to be advantageous in bridging theory with practice. Benbunan-Fich & Hiltz (1999) compared the effectiveness of case study learning with one hundred and forty undergraduate students enrolled in a computer science course under four conditions:

1. individual/manual (IM) – students solved cases individually in an open-book in-class exercise
2. individual/online (IO) – students posted solutions to cases individually in a computer conferencing environment; after solutions were posted, students were allowed to read others' answers
3. group/manual (GM) – students solved cases face-to-face in small groups
4. group/online (GO) – cases were solved collaboratively by a group of students, solely online

As the authors hypothesized, "groups who used an ALN [asynchronous learning network] to discuss and solve a case study submitted better and longer solutions than their counterparts but were the least satisfied with the process. In fact, the combination of teamwork with the use of an ALN results in better and longer reports than if only one of these factors is present, but negatively affects process satisfaction " (p. 14).

The investigators concluded that ALN effectively supports collaborative case analysis, likely due to the visibility of responses and time for deep reflection afforded by the asynchronous technology. Process satisfaction was lower among students working online than students working manually:

> Consistent with the literature (Wilson, et al., 1997), online groups were the least satisfied with the process due to the nature of asynchronous

> interaction, characterized by delayed feedback (Rice, 1984) and "login-lags" (Dufner, et al., 1994)…Groups working in an asynchronous environment had more difficulties coordinating the distribution of work and had to work harder than face-to-face groups (Galegher & Kraut, 1994). Since no other means of communication was allowed, it was up to each team to decide when to stop waiting for absent members (Smith & Vanecek, 1988, p. 14).

To compensate for student dissatisfaction with the process, the authors suggested that ALN designers should "provide effective coordination tools (such as agenda, voting, and polling) for structuring asynchronous interaction and overcome the inherent limitations of the medium" (Dufner, et al., 1994, p. 15).

The participants in this study were computer science majors, and the students who participated in the online treatment were older and had more work experience than the students who participated in the manual treatment conditions. How would the study have been influenced if the participants were not majors in computer science but were more heterogeneous in their comfort and experience with technology? Would it have made a difference if all participants had been enrolled in a face-to-face course and were using case study learning to augment face-to-face classroom instruction?

In a study similar to the one investigated in this experiment, Muukkonen, Lakkala, & Hakkarainen (2001) compared the progressive inquiry processes of thirty-four undergraduate university students enrolled in a psychology course on learning and thinking under two conditions: (1) traditional individual student writing assignments, and (2) computer-supported collaboration. The database postings of the technology groups (three small groups totaling seventeen students) and the learning logs of comparison groups (three small groups totaling seventeen students) were analyzed according to various components specific to a progressive inquiry process. No significant differences were found in the number of scientific explanations produced as anticipated, but qualitative differences were found in the inquiry process between the two groups. Students in the computer-supported collaborative condition produced more questions (problem category) and produced more metacognitive comments (metacomment category) than the comparison group. The traditional group produced more comments related to their own explanations than the computer-supported collaborative group. The authors concluded that optimal instructional strategies in progressive inquiry include a combination of computer-supported collaborative learning and individual reflection.

Like Muukkonen, Lakkala, & Hakkarainen (2001), this investigation compared the learning effectiveness between traditional individual case study analyses and case study analyses using computer-supported collaboration. The difference is that the focus in this study was case study learning rather than progressive inquiry. Instead of examining the cognitive processes involved in the learning task, assessment measured the depth of critical thinking displayed in students' individually written case analysis reports.

In consideration of the aforementioned studies and effective instructional design, specific elements related to implementing an effective technology-enhanced student-centered learning environment to support case-based learning will be discussed. Edelson, et al. (1999) identified five challenges associated with the design and implementation of technology-supported inquiry learning. The design challenges are characterized as follows: motivation, accessibility of investigation techniques, background knowledge, management of extended activities, and the practical constraints of the learning context. This study addressed each of these challenges according to Edelson's framework as follows:

Motivation. Students were actively engaged in the case study analyses due to the attraction of the authenticity of the real world context of the case studies. In addition to the interest in solving self-regulation issues that many college students face, a significant component of the course grade was the case study analyses.

Accessibility of investigation techniques. Students in this study were provided with an online case analysis template, guiding them through the various cognitive processes involved in problem-solving. *See Appendix C*.

Background knowledge. Students used the course textbook and lecture notes as their source of content knowledge to apply to the case study analyses.

Management of extended activities. Students were provided with a clear sequence of steps necessary to complete the case study analyses. *See Appendix D*. Other scaffolding entailed classroom discussion on various strategies to consider while completing the task such as time management, organization of materials, and effective navigation within the discussion board technology.

Practical constraints of the learning context. Students in the collaborative technology treatment group were instructed on effective navigation strategies for using discussion board. For example, students were instructed to use the problem-solving template headings as title labels for their threaded discussions, to assist in managing the complexities of online collaborative communication. "The use of textual labels offers a unique and powerful means to organize discussion, foster reflection, and categorize content" (Sloffer, Dueber, & Duffy, 1999, p. 11). Students were also instructed on how to sort and print their contributions to the discussion board to ensure individual accountability and assist in documentation for assessment purposes.

CHAPTER III

Research Methodology

Will computer-supported collaborative case-based learning effectively advance the critical thinking skills of undergraduate students enrolled in a learning frameworks course? This study compared the depth of critical thinking in case study analysis between two groups of students: students learning individually and students learning collaboratively using asynchronous computer-mediated technology. Prior to the case study learning, all participants completed a technology readiness survey to assess their current skill and comfort with the use of various technology applications. Upon completion of all case study learning assignments, participants completed a questionnaire designed to measure their satisfaction with the case study learning method in which they participated.

RESEARCH QUESTIONS

Research question #1: Will there be a significant difference in depth of critical thinking in case study analysis between students learning individually and students learning collaboratively using asynchronous computer-mediated technology?

Research question #2: Will students' perceived effectiveness of the critical analysis processes differ between students working individually and students working collaboratively using asynchronous learning network technology?

HYPOTHESES

Hypothesis #1: The depth of critical thinking will be higher in students analyzing case studies collaboratively using asynchronous CMC than in students analyzing case studies individually.

Rationale for Hypothesis #1: The benefits of collaborative learning including the opportunity to dialogue among peers will enhance learning effectiveness, as well as the extended think time for deep reasoning and reflecting upon the analytical process afforded by the asynchronous technology. The opportunity to view issues from multiple perspectives will enhance students' critical thinking skills. The architecture and collaborative nature of the discussion forum technology promotes metacognition and reflection as students type their thoughts and ideas and respond to and critique others' ideas.

Hypothesis #2: Students' perceived effectiveness of computer-supported collaborative case study analysis will be higher than students' perceived effectiveness of individual case study analysis.

Rationale for Hypothesis #2: This hypothesis is supported by the motivational aspect afforded to students working together and supporting each other as they engage in critical analysis of case studies. Using technology in a novel way may also motivate students as well.

EXPERIMENTAL DESIGN

A nonequivalent (pretest and posttest) control-group research design (Campbell & Stanley, 1963) was used. Figure 3 depicts the experimental design in a grid.

Effective Learning Classes/Groups	Pretest	Individual Case Analyses	Asynchronous CMC Case Analyses	Posttest
Group 1	X	X		X
Group 2	X		X	X

Figure 3. Experimental Research Design

The independent variable, the case study analysis method, had two treatment levels: (1) individual case study analysis, and (2) collaborative asynchronous computer mediated analysis. The treatment groups analyzed three case studies over a three-week period. The comparison group analyzed the case studies individually, and the experimental group analyzed the case studies collaboratively using asynchronous computer-mediated technology. Case study analyses were assigned as homework under both instructional methods. A holistic scoring rubric was used to measure the dependent variable, critical thinking, in the study.

RESEARCH PARTICIPANTS

The participants of this study were 83 undergraduate students enrolled in four sections of *EDP 1350: Effective Learning*, an elective course taught by this investigator during the Fall 2003 semester at Southwest Texas State University. The majority of students were beginning freshman, most of whom were on "PAS" contract status. PAS contract status means "predicted academic success" and pertains to students who are conditionally admitted to the university who are required to take this "Learning Frameworks" course as well as participate in other university services designed to improve student achievement. Other students enrolled in the course may be any undergraduate student who elects to take the course. Students from two sections of the course analyzed case studies individually; students from the remaining two sections analyzed case studies collaboratively, using Blackboard discussion board feature.

DATA COLLECTION INSTRUMENTS, VARIABLES, AND MATERIALS

Technology Readiness Survey

Among the set of skills required for online learning as identified by Wang, Kanfer, & Hinn (2001) are prior experience with technologies, prior attitudes toward technology, and prior online class experience. To assess participants' prior experience, a technological readiness survey was administered to all students.

Students with low technological readiness skills were paired with students with high technological readiness skills for the hands-on technology training. A modified version of Wang, Kanfer, Hinn, & Arvan's survey (2001) was used to assess students' readiness. See *Appendix A*.

Critical Thinking Stimulus

Case studies from *Handbook of Academic Learning: Construction of Knowledge* (1997) were modified and used to stimulate critical thinking (Phye, 1997), as well as case studies in Dembo's *Motivation and Learning Strategies for College Success: A Self-Management Approach* (2000). The case studies presented in Chapter Four: Self-Regulatory Dimensions of Academic Learning and Motivation written by Zimmerman & Risemberg (pp. 106-121), correlate with the learning frameworks course content and specifically relate to the concepts and strategies being studied: self-motivational techniques, self-regulatory methods and time management, self-regulation of performance, and regulating one's own physical and social environment. These case studies are considered "ill-formed" problems according to King & Kitchener (1994). They are similar to real-world self-regulation issues faced by many undergraduate students.

Case Study Analysis Diagnostic Pretest

Pretests were administered to all participants to measure their critical thinking skill level. The pretests were paper and pencil tests in which students analyzed a case study designed to prompt students' critical thinking. The essays were scored on a scale of one to four, based on Facione & Facione's (1994) holistic scoring rubric. The following script was used to introduce the diagnostic pretest:

We are now beginning the "application" stage of the course with case study learning. Analyzing case studies will give you the opportunity to apply the course content to student case scenarios. In order to identify your current critical thinking skills, you are being asked to analyze and respond to a case study. A Blue Book is provided for your answer. You may outline or diagram your response in the Blue Book before you actually begin writing. You may use your notes and text to help you answer the question. You will have the entire class period to complete this task.

The following case study prompt was used for the pretest:

<u>Analyze Student Behavior</u>

Suppose you were working at the university's student learning assistance center as a peer counselor. A student, Alan, comes to see you mid-semester to discuss his problems. Read the brief description of Alan and identify what you have learned to date that could be applied to his

> situation. What suggestions would you give to Alan related to his current situation? Please justify your suggestions.
>
> Alan is a freshman music major who is an accomplished bass player. He plays with a local band weekly at Cypress Creek Café. He is recognized by his peers as someone with a great deal of talent. His goal is to play professionally. He practices many hours a day and believes this activity is more worthwhile than taking general education courses. Alan believes he does not need a college education to attain his goal. His parents believe that the attainment of a college degree will benefit him throughout his life. He agrees to go to college to please his parents but is not very interested in some of his courses. As a result, his attendance is poor and his grades are especially low in English 1310 and History 1310.

To ensure interrater reliability, pretests were graded by the investigator and a colleague published in the field of critical thinking. Sixty-one percent agreement was reached initially; after discussion of those essays in question, one hundred percent agreement was reached.

Case Study Analysis Training

Following the pretest, students participated in large group instruction within the classroom setting to acquaint themselves with the cognitive analytical processes necessary for effective case study analysis. The pretest essays were returned to students. The students were then instructed to reread the case prompt and their prior responses to reacquaint themselves with the study. Case analysis templates (Paul & Elder, 2003) were given to students to complete working in pairs. The template was a paper copy of the web-based form students would be completing online in future assignments. *See Appendix C*. Students then shared and discussed their responses with the entire class. Large group discussion emphasized Paul & Elder's analytical steps:

1. Identify the problem.
2. What are the underlying causes and overt symptoms of the problem?
3. Identify any unstated assumptions you are making and determine whether they are justifiable.
4. Brainstorm and list several strategies for resolution of case.
5. Evaluate each alternative, and then choose and rank your top 3 strategies according to effectiveness.
6. List your top 3 recommendations and present a rationale for each.

Technology Training

Students received direct training on use of the web-based case study analysis template and the Blackboard discussion board feature within a university computer lab classroom. They were taught the following procedural skills:

Logging on to course website

Accessing and printing case study analysis template

Accessing the discussion board feature

Navigating within the Discussion Board

Using thread labels

Starting a new thread

Reading/replying to a message

Expanding/collapsing messages

Searching within a forum

Viewing forum archives

Printing discussion contributions (Blackboard, 1999)

All enrolled students have access to the university's courseware.

Case Study Learning Homework Assignments

All case study learning participants had one week to complete each of the three assignments, and all participants were required to complete the online web-based case study analysis template prior to completing the analyses. Participants in the comparison group individually analyzed the case studies and constructed an essay on their findings. Participants in the treatment group discussed the assigned case study asynchronously within their small group forum on Blackboard. Following the online discussion, each participant constructed and submitted an essay on his/her findings. Group consensus on the case study analysis steps was not required. Students were to consider the group's dialogue but the essay they submitted was to be individually constructed.

Assessment of Case Study Learning Homework Assignment

Students' essays were graded according to the criteria as set by Facione & Facione. Students were given a copy of the rubric to follow as they completed the assignments. Grades were based on each participant's essay analysis and for the treatment group, a minimum number of online comments and responses were also required to receive credit for the assignment:

Each student in the treatment group was expected to participate a minimum of two different occasions for a total of 12 responses per assignment. Students sorted and printed their contributions to turn in with the written case study analysis. To aid in the assessment process, the instructor was easily able to access course statistics from Blackboard such as student's number of accesses over time, total accesses by user, group areas report, etc. (Blackboard, 1999). After the assignments were graded and returned to students, large group discussions were conducted clarifying each case's components such as problem identification, causes/symptoms, assumptions, etc. (Paul & Elder, 2003).

Problem-Solving Template as Explicit Criteria

As stated previously, students in both treatment groups were trained in the use of the analysis template by Paul & Elder. *See Appendix C*. Students were required to complete the online template prior to beginning the case study learning assignment. In addition to using the case analysis template, students also had a paper copy of the holistic scoring rubric upon which their grades would be assessed. “Having access to evaluation criteria satisfies a basic fairness principle…Giving students the opportunity to get good at what it is that the standards require speaks to a ... fundamental sense of fairness, which is what Wolf and Reardon (1996) had in mind when they talked about ‘making thinking visible’ and ‘making excellence attainable’” (Shepard, 2000, p. 4). Providing students with explicit criteria affords them a form of scaffolding to support their articulation of their understanding (Goetz, Alexander, & Ash, 1992).

Paul & Elder’s case study analysis template guided the students’ discussion of the case studies, and Facione & Facione’s (1996) Holistic Critical Thinking Scoring Rubric guided the students’ construction of the analytical essays. Earning a score of four was equivalent to an A; three a B; two a C; and one a D. Students were also provided a paper copy of the explicit criteria explaining the format requirements of the five-paragraph essay assignment. *See Appendix D.*

Treatment

Participants in the treatment and comparison groups analyzed three case studies (one per week) over a three-week period. Students in the comparison group analyzed the case studies individually; students in the experimental group participated collaboratively using online discussions via discussion board on Blackboard course website. Following a technological readiness survey, all participants received hands-on training in the steps required to complete the online case study analysis template, and students in the experimental group received additional training in the use and navigation of the Blackboard discussion board feature.

All participants in the study were instructed in case analysis processes and provided with case analysis guidelines and a problem-solving template to facilitate case-based learning.

Posttest

Following the analysis of three case studies, all participants completed a posttest to measure their development in critical thinking. The posttest, similar to the pretest, required a written case study analysis essay and was also scored on a scale of one to four, according to the criteria included in the critical thinking scoring rubric.

Assessment of Critical Thinking

The level of critical thinking in participants' pretests and posttests were measured using Facione & Facione's holistic scoring rubric. To ensure interrater reliability, a colleague experienced in critical thinking research graded the posttests. Eighty-one percent agreement was reached initially; after discussion of those in disagreement, 100% agreement was achieved.

Satisfaction With Learning Experience

All participants completed a post-experiment self-report questionnaire designed to elicit the level/degree of satisfaction with the case-based learning method in which they participated.

CHAPTER IV

Results

The purpose of this study was to investigate differences in the critical thinking skills of undergraduate students as they participated in two different case study learning methods as measured by a holistic critical thinking scoring rubric. The case study learning homework assignments were designed to augment face-to-face instruction and to link course theory with practice. Participants in the comparison group analyzed the case studies individually after completing an online analysis template. Participants in the treatment group collaboratively discussed the cases in small groups using an online discussion board, after completing the online analysis template.

SCREENING AND STATISTICAL ANALYSIS

The pretest and posttest measures for critical thinking were examined for normality by using skewness and kurtosis coefficients (z-tests of greater or less than 1.96) and the Shapiro-Wilks test where indicated. Homogeneity of variance was examined across the treatment and control groups by the (dependent) variable by using the Levene test ($\alpha = .05$) for univariate homogeneity of variance. Pretest and posttest scores did not violate the assumption of normality; therefore, parametric tests were used to compare the means of the two groups.

Analysis of Research Hypothesis 1

Hypothesis 1 investigated the dependent outcome variable of students' participation in individual and online collaborative case study learning methods. Hypothesis 1 is restated below.

Hypothesis 1: The depth of critical thinking will be significantly higher in students analyzing case studies collaboratively using asynchronous computer-mediated communication than in students analyzing case studies individually.

In order to test hypothesis 1, a one-way analysis of variance was conducted using the posttest scores (Maxwell & Delaney, 1990; Stevens, 1996; SPSS, 2003). Since the critical thinking scoring rubric was created as an ordinal scale, a nonparametric test was also conducted to compare the obtained results from the parametric tests. The Mann-Whitney U Test was used for data analyses. In all, analyses of the results of the nonparametric and parametric analyses agreed.

Between-Group Analysis Results for Critical Thinking

No significant mean differences in critical thinking were detected between the treatment group (online collaborative discussion) and the comparison group (traditional individual assignment) as measured by the holistic critical thinking scoring rubric. The means and standard deviations for both groups are presented below in Table 1. Table 2 provides the results for the between group analysis.

Table 1

Means and Standard Deviations for Critical Thinking Increases for Individuals Who Participated in Online Collaborative Case Study Learning and Those Who Participated Individually

		M	SD	N
Pretest Score	Experimental Group	2.78	.59	36
	Comparison Group	2.64	.53	47
	Total	2.70	.56	83
Posttest Score	Experimental Group	3.31	.53	36
	Comparison Group	3.21	.41	47
	Total	3.25	.46	83

Table 2

Critical Thinking Differences Between Groups Who Participated in Online Collaborative Case Study Learning and Those Who Participated Individually

Source	df	SS	MS	F
Between Group	1	0.17	.17	.81
Within Group	81	17.51	.21	
Total	82	17.68		

Analysis of Research Hypothesis 2

Hypothesis 2 investigated the dependent outcome variable of students' participation within each of the case study learning methods. Hypothesis 2 is restated below.

Hypothesis 2: The depth of critical thinking will significantly improve for students analyzing case studies collaboratively using asynchronous computer-mediated communication and within students analyzing case studies individually.

In order to test hypothesis 2, paired samples t-tests and one-within repeated measure analyses were conducted across two measures: pretest and posttest (Maxwell & Delaney, 1990; Stevens, 1996; SPSS, 2003). Since the critical thinking scoring rubric was created as an ordinal scale, nonparametric tests were also conducted to compare the obtained results from the parametric tests. The Wilcoxon Matched-pairs Signed-rank Test was used for data analyses. In all, analyses of the results of the nonparametric and parametric analyses agreed.

Repeated Measures Within-Group Results for Critical Thinking

Significant gains in critical thinking were detected within both the treatment and comparison groups. The mean difference within pretest and posttest scores for the experimental group was -.528, $p < .05$, with an effect size of .736 standard deviation units. The mean difference between pretest and posttest scores for the comparison group was -.574, $p < .05$, with an effect size of .635 standard deviation units. Table 3 provides the results of the within group analyses.

Table 3

Critical Thinking Differences Within Individuals Who Participated in Online Collaborative Case Study Learning and Those Who Participated Individually

		M	SD	F	df
Experimental Group	Pretest Score- Posttest Score	-.528	.74	18.50	35
Comparison Group	Pretest Score- Posttest Score	-.574	.65	36.61	46

$p<.05$

Analysis of Research Hypothesis 3

Hypothesis 3 investigated the dependent outcome variable of students' process satisfaction in individual and online collaborative case study learning methods as measured by Process Satisfaction Questionnaire. Hypothesis 3 is restated below.

Hypothesis 3: Students' perception of computer-supported collaborative analysis will be more positive than students' analyzing case studies individually.

In order to test hypothesis 3, paired samples t-tests were conducted across group 1 and group 2 process satisfaction questionnaire responses.

Between-Groups Process Satisfaction Questionnaire Analysis

Process satisfaction questionnaire results showed no significant differences in satisfaction between the two groups. Overall, participants in both groups reported feeling satisfied with the case study learning analyses. The mean frequency of satisfaction with the case study learning process was 3.74 on a scale of 1-5. Students in both groups reported that the online problem-solving template was helpful in completing the case analyses. Students reported the case study learning assignments were well-designed and clearly explained. Students reported that they felt the case study learning activities helped them to learn the course content. The summary of participants' item responses are indicated in Table 4.

Table 4

Process Satisfaction Differences Between Individuals Who Participated in Online Collaborative Case Study Learning and Those Who Participated Individually

Item	Group	N	M	SD
1	1	36	2.97	1.24
	2	47	3.13	0.91
2	1	36	2.50	1.23
	2	47	2.96	1.01
3	1	36	3.59	1.18
	2	47	3.56	1.06
4	1	36	2.76	1.23
	2	47	2.67	1.25
5	1	36	3.29	1.24
	2	47	3.37	1.18
6	1	36	3.41	1.23
	2	47	3.20	1.11
7	1	36	3.97	1.00
	2	47	4.02	1.06
8	1	36	4.12	1.04
	2	47	3.85	1.07
9	1	36	3.74	1.21
	2	47	3.74	0.93

In summary, students' responses were positive related to their satisfaction with the case study learning process and the value of case study learning in reinforcing the course material.

Between-Groups Technology Readiness Survey Analysis

In order to control for participants' technology readiness between the groups, a technology readiness survey was administered at the beginning of the instructional cycle. The technology readiness survey analysis showed no significant differences in technology readiness between groups. Participants in both groups reported daily use of email and the World Wide Web (WWW) and bimonthly text chats. Participants reported little or no experience in audio chats or participation in newsgroups.

Participants reported possession of adequate keyboarding skills and adequate technical expertise. Participants reported that they enjoyed trying new technologies and were optimistic about the way technologies are changing their lives and the world.

In summary, the students enrolled in *Effective Learning* were experienced in using technology to communicate informally with others and search for information via the World Wide Web. Participants reported having adequate keyboarding skills, an optimistic view towards technology, and a willingness to try new technologies. Table 5 represents a summary of the technology readiness item differences between the treatment groups.

Table 5

Technology Readiness Differences Between Individuals Who Participated in Online Collaborative Case Study Learning and Those Who Participated Individually

Item	Group	N	M	SD
1	1	36	4.31	1.09
	2	47	4.33	1.10
2	1	36	4.47	0.95
	2	47	4.67	0.72
3	1	36	2.34	1.04
	2	47	1.94	0.93
4	1	36	3.25	1.52
	2	47	3.17	1.10
5	1	36	1.44	0.76
	2	47	1.44	0.97
6	1	36	2.97	1.33
	2	47	2.88	1.44
7	1	36	4.03	1.18
	2	47	4.00	1.20
8	1	36	4.22	1.10
	2	47	3.88	0.91
9	1	36	3.78	1.10
	2	47	3.65	0.98
10	1	36	4.53	1.05
	2	47	4.52	0.80
11	1	36	2.06	1.13
	2	47	2.00	0.95

12	1	36	3.72	0.99
	2	47	3.52	1.11
13	1	36	2.19	1.06
	2	47	2.08	1.03
14	1	36	2.75	0.95
	2	47	2.60	1.18

SUMMARY

Statistical analyses were conducted to investigate the differences between individual and online collaborative case study learning strategies on the development of critical thinking in undergraduate students. Paired sample t-tests and one-between repeated measure analyses were conducted across pretest and posttest measures of participants in both learning conditions. No significant differences were found between the treatment groups; however, significant gains were detected within both groups from pretest to posttest as measured by Facione & Facione's (1996) Holistic Critical Thinking Scoring Rubric.

A between-groups analysis was also conducted to investigate participants' satisfaction with the case study learning strategies. No significant differences in participants' satisfaction with their case study learning strategy were detected as measured by the process satisfaction questionnaire.

A between-groups analysis was conducted to investigate participants' technology readiness. No significant differences in technology readiness were detected as measured by the technology readiness survey.

CHAPTER V

Discussion and Conclusions

The previous chapter, Chapter IV, presented the findings of this study. This chapter discusses the major findings and the implications these findings have for practice and future research. This chapter consists of five sections. The first section clarifies the major findings relevant to the study. The second section emphasizes the validation of critical thinking improvement in undergraduate education. The third stresses the limitations of the study; the fourth discusses implications of the findings for practice. The fifth and final section highlights future research that is suggested by the findings of this study.

DISCUSSION OF FINDINGS

The following section discusses the results of the three hypotheses tested. In addition, it discusses the effects of using online collaborative case study learning in improving undergraduate student's critical thinking skills.

Hypothesis 1

The depth of critical thinking was not significantly higher in students analyzing case studies collaboratively using asynchronous computer-mediated communication than in students analyzing case studies individually. It was expected that the online collaborative discussion would enhance students' critical thinking scores by providing them the opportunity to view issues from multiple perspectives more than students analyzing the cases individually. After the case analyses were graded and returned to students, large group face-to-face discussions were conducted in both treatment groups to provide students feedback on the case analyses. Perhaps the face-to-face discussions equalized the groups in providing the students not engaged in collaborative online learning the multiple perspective component expected to be present only in the online collaborative method. If, in fact, the in-class discussions provided the same benefits to the participants not engaged in online learning, this may explain why differences were not found between the groups.

Extended think time is another component of asynchronous online discussions purported to enhance critical thinking. Not knowing how much time students worked on the assignments individually as compared to those who discussed the case online prior to writing the analysis is also a limiting aspect of the study. It would be helpful in future studies to have students track and record their time spent in total on the case study learning assignments.

Hypothesis 2

Students in both treatment groups significantly improved in the depth of their critical thinking as measured by the Facione & Facione's (1996) Critical Thinking Scoring Rubric from pretest to posttest. This finding supports the idea that critical thinking is a skill that can be taught and improved upon within a fifteen-week semester through the use of case study learning. Several instructional factors contributed to this gain in critical thinking within this study. First, relevant and interesting case studies were used to motivate the students and initiate the analytical cognitive processes. Second, students were directly instructed in the necessary steps required for the case analyses, as well as were provided with an online problem-solving template to scaffold the thinking processes each time they analyzed a case. Several students from both treatment groups commented on the value of the online case analysis template in their responses on the process satisfaction questionnaire. "The online templates really helped me with the case studies, and it did help me learn the material," reported one student. Another student reported, "I believe the case study templates were very helpful in completing the case study assignments."

Students also received timely feedback on their analytical reasoning through large group class discussions of each of the case studies as well as personal written feedback on individual graded essays. Students had ample practice analyzing a total of five case studies from pretest to posttest.

Hypothesis 3

Students' perception of computer-supported collaborative case analysis was not more positive than students' analyzing case studies individually. This hypothesis was not supported by the findings of this study. Both groups reported a positive satisfaction with the case study learning assignments. Perhaps the motivational aspect afforded to both groups through use of the online analysis template may have equalized the groups in their reported satisfaction between the two strategies. The online case analysis template was implemented in both learning conditions to equalize the participants' use of technology in learning as well as to assist them in discerning the differences between gains in learning due to the use of technology and gains in learning due to the collaboration.

The asynchronous component of the online discussion frustrated some students who reported having to wait for some group members to participate in the discussions. One student reported, "I didn't like doing the online discussion, where you put three comments on each topic because not everyone responded or waited until the last hour. This made it difficult for the people who were participating." Although clear expectations and criteria for students' participation were incorporated, it may be helpful to base a larger percentage of the grade on the students' timely participation in the online discussion. The increased weight of participation may help reduce this problem in future studies.

In summary, the findings of this study did not support hypotheses 1 and 3. No significant differences in critical thinking were found between the groups. No significant differences were found in process satisfaction between the groups.

Instead, process satisfaction was positive within both groups. The findings of this study did support hypothesis 2. The depth of critical thinking was significantly improved within both treatment groups.

Limitations of Study

The sample in this study was derived from a unique population of high-risk students conditionally admitted to Texas State University. One limitation is that the sample is small, consisting of only 79 participants. Additionally, the sample consisted of intact groups and neither random selection nor assignment was employed. In addition, it may be difficult to generalize the results to regularly admitted students or to other conditionally admitted students at other institutions. All of the students in this study were full-time, and the results may not apply to part-time students or other varied populations.

Participants were assigned to the differential treatments due to their enrollment in particular sections of *Effective Learning*. Students enrolled in the Monday/Wednesday sections were assigned the online collaborative case study learning treatment, and the students who were enrolled in the Tuesday/Thursday classes were assigned to the individual case study learning treatment. A purely random selection of participants would enhance the study's generalizability, as well as increase the internal validity of the study.

The short treatment period was a limitation as well. The experimental treatment was conducted over a three-week period. Participants' critical thinking skills may be enhanced by having the opportunity to participate in case study learning over a longer period of time.

Another limitation of the study is the limited variability in the instrument used to assess participant's critical thinking. Although Facione & Facione's (1996) Holistic Critical Thinking Scoring Rubric is a very practical and useful tool to assess students' demonstration of various levels of critical thinking, an instrument with greater psychometric sensitivity is needed to detect change in critical thinking over time. Little variability was built into the instrument itself, since it was created on a scale of 1-4. Having a more sensitive instrument would help to detect discernible differences more effectively. In addition to the instrument's limited variability, the 4.0 scale does not coincide well with the A-F academic scale. A 5.0 scale would be more congruent with traditional scoring and would allow for more variability in scores. There were numerous times a score of a 2- or a 3+ seemed appropriate. Although interrater reliability on the posttest was very good (82%), having a 5.0 scale may 1improve interrater reliability as well.

Implications for Practice

The findings of this study support the concept that critical thinking can indeed be taught. Undergraduate students can significantly improve their critical thinking skills within the course of a semester through participation in well-designed instructional activities, such as online collaborative case study learning. Participating in online collaborative case study learning affords students the opportunity to develop and practice their higher order reasoning skills, interpersonal and written communication skills, various technological skills, and vital self-regulatory skills.

The findings of this study challenge the perception that face-to-face instructional strategies are always better than computer-supported. Participants' scores as determined through the use of the Holistic Critical Thinking Scoring Rubric demonstrated that students participating in both the individual and online collaborative learning significantly improved. Both strategies were effective in improving the critical thinking skills of the undergraduate students enrolled in these *Effective Learning* courses.

Recommendations for Future Research

Considering the findings of this study, several recommendations for future studies are discussed below. The first recommendation is based on the relatively small number of subjects participating in this study (N=79). Due to the small sample size and unique sample population, the results of this study may not be generalizable to other undergraduate students, such as regularly admitted students or conditionally admitted students in other institutions. Replicating the study using a larger sample is recommended.

Improving the study with a larger sample would not only strengthen the study's generalizability but would also allow the experimental design to include a third case study learning strategy treatment—small group face-to-face case study analysis. Including this third learning condition would facilitate closer investigation of the distinctive relationships between individual learning, collaborative learning, and online learning.

To further illuminate the effects of the various case study learning strategies on students' critical thinking, a similar study may be conducted giving students the choice of working on the case study learning assignments under their preferred method: individual, small group face-to-face, or small group online discussion.

Additional research of this type with students enrolled in other undergraduate courses may be useful. Since the sample in this study was derived from a unique population of high-risk students conditionally admitted to Texas State University, it would be beneficial to explore the case study learning strategies with a different sample of undergraduate students. Future studies might investigate the development of critical thinking with various student populations, such as part-time, full-time, traditional, and nontraditional students.

To better assess the effectiveness of individual and online collaborative case study learning strategies, it is recommended in future studies that large group face-to-face discussions not be implemented. Large group face-to-face discussions were conducted with both treatment groups as a way to provide students feedback on their graded case study analyses. This "compensatory equalization of treatments" (Gall, Borg, & Gall, 1996, p. 472) may have obscured the effects of the experimental treatment.

Developing an instrument with greater sensitivity to assess students' demonstration of various levels of critical thinking is needed. Perhaps modifying Facione & Facione's Holisitic Critical Thinking Rubric 4.0 scale to a 5.0 scale would increase variability in scores, increase interrater reliability, and coincide more effectively with the A-F academic scale.

A longer treatment period would strengthen the study's reliability as well. Conducting the study over a longer period of time may provide useful information about the temporal course of the acquisition of critical thinking in undergraduate students.

APPENDIX A

Technology Readiness Survey

Last Name, First "Nickname"	Freshman Sophomore Junior Senior (Circle one)
Do you commute? Yes/No	If yes, from where?
Where will you complete most of the online assignments in this course (dorm, house/apartment, on-campus computer lab)?	How would you describe your online learning environment (quiet, some distraction, etc.) where you will be completing most of your assignments?
Which Internet service provider do you connect to when completing online assignments (AOL, Roadrunner, university server)?	How would you describe your Internet connection (fast/slow, stable, reliable, etc.)?
Why are you taking this course (PAS contract, advised to take course, as an elective)?	Have you previously participated in any online learning activities? Yes/No If yes, please describe.

Next to each technology listed below, please write the ONE response that indicates the frequency with which you used them before taking this class. The scale ranges from 1=NEVER to 5=DAILY.

1	2	3	4	5
Never	Few times	Monthly	Weekly	Daily

_____ E-mail
_____ WWW
_____ Newsgroups
_____ Text chat only
_____ Audio chat
_____ Real Player
_____ Blackboard

Next to each statement, please write the ONE response that indicates the extent to which you agree or disagree with the statement. The scale ranges from 1 = STRONGLY DISAGREE to 5 = STRONGLY AGREE.

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

_____ My keyboarding (typing) skills are strong.
_____ I always want to try new technologies.
_____ I enjoy the convenience that technologies give me.
_____ I don't like new technologies, even though I do use them.
_____ I am optimistic about the way technologies are changing the world and my life.
_____ I am slow to catch on to new technologies.
_____ I am one of the most technical-savvy people I know compared to my peers.

*Modified survey from Wang, Kanfer, Hinn, & Arvan, 2001

APPENDIX B

Critical thinking holistic scoring rubric

Holistic Critical Thinking Scoring Rubric

Dr. Peter A. Facione
Santa Clara University
Dr. Noreen C. Facione, R.N., FNP
University of California, San Francisco
Facione and Facione

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4 Consistently does all or almost all of the following:

Accurately interprets evidence, statements, graphics, questions, etc.
Identifies the salient arguments (reasons and claims) pro and con.
Thoughtfully analyzes and evaluates major alternative points of view.
Draws warranted, judicious, non-fallacious conclusions.
Justifies key results and procedures, explains assumptions and reasons.
Fair-mindedly follows where evidence and reasons lead.

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3 Does most or many of the following:

Accurately interprets evidence, statements, graphics, questions, etc.
Identifies relevant arguments (reasons and claims) pro and con.
Offers analyses and evaluations of obvious alternative points of view.
Draws warranted, non-fallacious conclusions.
Justifies some results or procedures, explains reasons.
Fair-mindedly follows where evidence and reasons lead.

---

2 Does most or many of the following:

Misinterprets evidence, statements, graphics, questions, etc.
Fails to identify strong, relevant counter-arguments.
Ignores or superficially evaluates obvious alternative points of view.
Draws unwarranted or fallacious conclusions.
Justifies few results or procedures, seldom explains reasons.
Regardless of the evidence or reasons, maintains or defends views based on self-interest or preconceptions.

---

1 Consistently does all or almost all of the following:

Offers biased interpretations of evidence, statements, graphics, questions, information, or the points of view of others.
Fails to identify or hastily dismisses strong, relevant counter-arguments.
Ignores or superficially evaluates obvious alternative points of view.
Argues using fallacious or irrelevant reasons, and unwarranted claims.
Does not justify results or procedures, nor explain reasons.
Regardless of the evidence or reasons, maintains or defends views based on self-interest or preconceptions.
Exhibits close-mindedness or hostility to reason.

Critical Thinking Rating Form

ID or Name Score ID or Name Score

Rater's Name: _____________________ Date: _____________

Project/Assignment/Activity Evaluated:

____

Holistic scoring requires focus. In any essay, presentation, or clinical practice setting many elements must come together for overall success: critical thinking, content knowledge, and technical skill (craftsmanship). Deficits or strengths in any of these can draw the attention of the rater. However, in scoring for any one of the three, one must attempt to focus the evaluation on that element to the exclusion of the other two.

Ideally, in a training session with other raters one will examine sample essays (videotaped presentations, etc.) which are paradigmatic of each of the four levels. Without prior knowledge of their level, raters will be asked to evaluate and assign ratings to these samples. After comparing these preliminary ratings, collaborative analysis with the other raters and the trainer is used to achieve consistency of expectations among those who will be involved in rating the actual cases. Training, practice, and inter-rater reliability are the keys to a high quality assessment.

Usually, two raters will evaluate each essay/assignment/project/performance.

If they disagree there are three possible ways that resolution can be achieved: (a) by mutual conversation between the two raters, (b) by using an independent third rater, or (c) by taking the average of the two initial ratings. The averaging strategy is strongly discouraged. Discrepancies between raters of more than one level suggest that detailed conversations about the CT construct and about project expectations are in order. This rubric is a **four** level scale, half point scoring is inconsistent with its intent and conceptual structure. Further, at this point in its history, the art and science of holistic critical thinking evaluation cannot justify asserting half-level differentiations.

If working alone, or without paradigm samples, one can achieve a greater level of internal consistency by not assigning final ratings until a number of essays/ projects/performances/assignments have been viewed and given preliminary ratings.

Frequently natural clusters or groupings of similar quality soon come to be discernible.

At that point one can be more confident in assigning a firmer critical thinking score using this four level rubric. After assigning preliminary ratings, a review of the entire set assures greater internal consistency and fairness in the final ratings.

Instructions for Using the Holistic Critical Thinking Scoring Rubric

1. Understand the construct.

This four level rubric treats critical thinking as a set of cognitive skills supported by certain personal dispositions. To reach a judicious, purposive judgment a good critical thinker engages in analysis, interpretation, evaluation, inference, explanation, and meta-cognitive self-regulation. The disposition to pursue fair-mindedly and open-mindedly the reasons and evidence wherever they lead is crucial to reaching sound, objective decisions and resolutions to complex, ill-structured problems. So are the other critical thinking dispositions, such as systematicity, reasoning self-confidence, cognitive maturity, analyticity, and inquisitiveness. [For details on the articulation of this concept refer to Critical Thinking: A Statement of Expert Consensus for Purposes of Educational Assessment and Instruction. ERIC Document Number: ED 315 423.]

2. Differentiate and Focus

3. Practice, Coordinate and Reconcile.

APPENDIX C

Case Analysis Template

1. Clearly state the problem.	
2. Identify central issues.	
3. Determine relevant and irrelevant information.	
4. Identify any assumptions you are making and determine whether they are justifiable.	
5. Brainstorm and list several strategies for resolution of case.	
6. Rank your strategies above according to importance.	
7. List your top 3 recommendations and present a rationale for each.	

APPENDIX D

Case Study Learning Assignment Criteria

Case Study Learning Assignment Criteria (individual learning)

Case study learning provides you the opportunity to improve your critical thinking skills by applying theory to practice. Assignments are due before class begins. Late assignments will be reduced a letter grade per day following the due date.

Procedures

1. Read the case and think about it.
2. Use textbook and lecture notes to consider solutions to problem (consider MSLQ categories under skill and will).
3. Complete online analysis template and print a copy of it.
4. Using your template as a guideline, construct your 5¶ essay. Your essay will be graded according to Facione & Facione's critical thinking rubric. Refer to template handout. Scoring of a 4 will constitute an A, 3-B, 2-C, 1-D. The range of scores (such as the range of an A, 90%-100%) will depend on the following: your overall assignment presentation, including following all requirements carefully, formatting of cover sheet and essay, as well as correct word choice, sentence fluency, and mechanical correctness (spelling, grammar, usage and punctuation).

Criteria (to be handed in)

Cover Sheet
Analysis template
Essay (5 ¶), typed, double-spaced, and free of errors

I. Introduction
   A. Clearly state the problem.
   B. Identify the underlying causes and overt symptoms of the problem.
   C. Identify any assumptions you are making w/justification for each.
   D. List your top 3 recommendations.
II. First recommended strategy
   A. Present rationale
   B. Discuss consequence(s) of strategy implementation
III. Second recommended strategy
   A. Present rationale
   B. Discuss consequence(s) of strategy implementation

IV. Third recommended strategy
    A. Present rationale
    B. Discuss consequence(s) of strategy implementation
V. Conclusion
    A. Summarize, restate, or evaluate the information presented
    B. Direct the reader to a larger concept

I encourage you to make an appointment with the Flowers Hall Writing Center if you need any type of assistance with composing, proofreading, and/or editing your essay (245-3018).

Case Study Learning Assignment Criteria (online collaborative)

Case study learning provides you the opportunity to improve your critical thinking skills by applying theory to practice. Assignments are due before class begins. Late assignments will be reduced a letter grade per day following the due date.

Procedures

1. Read the case and think about it.
2. Use textbook and lecture notes to consider solutions to problem (consider MSLQ categories under skill and will).
3. Complete online analysis template (before online discussion) and print copy of it.
4. Discuss case (steps #1-4) with small group via Blackboard using thread labels to navigate through discussion (a minimum of 3 postings per step over a minimum of 2 different times = 6 total contributions; each time = 1 original + 1 response to peer).
5. Sort and print your forum contributions after second participation.
6. Annotate template w/additional ideas or revisions following discussion (handwritten).
7. Construct 5¶ essay. Essay will be graded according to Facione & Facione's critical thinking rubric. Refer to template. Scoring of a 4 will constitute an A, 3-B, 2-C, 1-D. The range of scores (such as the range of an A, 90%-100%) will depend on overall presentation of assignment, including following all requirements carefully, formatting of cover sheet and essay, as well as correct word choice, sentence fluency, and mechanical correctness (spelling, grammar, usage and punctuation).

Criteria (to be handed in)

a. Cover Sheet
b. Analysis template w/post discussion handwritten annotations
c. Printed contributions to discussion forum
d. Essay (5 ¶) typed, double-spaced, and free of errors

I. Introduction

A. Clearly state the problem.
B. Identify the underlying causes and overt symptoms of the problem.
C. Identify any assumptions you are making w/justification for each.
D. List your top 3 recommendations.

II. First recommended strategy
    A. Present rationale
    B. Discuss consequence(s) of strategy implementation
III. Second recommended strategy
    A. Present rationale
    B. Discuss consequence(s) of strategy implementation
IV. Third recommended strategy
    A. Present rationale
    B. Discuss consequence(s) of strategy implementation
V. Conclusion
    A. Summarize, restate, or evaluate the information presented
    B. Direct the reader to a larger concept

I encourage you to make an appointment with the Writing Center if you need any type of assistance with composing, proofreading, and/or editing your essay.

APPENDIX E

Case studies

ANALYZE STUDENT BEHAVIOR

Suppose you were working at the SWT Student Learning Assistance Center as a peer counselor. A student, Alan, comes to see you mid-semester to discuss his problems. Read the brief description of Alan and identify what you have learned to date that could be applied to his situation. What suggestions would you give to Alan related to his current situation? Please justify your suggestions.

Alan is a freshman music major who is an accomplished bass player. He plays with a local band weekly at Cypress Creek Café. He is recognized by his peers as someone with a great deal of talent. His goal is to play professionally. He practices many hours a day and believes this activity is more worthwhile than taking general education courses. Alan believes he does not need a college education to attain his goal. His parents believe that the attainment of a college degree will benefit him throughout his life. He agrees to go to college to please his parents but is not very interested in some of his courses. As a result, his attendance is poor and his grades are low in English 1310 and History 1310.

ANALYZE STUDENT BEHAVIOR

Byron is a first-year college student. He has been fairly lucky so far in that at least he isn't failing any of his classes. He puts in the minimum amount of work possible to try to maintain what he calls "average" performance—no less than a D in any course. But all of this is starting to wear on him; on top of that, he's running out of excuses for his parents.

Byron uses every excuse in the book for not following a study regimen: "I have a photographic memory so I don't have to study and review…I'll study over the weekend when I have more time…I don't like this course and the professor is so boring…I work best under pressure." He once told a professor that he missed the 3:00 class because "My alarm clock didn't go off."

Byron prides himself on the fact that he's been able to pass his classes without purchasing the required textbooks. He's making a "final push" to turn in his late work before his finals. He's had perfect attendance the last few weeks of the semester.

Applying what you have learned in *EDP 1350: Effective Learning*, what advice would you give Byron for next semester?

ANALYZE STUDENT BEHAVIOR

Suppose you were working in your college counseling center as a peer counselor. Felicia comes to see you to discuss her academic problems. Read the brief discussion of Felicia and identify what you have learned to date that could be applied to her situation. What three suggestions would you recommend to improve Felicia's academic performance in chemistry? Why?

Felicia has always wanted to be a pediatrician. She is a freshman majoring in pre-med and is having difficulty in her first chemistry course. Although she did well in her high school chemistry course, she finds her college course more difficult because it is taught differently. The exams require more problem solving and higher level thinking than she experienced in high school. She begins to worry about her ability to excel in the sciences and to obtain admission to medical school.

ANALYZE STUDENT BEHAVIOR

Read the following information concerning Lara. Consider the strengths and weaknesses of her motivation and learning strategies. What three (3) suggestions do you have to help her perform more successfully and why?

Lara is studying a chapter in her biology textbook for a quiz the next day. Her experience taking biology in high school was mostly negative because her instructors focused on facts and definitions. As a result, she never developed much interest in the subject. She has been told that she will be asked to answer one essay question to test her knowledge of the material. She is not sure exactly what content will be tested, but decides to develop a study plan to gain a general understanding of the main ideas and to recall the most important facts. She paraphrases each section of the chapter and underlines the most important information. She realizes that she has difficulty comparing and contrasting some of the concepts discussed in class. Therefore, she decides to develop and write responses to short-answer essay questions she thinks may be on the test. She develops so many possible questions that she quickly becomes frustrated and only answers two essay questions. She then reads the chapter summary. Finally, she reviews the underlining in her textbook and decides it is time to move on to another subject.

ANALYZE STUDENT BEHAVIOR

Professor Jasek announced in her syllabus for American Literature 101 that final term papers had to be turned in during the last class of the semester. No student would pass the course without a completed paper turned in on time. No late papers would be accepted. The week before the paper was due, Reggie, a student-athlete, realized he would be out of town for a meet on Friday, the last day of class. At this point in the semester Reggie had a B average in the course. He explained his situation to Professor Jasek who told him he could turn in the paper early, but she would not accept any late papers. If his paper were not in on time, he would flunk the course.

Reggie was really upset. He hadn't started the paper. In fact he had only read about 25 pages out of 200. He had missed class discussions because of meets.

1. What 3 suggestions (in order of importance) do you have for helping Reggie? Why?
2. Describe your experience of the process of using the online discussion board feature with your assigned group. What did you like and dislike about the process? Why?

Print your contributions to the forum.

APPENDIX F

Process Satisfaction Questionnaire

Last Name, First Name	Freshman Sophomore Junior Senior (Circle one)
Where did you complete most of the online assignments in this course (dorm, house/apartment, on-campus computer lab)?	How would you describe the online learning environment where you completed most of the assignments in this course (quiet, some distraction, etc.)?
Which Internet service provider did you connect to when completing online assignments (AOL, Roadrunner, university server)?	How would you describe your Internet connection (fast/slow, stable, reliable, etc.)?
Did your Internet connection inhibit your ability to complete the online assignments?	

For each statement, please fill the ONE response that indicates the extent to which you agree or disagree with the statement. The scale ranges from 1 = STRONGLY DISAGREE to 5 = STRONGLY AGREE.

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

______ 1. I enjoyed the case study learning assignments.

______ 2. I was frustrated by the case study learning assignments.

______ 3. The case study learning activities helped me to learn the course content.

______ 4. I would like to participate in more activities similar to the case study analyses.

_____ 5. I prefer working alone.

_____ 6. I prefer working collaboratively in groups.

_____ 7. Using the online problem-solving template was helpful in completing the assignments.

_____ 8. The case study assignments were well-designed and clearly explained.

_____ 9. Overall, I was satisfied with the case study learning analyses.

Comments regarding case study learning assignments:

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