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Investigation of factors affecting students' satisfaction with online course components.

Elena Qureshi
University of Windsor

NOTE TO USERS

INVESTIGATION OF FACTORS AFFECTING STUDENTS' SATISFACTION WITH ONLINE COURSE COMPONENTS

by

Elena Qureshi

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ABSTRACT

Technological advances in Internet delivery have allowed university course offerings to change from synchronous to asynchronous. These changes have occurred so rapidly that Web-based (WB) courses have proliferated without significant research as to their effectiveness from a student's perspective (Ewing-Taylor, 1999). Researchers are aware that it is not sufficient to measure the effectiveness of WB learning purely through testing and grades. Indeed, Marshall (1999) pointed out that it is necessary to look at and evaluate the process of delivery and attitudes toward various delivery methods as well as course components in order to design more effective courses for Web delivery and to explore their effectiveness. Five quasi-models of descriptive characteristics (Demographic, Experiential, Motivational, Learning Styles, Instructional Design) were singled out as potentially having an impact on students' satisfaction with the online course components (email, hypertext, online threaded discussions, web links, chat, video, audio, simulations, and graphics). The purpose of this study was to investigate various factors that might affect students' satisfaction with online course components. Data were collected from 240 online undergraduate students using an online questionnaire.

The findings of this study may lead educators to rethink the process of Instructional Design (ID). They may shift or adapt the traditional ID models and theories to accommodate the new features of online courses. At the very least, a deeper understanding about the Web as a mode of delivery in distance education and its effects on distance learning should emerge. Furthermore, the findings from this research study may strengthen our understanding of how students' internal characteristics affect learning outcomes in technology-mediated online environment.

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CHAPTER I

INTRODUCTION

Scope of the Problem

In its short 130 years, Canada has become one of the most prosperous countries in the world. Canadians enjoy long life expectancy, low infant mortality, high education levels, and relatively open access to postsecondary education. Concern is growing, however, about some general dimensions of Canadian society: high unemployment levels, reduced productivity growth, increased international competition for markets, and the effectiveness of our educational institutions. Concern over Canada's economic prosperity in a highly competitive global market has led to the recognition that education is a public issue. Since movement toward an advanced technological economy of highly skilled and well-paying jobs is an important objective on the public agenda, most new jobs in the future will require a college degree (Higgins, 1995). Furthermore, future jobs will require individuals to reason in high-level, abstract terms in order to make inferences and solve intricate problems (Kemp, Morrison, & Ross, 1998).

In order to reach the goal of providing more qualified citizens, educators and administrators in the field of higher education must make full use of the existing materials and facilities in the institution, and take advantage of the modern technology to serve their educational purpose. Since the early 1970s, traditional classroom teaching has been supplemented by learning via distance, first, through correspondence, radio, and television, and later on through computers.

With advances in computer technology, revitalized efforts have taken place in the field of knowledge engineering, expert systems, and multimedia educational technology. Also, recent developments in Internet technologies have enabled higher-education institutions to implement

cost-effective Web-Based Instruction (WBI) and to provide open learning environments 24 hours a day, 7 days a week. Educators have sensed the potential of the Internet to change the social structures of educational practice. More and more colleges and universities have taken initiatives to explore the potential and possibilities of offering online courses in order to survive in the competitive academic world (Khan, 1997). As such, online education has become a recognized educational paradigm that brings about unprecedented options for learning and instruction (Harasim, 1990).

Furthermore, technological advances in Internet delivery have allowed university course offerings to change from synchronous to asynchronous. These changes have occurred so rapidly that Web-based courses have proliferated without significant research as to their effectiveness from a student's perspective (Ewing-Taylor, 1999). Researchers are aware that it is not sufficient to measure the effectiveness of Web-based learning purely through testing and grades. Indeed, Marshall (1999) pointed out that it is necessary to look at and evaluate the process of delivery and attitudes toward various delivery methods as well as course components in order to design more effective courses for Web delivery and to explore their effectiveness.

Although competition in the education marketplace is not new, competition on this level is. Online education is not for every student, but if such courses fit the needs of enough students then they can and will change the nature of higher education in a very short time frame (Ewing-Taylor, 1999). Consequently, there is a need to profile students and create courses and delivery systems that address their needs. In line with this problem, the following study focuses upon the factors that affect students' learning and satisfaction with various online course components such as email, online discussions, chat, web links, audio, video, graphics, simulations, and text. The findings of this research study may lead educators to rethink the process of instructional design.

They may shift or adapt the traditional instructional design models and theories to accommodate the new features of Web-based courses. At the very least, a deeper understanding about the Web as a mode of delivery in DE and its effects on distance learning should emerge.

Furthermore, one of the major challenges faced by the educational institutions nowadays is the increasing diversity of students. Variations in motivation, time management and learning styles, maturity and other factors create new challenges for achieving consistent, high quality learning (Lengnick-Hall & Sanders, 1997). To the extent that information technology is extensively used as a mediator in a distance learning environment, it offers the opportunity to accommodate a variety of individual differences in students (Carswell, 2001). Accordingly, the findings from this research study may strengthen our understanding of how students' internal characteristics affect learning outcomes in technology-mediated Web-based environment.

Significance of the Study

With computer hardware and software affordable to most people, the rapid development of technology in educational institutions and the growing momentum behind distance education, it is more important today than ever before to continue to develop courses and instruction that can be delivered using the latest technologies (Bi, 2000). It is also increasingly important to monitor the quality and effectiveness of the delivery systems and courses. By monitoring the quality of instruction and identifying the effectiveness of technology in WBI, we will ensure the academic integrity of college courses and distance learning programs, and guarantee that students who are accessing this new mode of delivery are receiving the best possible education.

This research study is significant for the following reasons: Firstly, there is a lack of current research in effective instructional design for distance education. For the purpose of better learning outcomes, this research study will evaluate the effectiveness of various online delivery

and course components. Secondly, this research study provides data for future comparative and empirical research. In areas as heavily invested in innovation as educational multimedia, hypermedia, and telecommunications, some might question in the future the meaning and value of face-to-face classroom instruction versus teaching adults electronically. After all, changes in the technologies employed in distance education occur at a faster and faster pace. The technologies not only affect the mode of delivery, but also the way academic learning is studied. Thirdly, this research study might be of some benefit for the programs of lifelong learning, for the future improvement of their services. The information this research provides might allow potential users of the courses, programs, or products to make more reasonable choices about how to utilize them.

In relation to the audiences, this research study serves four audiences: first it assists the faculty in designing effective online courses. The information gathered in this study should show them areas that are considered essential and non-essential to outside stakeholders. Thus, they should be able to make informed decisions about what to retain, delete, and add to the course structure and components. Secondly, this study assists scholars of course assessment. The methods used may be examined and critiqued for other studies. This benefit is particularly important because education is now expanding with Web-based instruction that is short on tested course assessment procedures in part because it is so new and in part because we do not fully understand the differences between classroom teaching and WBI other than the obvious. Thirdly, this study assists online students who might benefit from this research due to the improved teaching methods that may be identified and utilized. Finally, this study informs the public about the value and/or effectiveness of WBI as one option of distance education.

This research study makes an attempt to illustrate the value of interpreting students' goals and underlying motivations within the context of their life circumstances. Without understanding students' backgrounds, previous educational experience, level of self-confidence, fears, aspirations, learning styles, it is difficult to identify the learning activities and student support services that are crucial to success. The results of the investigation shed light on the impact of students' motivations/learning styles/prior online experiences on students' attitudes and satisfaction with the online course components. These findings, in turn, could be used to develop and improve methods of instruction in distance education institutions. They could also act as a guide for determining areas, which need improvement and areas in which students are currently satisfied. It is essential that university professors are aware of the variables which can positively or negatively affect student performance. The results of the study could improve decision-making regarding students' learning experiences. This research study makes a case for using research results to guide future applications in this area, and for pursuing additional research to address still unanswered questions.

Structure of the Study

This study consists of five chapters. In the first chapter, the problem is stated and the significance of the research is discussed. The second chapter, the Literature Review, includes four parts that form the conceptual framework: (1) the application of instructional design theories in online education is examined, (2) various components of online courses will be explored, (3) characteristics and motivations of online learners are examined, (4) learning style preferences of online students are investigated. Chapter three dwells on the research design and methodology. The results of the study are discussed in Chapter four. Chapter five includes discussion, conclusions, and implications for future research.

CHAPTER II

REVIEW OF LITERATURE

INSTRUCTIONAL DESIGN

Definition Overview

Educational research contains a wide variety of definitions for *instructional design* (ID). Briggs, Gustafson, and Tillman (1991) defined *instructional design* as a systematic approach to creating effective instruction that had not had the test of time such as scientific principles, for example. Merrill, Drake, Lacy, and Pratt (1996) defined *instructional design* as a technology for the development of learning experiences and environments, which promotes the acquisition of specific knowledge and skill by students. Instructional design is also a technology that incorporates known and verified learning strategies into instructional experiences which make the acquisition of knowledge and skill more efficient, effective, and appealing.

Smith and Ragan (1997) described *instructional design* as (a) a systematic process (step by step approach, considering all variables) (b) of translating principles of learning and instruction (learning theory as a basis) (c) into plans for instructional materials and activities (produce specified detailed documents, greater chance for learning).

Spector (as cited in Morgan, 1997) referred to *instructional design* as a structuring of the learning environment for the purpose of facilitating learning or improving learning effectiveness. This definition of ID is adopted in this research study as well.

Depending on whether Instructional Design is viewed as a process, discipline, science, or reality, research suggests the following definitions of Instructional Design:

1. Instructional Design as a Process: Instructional Design is the systematic development of instructional specifications using learning and instructional theory to ensure the quality of

instruction. It encompasses the entire process of analyzing learner needs and goals and developing a delivery system to meet those needs. In addition, it includes development of instructional materials and activities, as well as the tryout and evaluation of all the instruction and learner activities (Berger & Kam, 1996).

El-Tigi and Branch (1997) defined *instructional design* as a process for planning episodes of guided learning. The contention here was that the process of Instructional Design could be utilized for a host of educational delivery options, including Web-based learning.

According to Reigeluth (1983), *instructional design* is the process of deciding what methods are best for bringing about desired changes in student knowledge and skills for the specific course content and the specific student population.

2. Instructional Design as a Discipline: Instructional Design is that branch of knowledge concerned with research and theory about instructional strategies and the process for developing and implementing those strategies (Berger & Kam, 1996).

3. Instructional Design as a Science: Instructional Design is the science of creating detailed specifications for the development, implementation, evaluation, and maintenance of situations that facilitate the learning of both large and small units of subject matter at all levels of complexity (Berger & Kam, 1996).

Richey (1986) defined *instructional design* as the science of creating detailed specifications for the development, evaluation, and maintenance of situations that facilitate the learning for both large and small units of subject matter.

4. Instructional Design as Reality: Instructional Design can start at any point in the design process. Often a glimmer of an idea is developed to give the core of an instruction situation. By the time the entire process is done the designer looks back and checks to see that all parts of the

"science" have been taken into account. Then the entire process is written up as if it occurred in a systematic fashion (Berger & Kam, 1996).

Reiser (2001) suggested a very detailed definition of the field of instructional design and technology: The field of instructional design and technology encompasses the analysis of learning and performance problems, and the design development, implementation, evaluation, and management of instructional and noninstructional processes intended to improve learning and performance in a variety of settings, particularly educational institutions and the workplace. Professionals in the field of instructional design and technology often use systematic instructional design procedures and employ a variety of instructional media to accomplish their goals. Moreover, in recent years, they have paid increasing attention to noninstructional solutions to some performance problems. Research and theory related to each of the aforementioned areas is also an important part of the field.

The major features of this definition, according to Reiser (2001), include (a) its listing of six categories of activities or practices (analysis, design, development, implementation, evaluation, and management) often associated with the field, (b) its identification of research and theory, as well as practice, as important aspects of the profession, (c) its recognition of the influence the performance technology movement has had on professional practices.

General Instructional Design Phases

Instructional design refers to the process of instructional program development from start to finish (Braxton, Bronico, & Looms, 1995). Many models exist for use by different levels of instructional designers and for different instructional purposes. However, Braxton et al. summarized the process into five general phases (See Figure 1).

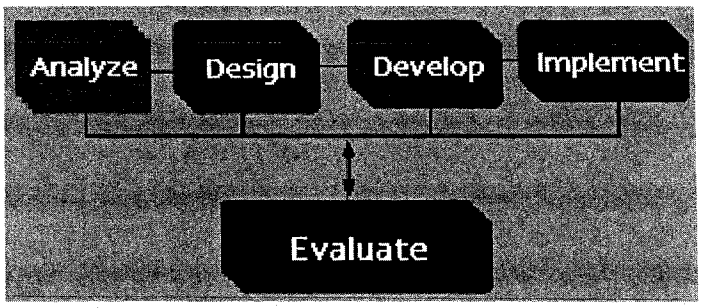

Figure 1. Five Phases of ID Process

The **Analyze** phase is the foundation for all other phases of instructional design. During this phase, one must define the problem, identify the source of the problem, and determine possible solutions. The phase may include specific research techniques such as needs analysis, job analysis and task analysis. The outputs of this phase often include the instructional goals, and a list of tasks to be instructed. These outputs will be the inputs for the Design phase.

The **Design** phase involves using the outputs from the Analyze phase to plan a strategy for developing the instruction. During this phase, one must outline how to reach the instructional goals determined during the Analyze phase and expand the instructional foundation. Some of the elements of the Design Phase may include writing a target population description, conducting a learning analysis, writing objectives and test items, selecting a delivery system, and sequencing the instruction. The outputs of the Design phase will be the inputs for the Develop phase.

The **Develop** phase builds on both the Analyze and Design phases. The purpose of this phase is to generate the lesson plans and lesson materials. During this phase one will develop the instruction, all media that will be used in the instruction, and any supporting documentation. This may include hardware (e.g., simulation equipment) and software (e.g., computer-based instruction).

The **Implementation** phase refers to the actual delivery of the instruction, whether it is classroom-based, lab-based, or computer-based. The purpose of this phase is the effective and efficient delivery of instruction. This phase must promote the students' understanding of

material, support the students' mastery of objectives, and ensure the students' transfer of knowledge from the instructional setting to the job.

The **Evaluation** phase measures the effectiveness and efficiency of the instruction. Evaluation should actually occur throughout the entire instructional design process--within phases, between phases, and after implementation. Evaluation may be formative or summative.

Formative Evaluation is ongoing during and between phases. The purpose of this type of evaluation is to improve the instruction before the final version is implemented.

Summative Evaluation usually occurs after the final version of instruction is implemented. This type of evaluation assesses the overall effectiveness of the instruction. Data from the Summative Evaluation is often used to make a decision about the instruction (such as whether to purchase an instructional package or continue/discontinue instruction). These phases sometimes overlap and can be interrelated, however, they provide a dynamic, flexible guideline for developing effective and efficient instruction.

Instructional Design Theories

Instructional theory describes a variety of methods of instruction (different ways of facilitating human learning and development) and the situations in which those methods should be used. The methods can be broken into simpler component methods, and the methods are probabilistic (Reigeluth, 1999, p.7). Winn (1997) maintained that ID theories are based on Learning Theories. Although there are many learning theories, three theories, behaviorism, cognitivism, and constructivism dominate instructional design. Each theory is summarized below.

Behaviorism

Many behaviorists believe that the behavior of humans, like other animals, can be understood entirely without reference to internal states such as thoughts and feelings. Behaviorists were interested in discovering the ways in which environmental events, or stimuli, control behavior. The behaviorist philosophy descended from the views of the British Empiricists, specifically of John Locke and his concept of *tabula rasa*. The central notion is that human nature is essentially a blank slate. We are born into the world with no knowledge, and without having any disposition to do good or evil. What we become depends entirely upon the affect of the environment. If we control a child's environment we can make a child become what we wish (Shermis, 1998). This approach was adapted by some German philosophers and also by turn-of-the century psychologists such as Pavlov, Thorndike, Watson, and in the mid-century by Skinner.

Skinner claimed that children come into the world with a *tabula rasa* -- a blank slate -- bearing no pre-conceived notions about the world or about language, and these children are then shaped by their environment, slowly conditioned through various schedules of reinforcement. Skinner also claimed that learning in general could be programmed. You can teach anything by a carefully designed program of step-by-step reinforcement. Skinner characterized the learner as being similar to a battery, in that it continually emits behavior, while the environment selects certain behaviors based upon their consequences.

Andrew and Isaacs (1995), criticizing Skinner's model of operant learning, noted that it denied the importance of internal states in learning. Murphy (1997) pointed out that Skinner's behaviorism avoided reference to meaning, representation and thought because it emphasized only observable, external behaviors. Other researchers (Chomsky, 1971; Graham, 2000) pointed

out that one remarkable feature of human behavior that Skinner deliberately rejected was that people creatively make their own environments. The world is as it is, in part, because we make it that way. Skinner protested that "it is in the nature of an experimental analysis of human behavior that it should strip away the functions previously assigned to autonomous man and transfer them one by one to the controlling environment" (Chomsky, 1971, p.198). Critics also say that behaviorism oversimplifies human behavior and that it sees the human being as an automaton instead of a creature of will and purpose (Graham, 2000).

In the behavioral approach, learning, according to Murphy (1997), is conceived as a process of changing or conditioning observable behavior as a result of selective reinforcement of an individual's response to events (stimuli) that occur in the environment. Behaviorism centers on students' efforts to accumulate knowledge of the natural world and on teachers' efforts to transmit it. It therefore relies on a transmission, instructionist approach, which is largely passive, teacher-directed and controlled.

One of the models of teaching and learning based on the Skinner's model is instructivism. According to Fardouly (1998), the instructivist approach is characterized by the following features: (a) Students learn as a result of instruction so they should be instructed in what to learn, (b) Learning is a stimulus-response association that shapes desirable behaviors, (c) Goal oriented learning, (d) Goals are structured into a learning hierarchy from lowest (memorization) to highest (analysis and synthesis), (e) Learning tasks reduced into individual components, (f) Tasks must be mastered independently and then assembled (task and skill analysis is carried out to break down skills into their component parts).

Occasionally, instructors mistakenly adopt a behaviorist rather than a constructivist approach to instructional design in the online environment. Stahl (1999) gave the following

explanation to this phenomenon: Most instructors agree that learners place more belief in knowledge they have discovered on their own than in knowledge presented by others. However, often these same instructors fail to trust students to learn anything not explicitly stated by the instructor. This is particularly true when applied to two-way compressed video or one-way video interactive television systems, where instructors continue to use classroom lecture practices. All too often, instructors have no confidence that learners can discover meaning for themselves. Instead, instructors perceive that lecturing is essential to ensure that students "get it." Thus, they adopt a behaviorist rather than a constructivist approach to instructional design. The instructor often becomes so focused on the desired outcome that the process by which the outcome can best be attained is forgotten or ignored. If it is true that it takes more than the mere transfer of information for attitudes, ideas, and behaviors to change, then the instructor who relies on lectures may be failing to support the very learning that leads to long-term change (Stahl, 1999).

Some researchers (Russell, 1998) believe that the behaviorist perspective can be effective if chosen for learning routine tasks, sometimes through drill and practice, but particularly if instruction is individualized on a student-by-student basis, and can be designed to allow successive approximation to a desired goal state or level of performance. There are already in existence a number of behaviorist-inspired Internet sites providing documents for self-paced instruction (e.g., Litchfield, 1997; Martineau, 1997; National Center for Supercomputing Applications, 1996; Zohrob, 1997), suggesting the broad acceptance of the behaviorist approach. However, in implementing the behaviorist paradigm, one must be aware of its instructional limitations (Russell, 1998). The student may have the information, but have little understanding of that information beyond a sterile representation of facts, skills and concepts. To go farther and

provide the student with an understanding of associated processes and strategies requires the assumption of the cognitivist and constructivist perspective.

Cognitivism

Cognitive psychologists asserted that learning occurs when learners are able to add new concepts and ideas to their cognitive structure by recognizing a relationship between something they already know and what they are learning. Knowledge consists of symbolic mental constructs in the learner's mind, and the learning process is the means by which these symbolic representations are committed to memory. Changes in behavior are observed, but only as an indicator to what is going on in the learner's head. The cognitivist version of the human mind is an input/output model of information or symbol processing.

For cognitive learning theorists, the input, processing, storage, and retrieval of information are the processes that are at the heart of learning. The instructor remains the manager of the information-input process, but the learner is more active in planning and carrying out his/her own learning than in the behaviorist environment. Instruction is not simply something that is done to a learner but rather involves the learner and empowers their internal mental processes. The learner is viewed as an active participant in the knowledge acquisition process. In addition, instructional material that utilizes demonstrations, illustrative examples and corrective feedback are helpful in providing mental models that the learner can follow.

Cognitivism was influenced by a number of people. Specifically, Jean Piaget's studies in learning development had considerable influence on the notion that knowledge is organized and structured, as well as the view that, for learning to occur, it must be incorporated within existing cognitive structures, from which it follows that new experience and prior knowledge must overlap. A significant influence also came from Chomskian linguistics. In a review of Skinner's

book on verbal behavior, Chomsky (1959) argued that some behavior (linguistic behavior, in particular) has to be understood in terms of internally represented rules. These rules are not products of learned associations. They are part of our native psychological endowment as human beings. Chomsky charged that behaviorist models of language learning could not explain various facts about language acquisition, such as the rapid acquisition of language by young children, which is sometimes referred to as the phenomenon of "lexical explosion." A child's linguistic abilities appear to be radically under-determined by the evidence of verbal behavior offered to the child in the short period in which he or she acquires those abilities. By the age of four or five (normal) children have an almost limitless capacity to understand and produce sentences they have never heard before. The basic rules or principles of grammar, therefore, argued Chomsky, must be innate.

Keil (1999) noted that the problem of behavioral capacities outstripping individual learning histories to which Chomsky had referred, seemed to go beyond merely the issue of linguistic behavior in young children. It appeared to be a fundamental fact about human beings that our sensitivities and behavioral capacities often surpass the limitations of our individual learning histories. Our history of reinforcement often is too impoverished to determine our unique behavior. Many types of learning, therefore, seem to require pre-existing or innate representational structures within which learning occurs.

Palmer (2000) in his critical review of Chomsky's nativism noted that Chomsky shared a number of fundamental assumptions with behaviorists and other experimental psychologists. Chomsky believed that organisms are a joint product of their genetic endowment and individual experience and that the experimental approach of the natural sciences is appropriate for the study of language. Chomsky's goals, however, are different from those of behaviorists. Chomsky,

according to Palmer, was not particularly interested in verbal behavior itself, influenced as it is by the circumstances of the speaker; rather Chomsky was interested in the "essential nature" of human beings that enables us to acquire a language. Specifically, Chomsky wanted to discover those elements of our nervous systems implicated in language that are genetically coded, hence "universal." Chomsky called these elements "universal grammar," a name that suggested the researcher's view of the task accomplished by these innate mechanisms: providing a set of rules to be used in speech production and comprehension.

Linuma (2000a) analyzed what Chomsky's theory meant in terms of examining electronic materials. The researcher noted that if one agreed that language could not really be "taught" but only acquired, then the theory could not be applied to materials that teach language. If one had developed a software program to teach grammar or pronunciation, then one was not on the side of those who maintained a nativist theory, which holds that language is unconsciously acquired. If one had developed software to increase vocabulary, promote literacy, or develop better writing skills, one was working with people who had already "acquired" the basics of language in the nativist sense. The researcher listed the following implications of the theory for computers: (a) Providing input so that the learner could use those (much like a child would) to generate grammatical utterances/sentences, (b) Using some of the aspects of language structure to help learners of English see how the language works, and (c) Using these aspects to help second language writers to develop their literacy skills.

Cognitivism has strongly influenced the development of instructional design theories. For instance, Robert Gagné's early instructional design theories were initially heavily rooted in the behaviorist psychology paradigm. In the 1970s, Gagné incorporated cognitive psychology theories, specifically the information-processing model of cognition. Gagné considered the

information-processing model a major advance in the scientific study of human learning (Gagné, 1977). Accordong to Striebel (1995, p.150), "Instructional design theories such as Gagné's theory, take the cognitivist paradigm one logical step further by claiming that an instruction plan can generate both appropriate environmental stimuli and instructional interactions, and thereby bring about a change in cognitive structures of the learner."

Some of the strengths of cognitivism include the following: (a) Because learners are trained to perform a function the same way based on specific cues, their behavior will be consistent with others who are trained in the same manner, and (b) The context of learners -- their thoughts, beliefs and values -- are influential in the learning process. However, as with behaviorism, the learner knows a certain way to do things based upon specific cues, but that way may not be the best, most efficient or safest way to do something in the advent of different environmental stresses or scenarios.

To facilitate learning, instruction should be structured in such a way that it allows for understanding the learner's existing mental structures. There is a reality that is socially imposed and universally agreed upon, one that the instructional designer must be able to assume exists for the learner. That way, the designer can use simulation to reflect real life situations. The Internet and computers in general directly model the connections cognitive psychologists expect learners to make. Computers allow students to categorize, organize and link concepts. The web is compartmentalized; concepts are grouped together. Search engines also often model logical connections between pieces of information. Through Web-based instruction, educators encourage computer-like thought processes. Accurately and effectively drawing conclusions stems from the starting point of a solid, well-worn path, a path worn in by routine and repetition. At the start of a new year, students are notorious for pointing out to each new teacher, "We

learned this last year." Teachers know that, but what students do not know is that based on cognitive methods, that sort of repetition is part of a grand plan to foster retention and extension of knowledge. Computer- and Web-based instruction have the potential to be valuable tools in carrying out the plan.

Constructivism

Constructivism is a theory that challenges the traditional behaviorist view that knowledge exists independently of the individual, that the mind is a *tabula rasa*, a blank tablet upon which a picture can be painted, and that learning is the resulting change in behavior due to reinforcement strategies.

The constructivist perspective asserts that learners construct knowledge by making sense of experiences in terms of what is already known (Brandt, 1997). That is, learners transfer knowledge through experiences via mental models that are used to assimilate new information into knowledge and expanded mental models (Tobin & Tippins, 1993). Constructivists also hold that learning is personal discovery, based on insight derived as a result of the student's intrinsic motivation.

According to Smith (1999), the constructivist philosophy was a leading perspective among progressive educators during the early half of the 20th century and was part of John Dewey's paradigm of learning and instruction. It derived from several theoretical traditions. Many attribute influences to the work of Bruner, who holds that the work of the learner is an active process in which the learner constructs new ideas based on previous knowledge. Others have turned to the Vygotsky's research on the importance of a social context and his practical notion of the zone of proximal development. However, the most important influence today is from the work of Piaget.

Piaget (1968) maintained that human knowledge is essentially active. According to the researcher, to know was to assimilate reality into systems of transformations. Piaget opposed those theorists who saw knowledge as a passive copy of reality. Knowing an object did not mean copying it; it meant acting upon it. It also meant constructing systems of transformations that could be carried out on or with this object. Knowing reality meant constructing systems of transformations that corresponded, more or less adequately, to reality. Piaget viewed knowledge as a system of transformations that become progressively adequate.

Hein (1991) identified the following principles of constructivist learning:

1. Learning is an active process in which the learner uses sensory input and constructs meaning out of it.
2. The crucial action of constructing meaning is mental: it happens in the mind. Physical actions, hands-on experience may be necessary for learning, especially for children, but it is not sufficient; we need to provide activities that engage the mind as well as the hands.
3. Learning involves language: the language we use influences learning. On the empirical level, researchers have noted that people sometimes talk to themselves as they learn. On a more general level, there is a collection of arguments, presented most forcefully by Vygotsky, that language and learning are inextricably intertwined.
4. Learning is a social activity: our learning is intimately associated with our connection with other human beings, our teachers, our peers, our family as well as casual acquaintances, including the people before us or next to us at the exhibit.
5. Learning is contextual: we do not learn isolated facts and theories in some abstract ethereal land of the mind separate from the rest of our lives: we learn in relationship to what else we know, what we believe, our prejudices and our fears.

6. One needs knowledge to learn: it is not possible to assimilate new knowledge without having some structure developed from previous knowledge to build on. The more we know, the more we can learn.
7. It takes time to learn: learning is not instantaneous. For significant learning we need to revisit ideas, ponder them try them out, play with them and use them.
8. Motivation is a key component in learning. Not only is it the case that motivation helps learning, it is essential for learning.

Ryneveld (2000) suggested that in the constructivist theory the emphasis is placed on the learner or the student rather than the teacher or the instructor. It is the learner who interacts with objects and events and thereby gains an understanding of the features held by such objects or events. The learner, therefore, constructs his/her own conceptualizations and solutions to problems. Both learner autonomy and initiative are accepted and encouraged.

Constructivists believe that learning is a process of sense-making, of adding and synthesizing new information within existing knowledge structures and adjusting prior understandings to new experiences (Jones, 2000). The meaning that learners derive from a particular learning experience is unique and each individual's experience is filtered through their personal understandings, beliefs, and values.

Ryneveld (2000) pointed out that in constructivist thinking learning is also affected by the context and the beliefs and attitudes of the learner. Learners are encouraged to invent their own solutions and to try out ideas and hypotheses. They are given the opportunity to build on prior knowledge.

Learning is considered to be a social process (Jones, 2000). Learners who are dissatisfied with their current level of knowledge engage others in a sharing, comparing, and reformulating

of ideas. Through a collaborative process, learners restructure new understandings. Constructivist activities include (Landau, 2001): constructing, experimenting, practicing, summarizing and reading, conducting research and analysis, and articulating (writing, drawing). In order to carry out these learning projects, students often need preparation and guidance. According to Landau (2001), this preparation and guidance in the online environment can be: (1) instructor's notes (text-based Web pages, listservs, emails, chat sessions or via audio or video streaming), (2) other media (books/videos), and (3) collaboration with other students.

The constructivist classroom presents the learner with opportunities to build on prior knowledge and understanding to construct new knowledge and understanding from authentic experience. Students are allowed to confront problems with real-life context. In solving these problems, students are encouraged to explore possibilities, invent alternative solutions, collaborate with other students (or external experts), try out ideas and hypotheses, revise their thinking, and finally present the best solution they can derive (NCREL, 1995).

There is a body of educational research (Landau, 2001) that shows that the student-centered courses are more effective online because the students feel supported and engaged by their classmates and think of the teacher like a personal trainer who cares about their progress and monitors their achievements. In online student-centered courses a sense of community can be created.

Bridwell, White, DeVries, and King (1996) set out several steps that should be applied when designing learner-centered distance education. They were the following: (a) Goal Statement, (b) Defining the Learner (be specific, adapt to learning style, define learning objectives), (c) Writing Learner-Center Objectives (Audience: List the specific characteristics of the audience; Behavior: Specify the behavior the audience will exhibit if they master the

objective; Conditions: Describe the conditions from which the objective will be accomplished; the restrictions or givens in the situation; Degree: Define the degree of completion or attainment which participants must achieve for the objective to be labeled successful; what is an acceptable level of performance), (d) Developing the Content (Select the Instructional Method/Strategy, Selecting the Delivery Method(s)), (e) Evaluation (Formative: can help you make positive changes to your program while it is taking place or even before it is delivered; Summative: occurs at the end of a program and measures program results, effectiveness and impact).

In addition two-way feedback techniques can be established through email with an anonymous complaint and suggestion board on course activities, content, or any other issue that may concern a student. Assessments and involvement with students can be facilitated with database technology, which would allow students free access to performance evaluations on a regular basis (Bailey & Coltar, 1994).

Gay (1997) pointed out that the Web's ability to foster cooperative collaborative interaction between students makes it an ideal tool for delivering constructivist type instruction. Numerous studies demonstrated that higher achievement, more positive relationships among the learning community, and the development of cooperative behaviors could result from cooperative learning experiences (Johnson, Johnson, & Smith, 1988, as cited in Bailey & Coltar, 1994). Jonassen, Davidson, Collins, Campbell, and Haag (1995) applied the principles of constructivism to technology and described constructivism's place in distance education. The researchers described various technological applications that promote the social interaction necessary to help students construct knowledge. These applications included computer-mediated communication, computer-supported collaborative work, case-based learning environments, and computer-based cognitive tools. Using synchronous and asynchronous communication, hypertext

based programs to promote debate, "real life" problems, and computer programs like databases and artificial intelligence, online learners can work together to solve problems and provide the social interaction necessary to translate educational material into meaningful experiences.

VonBoeck (1998) argued that a pure constructivist approach might not be the most appropriate strategy for distance education, but making slight modifications, sacrificing in some areas and choosing appropriate media would allow for designs that put the task of constructing knowledge back into the hands of the learner. According to VonBoeck (1998), a good understanding of constructivism and the use of such technologies like virtual reality might make the difference in applying constructivism to online education. The following guidelines addressed some potential deficiencies of constructivism for distance education and provided a framework for implementation of constructivism in distance education (VonBoeck, 1998):

1. Students are given several open-ended choices on where they want the course to take them.
2. The instructor acts as guide and partner to direct the student towards resources that will support their choice of objectives.
3. The instructor commits to spending time providing feedback and guidance that will direct the learner towards the objective.
4. Where appropriate, collaborative learning strategies are used. The jigsaw method is especially appropriate.
5. Delivery technology is selected that supports the level of dialog necessary to allow the learner to communicate their understandings to the instructor and the instructor is able to guide the student.

Sherry (1996) pointed out that in constructivist environment, students were active participants in the learning process. Students affect the manner in which they deal with the material to be learned. Learners must have a sense of ownership of the learning goals (Savery & Duffy, 1995). They must be both willing and able to receive instructional messages. Salomon's study (as cited in Saettler, 1990), found that the mental effort which a learner will invest in a learning task depends on his own perception of two factors: (1) the relevance of both the medium and the message which it contains, and (2) his ability to make something meaningful out of the material presented. Interestingly enough, Salomon found that television proved to be mentally less demanding than printed text when comparable content was employed. By giving students some expectations about the purpose of their viewing, the researcher was able to influence the effort that students invested in processing the content of television instruction (Saettler, 1990, p. 487).

According to Brandt (1997), while the goal of constructivism is to recognize and help facilitate the learner's ability to construct knowledge, when applied to teaching information retrieval on the Internet it also provides the teacher with a structure for teaching. By focusing on concepts and connecting them to mental models, instructors and teachers can gain both confidence and control over the amount of material they cover in the small blocks of time usually allotted to teaching and training. Integrated with experiences that learners use to alter and strengthen mental models, a constructivist approach to teaching information retrieval also gives users a needed structure to get the most out of the Internet.

Learner-Focused Models

According to Northcote and Kendle (2000), if a constructivist content-oriented and learner-centered approach is adopted and implemented in online teaching and learning situations,

the quality of student learning will improve and deepen in both the short and the long term. A number of various learner-centered instructional theories were proposed in the past few decades. The two most relevant ones for online instruction are Knowles's Theory of Adult Learning and Reigeluth's Elaboration Theory.

Knowles's Theory of Adult Learning

Knowles's theory of andragogy was an attempt to develop a theory specifically for adult learning. Knowles emphasized that adults are self-directed and expect to take responsibility for decisions. Andragogy makes the following assumptions about the design of learning: (1) adults need to know why they need to learn something, (2) adults need to learn experientially, (3) adults approach learning as problem-solving, (4) adults learn best when the topic is of immediate value, and (5) adults tend to be internally motivated (Knowles, 1984).

The model, proposed by the researcher, related entirely to delivery strategies that considered the unique characteristics of adults. Knowles also identified the following assumptions underlying the model of adult instruction. The assumptions highlighted differences between adults and children as learners, and provided the rationale for Knowles's recommendations. First, as one becomes older there is movement from total dependency to self-directedness. Moreover, there is resistance when adults are put into situations where they are not allowed to be self-directed. The second assumption relates to the role of personal experiences in learning. This assumption posits that there should be a decreasing emphasis on traditional teaching techniques, such as lecturing, and increasing use of techniques that incorporate the learner's experience as an integral part of instruction. Third, adults' readiness to learn is dependent upon their needs and the developmental phases of the various roles played. Roles include worker, spouse, and parent. Thus, planned learning activities for adults should coincide

with current needs evolving from these various roles. Fourth, Knowles assumes that instruction should focus on problems rather than subject matter. Such curriculum organization is designed to facilitate immediate application in everyday life.

These assumptions have been translated into a process model for organizing and delivering adult instruction. The steps are:

1. Establishing a climate conducive to learning.
2. Creating a mechanism for mutual planning.
3. Diagnosing the needs for learning.
4. Formulating program objectives (which is content) that will satisfy these needs.
5. Designing a pattern of learning experiences.
6. Conducting these learning experiences with suitable techniques and materials.
7. Evaluating the learning outcomes and rediagnosing learning needs (Knowles, 1978).

Andragogy can be applied to any form of adult learning. Knowles (1984) provided an example of applying andragogy principles to the design of personal computer training:

1. There is a need to explain why specific things are being taught (e.g., certain commands, functions, operations, etc.).
2. Instruction should be task-oriented instead of memorization - learning activities should be in the context of common tasks to be performed.
3. Instruction should take into account the wide range of different backgrounds of learners. Learning materials and activities should allow for different levels/types of previous experience with computers.
4. Since adults are self-directed, instruction should allow learners to discover things for themselves, providing guidance and help when mistakes are made.

Knowles emphasized that by using the adult model of instruction, adult learners are helped to acquire information and skills, rather than simply receive information as in a traditional instructional model. This model has a lot of value for DE instruction since it included characteristics of adult learners and outlined instructional strategies that could accommodate the diverse learning styles and preferences for adult learners. Applied correctly, the andragogical approach to teaching and learning in the hands of a skilled facilitator can make a positive impact on the adult learner. Furthermore, the importance of this model for the WBI is in the role given to adult student motivation. In distance education, the ability of an instructor to influence motivation is greatly reduced because of the loss of face-to-face contact with the learner (Cote, 1998). Instructional design, while always important, becomes critical in distance education to ensure that the learning provided is both appealing and effective. According to Blake (1999), since adult learning is heavily governed by motivation to learn, adults become frustrated easily when they cannot see the "obvious" connections. For adults to be motivated they must be able to actually see how the learning is relevant to them. Accordingly, online instructors should try to relate all new information to what adults already know, and refer to situations where the subject matter can be usefully applied, even if it seems obvious. Blake provided the following example: when introducing shell scripts to an ex DOS user, an instructor might start by pointing out the major similarities and differences, then list a few ways that easy scripts can be used to make students' everyday tasks easier, and follow up with actual examples as the technique is explained.

Reigeluth's Elaboration Theory

Reigeluth's Elaboration Theory is a Cognitive Prescriptive theory, which is based on Bruner's Spiraling curriculum, Norman's Web Teaching, Gagne's Cumulative Learning Theory,

and Ausubel's Subsumptive sequencing. Reigeluth's goal was to integrate all existing knowledge on learning and instruction, including behavioral, cognitive, and constructivist. Like CDT, Elaboration Theory organizes instruction in such a way as to facilitate learner control, but on the macro level this means control over selection and sequencing of ideas as well as control over frequency and timing of such strategy components as synthesizers and reviews (Reigeluth, 1983).

According to elaboration theory, instruction should be organized in increasing order of complexity for optimal learning. For example, when teaching a procedural task, the simplest version of the task is presented first. Subsequent lessons present additional versions until the full range of tasks are taught. In each lesson, the learner should be reminded of all versions taught so far (summary/synthesis). A key idea of elaboration theory is that the learner needs to develop a meaningful context into which subsequent ideas and skills can be assimilated.

Elaboration theory proposes seven major strategy components: (1) an elaborative sequence, (2) learning prerequisite sequences, (3) summary, (4) synthesis, (5) analogies, (6) cognitive strategies, and (7) learner control.

1. Elaborative Sequence

The first component is the most critical as far as elaboration theory is concerned. The elaborative sequence is defined as a simple to complex sequence in which the first lesson epitomizes (rather than summarize or abstract) the ideas and skills that follow. Epitomizing should be done on the basis of a single type of content (concepts, procedures, principles), although two or more types may be elaborated simultaneously, and should involve the learning of just a few fundamental or representative ideas or skills at the application level.

2. Prescriptions for Sequencing

Once the elaborative sequence is developed, the lessons within each unit are similarly sequenced. The rules for sequencing are simple:

1. Begin with the most familiar or organizing concepts.
2. Put supporting content immediately after the organizing information.
3. Place learning prerequisites before new content.
4. Group related concepts.
5. Teach principles before procedures.

The above five rules repeat at different levels. It is the theme of moving from the simple to the more complex. First, introduce new material in the order of familiarity, that is, maximize the connections learners can make to material they already know. When possible, start with material that can organize, or provide mental hooks for, new material. Connect new content immediately to the familiar content and show the relationships. Be sure that learners know what they need to know before learning new information. Then, group related concepts to increase the number of connections. Increasing connections both facilitates learning and promotes effective and efficient movement from short- to long-term memory. Finally, teach underlying principles before the procedures that make use of those principles (e.g., have a model for development before you begin.)

3. Summarizers

Summarizers collapse lessons to single, easily handled concepts. These summarizers can be presented by the developer or drawn from the learners as insights.

4. Synthesizers

Synthesizers make the connections both to previous learning and to current learning. They allow us to make connections, so that we can begin to make sense and new meaning. Synthesizers may be lessons in and of themselves (depending on the complexity of the material), but typically they are simple ways to connect content (subject matter), procedures (what to do), or theories (why to do what you do).

5. Analogies

Analogies relate new material to old. They take two forms: examples and non-examples. Examples are those where the resemblances between objects, situations, or ideas are similar, and the similarity is extensive. Non-examples are instances in which the similarities may be superficial or misleading. The combination of the two helps the learner understand how the new material is similar to the old and equally important, in what ways they differ.

6. Cognitive-Strategy Activators

Activators are cues to the learner to apply the learning skills they already have, for example, asking, "How does this relate to your past experience?"

7. Learner Control

Learner control is a relatively advanced function. Basically, entry-level learners learning primary skills tend to need a lot of structure to facilitate new learning. More advanced learners, however, learn more quickly when they have control over their learning decisions. Typical participants bring a wealth of information to the community. Therefore, it is critical that instruction is set up to maximize the number of choices the learner can make.

It is claimed that the elaboration approach results in the formation of more stable cognitive structures and therefore better retention and transfer, increased learner motivation

through the creation of meaningful learning contexts, and the provision of information about the content that allows informed learner control. Elaboration theory applies to the design of instruction for the cognitive domain. The theoretical framework has been applied to a number of settings in higher education and training (English & Reigeluth, 1996; Reigeluth, 1992). For example, Hoffman (1997) considered the relationship between elaboration theory and hypermedia.

Reigeluth's (1999) model of Instructional Design theory has two components for facilitating human learning and development: (1) *methods of instruction* that relate to the context in which learning can take place and (2) *situations for learning* that affect the methods of instruction. Reigeluth's (1999) model is illustrated in Figure 2.

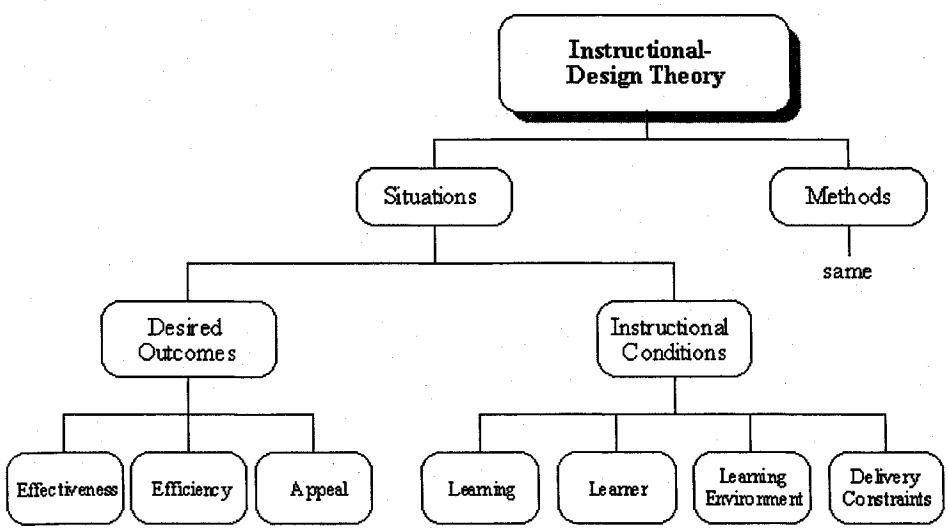

Figure 2. Reigeluth's Components of Instructional Design Theories

McGriff (2001) pointed out that educators would choose to use the elaboration theory for guidance in making scope and sequence of instruction decisions, particularly ones that support holistic approaches to learning. Holistic approaches are key for the new paradigm of learning, which includes simulations, apprenticeships, goal-based scenarios, problem-based learning, and situated learning. The theory is flexible enough so that different guidelines can be used for

different instructional situations (McGriff, 2001). One of the advantages of this model is that it provides a holistic approach to sequencing which enhances the learning process to be more meaningful and motivational to learners. Also, it was designed to allow the instructional designer to empower the learner to make some scope and sequence decisions during the learning process.

The strength of this model is the provision of numerous aids to guide the development process. It is thus suitable for use with novice instructional designers. Other strengths of the model are: (a) Organizes instruction to facilitate learner control, (b) Holistic instructional design theory -- exclusively on the macro level, (c) General-to-Specific learning model, (d) Uses analogies to facilitate learning. Furthermore, Simple-to-Complex approach of this model can be valuable for the Web-based course design. This approach (1) helps to ensure that the learner is always aware of the context and importance of the different ideas that are being taught, (2) allows the learner to learn at the level of complexity that is most appropriate and meaningful to him/her at any given state in the development of one's knowledge, (3) the learner never has to struggle through a series of learning prerequisites that are at too deep a level of complexity to be interesting or meaningful at the initial stages of instruction (Remley, 2002). Limitations of this model include lack of attention to project management and implementation.

Instructional Design and Student Satisfaction

Navarro and Shoemaker (2000) suggested that student satisfaction is an important indicator of success in distance learning courses. While many studies have focused on factors such as attrition, locus of control, media tools, and student achievement, student satisfaction, however, has not been explored sufficiently. DeBourgh (1999) conducted a study to determine predictors of student satisfaction in a graduate nursing program taught via fully interactive, multipoint real-time video teleconferencing and the World Wide Web/Internet. A correlational

research design was used to examine relationships among five learner attributes, three instructional variables, and student satisfaction. The five learner attribute predictors were: (1) previous experience with courses taught via technology, (2) self-ratings of competence with technology, (3) frequency of between-class usage of communications technology, (4) age, and (5) remote-site group size. The instructional variables were instructor/instruction, technology, and course management. Forty-four students enrolled in Nursing Program were surveyed using an attitudinal instrument (5-point Likert scale). Data were analyzed using reliability coefficients, simple correlation coefficients, linear regression analyses, and content analysis. Results showed that the following characteristics of teaching correlated with student satisfaction: clear expectations about assignments, prompt response to student questions, encouraging student participation, using a variety of instructional techniques in explaining concepts, responding to student assignments in a timely fashion. The study found that overall instructor rating strongly correlated with satisfaction. The most potent finding, according to the author, was that good pedagogy is important to students' perceived satisfaction with distance education.

To conclude, it is apparent that past instructional design theories have drawn heavily on the pedagogical principles of behaviorism, objectivism and linear patterns of instruction. The current educational arena, however, is one in which the learner's attributes are valued and the process of learning is based more on constructivist values. It is also evident that knowledge and implementation of the adequate instructional design theories contributes to the general effectiveness of the online instruction. This, however, is only one component of a successful online course design. The other component includes factors related to the specificity of a course delivery in an online technology-based environment. These factors are the following: course delivery options, a choice of course components (e.g., email, online threaded discussions, video

streaming, etc.), and consideration of the various specifics of the WB environment. Accordingly, in the next part of the Literature Review, the specificity of online environment will be examined and various online course components will be analyzed.

WEB-BASED INSTRUCTION (WBI)

Definitions

According to Khan (1997), Web-Based instruction (WBI) is "an innovative approach for delivering instruction to a remote audience, using the Web as the medium. It is defined as a hypermedia-based instructional program that utilizes the attributes and resources of the World Wide Web to create a meaningful learning environment where learning is fostered and supported." Other researchers accentuated a repertoire of cognitively-oriented instructional strategies implemented within a constructivist and collaborative learning environment, utilizing the attributes and resources of the World Wide Web (Lebow, 1993; Relan & Gillami, 1997). Though the above definitions are not identical, there is a common theme: WBI takes advantage of the Internet and World Wide Web to deliver information. Anyone who is involved in developing Web-based instructional materials can benefit from a basic knowledge of instructional design principles.

Web-Based Instruction Components

Ward and Newlands (1998) identified the following potential advantages of online courses: better learning resources, a more flexible pace of learning, greater choice of when to study, increased self reliance, more tutorials/seminars, and improved computer literacy. Among the potential disadvantages of online courses, Ward and Newlands singled out the following: poorer learning resources, an alienating learning experience, technical frustrations, inadequate access to computers, unfairness, loss of contact with staff, loss of contact with other students, and reduced motivation.

Components are integral parts of a WBI system (Banathy, 1992). Components are never static. According to Khan (1997), as the web matures, new components become available for

WBI, and the existing components improve with time. As a result, new features will be available to enrich WBI learning environments. For example, the collaborating on or with databases that Scardamalia (Scardamalia & Bereiter, 1992) and other are developing seems to hold considerable promise for the future.

Khan (1997) proposed the following classification of WBI components:

1. Content Development (Learning and instructional theories, Instructional design (ID), Curriculum development).
2. Multimedia Component (Text and Graphics, Audio Streaming, Video Streaming, Graphical User Interface (GUI), Compression technology).
3. Internet Tools (Communication Tools: (a) Asynchronous: email, listservs, newsgroups, etc., (b) Synchronous: text-based and audio-video conferencing tools, Remote Access Tools, such as Telnet, File Transfer Protocol (ftp), etc., Internet Navigation Tools (Access to databases and Web documents) such as Gopher, Lynx, etc., and Search and Other Tools such as Search Engines and Counter Tool).
4. Computer and Storage Devices (Computer Platforms running Unix, DOS, Windows and Macintosh operating systems, Servers, hard drives, CD ROMs, etc.).
5. Connections and Service Providers (Modems, Dial-in and dedicated services, Gateway Service Provider, Internet Service Providers, etc.).
6. Authoring Programs (Programming languages, Authoring Tools (easier to use than programming languages), HTML Converters and Editors, etc.).
7. Servers (HTTP servers, HTTPD software, Web site, URL – Uniform Resource Locator, etc., Common Gateway Interface (CGI) – a way of interacting with the http or Web servers. CGI enables such things as image maps and fill-out forms to be run).
8. Browsers and Other Applications (Text-based browser, graphical browser, VRML browser, etc., Links, Applications that can be added to Web browsers such as plug-ins).

Email

The use of email is now widespread within higher education and, according to Gilbert (as cited in Smith, Whiteley, & Smith, 1999), course-related use of email is becoming the single most powerful force for integrating information technology into teaching and learning. A number of researchers suggested that the use of email facilitates communication among students and between students and faculty (Bork, 2000; Grabowski, Suciati, & Pusch, 1990; Hadidi, 1998; Junk & Fox, 1998). Many students find that via email their interaction with the instructor

substantially increases when compared to those face-to-face meetings. It especially can be beneficial to those students who are shy or have verbal challenges (Junk & Fox, 1998). Wild and Winniford (1993) argued that electronic mail is the most mature and widely utilized tool among the group communication tools currently in use in WBI. Smith et al. (1999) suggested that from the students' viewpoint email offered the following advantages: Students could work at their own pace and in their own time, course material could be received well in advance of its scheduled use, all course material could be stored for future use, access to the tutor could be gained via email, delivery and "reading" of course work was recorded, rapid, secure feedback could be given by email. Possible disadvantages of email, according to Huff (as cited in Smith et al., 1999), included: The need for students to be willing and able to operate the software, most information is text based, and loss of non-verbal communication.

A large body of studies has concentrated on describing how the use of email as a teaching mode affects students' learning. The results have indicated that email studies have led to as good or better learning outcomes compared with traditional face-to-face (F2F) mode (Alavi, 1994; Hiltz, 1993) and correspondence mode (Paulsen, 1995). Alavi (1994) studied the effectiveness of collaborative learning via a Group Decision Support System (GDSS) in enhancing student learning and evaluating classroom experience. One hundred and twenty seven MBA students participated in this research study that lasted for a semester. The results of this study indicated that the GDSS supported group learning led to higher levels of perceived skill development, self-reported learning, and evaluation of classroom experience in comparison with non-GDSS supported collaborative learning. Although the analysis of the midterm exam scores showed no significant difference (M=89.72 for GDSS group and M=90.92 for the non-GDSS group), students in GDSS groups achieved higher final exams scores (M=88.23 versus 83.97). Students'

affective reactions to the GDSS supported learning were more positive than traditional classroom learning. This finding suggested that students in the GDSS group perceived higher levels of skill development (critical thinking, integrating, analyzing, valuing, and interrelating other's ideas), learning (understanding concepts and identifying central issues), and interest in learning relative to students in the traditional classroom. In addition, students with GDSS had a more positive evaluation of the learning experience and group learning activities than those in the traditional classroom, suggesting that they perceived more group work that contributed to course quality, learning, and fun. Further, the researcher suggested that the specific features and capabilities of the software structure itself (information generation, data categorization and aggregation, alternative evaluation, and analytical capabilities) might have contributed to positive outcomes because they increased positive interdependence and individual student accountability. Another implication of the findings was that the impact of the computer-supported group learning process on student achievement might have been cumulative and realized over time. As such, longitudinal studies would be useful in investigating this phenomenon.

The results of other studies (Ahern, Peck, & Laycock, 1992; Marttunen, 1998) showed that when the role of the tutor was not dominant, students had more freedom to present their points of view, which in turn allowed argumentative discourse to take place. Marttunen (1998) conducted similar to Ahern's et al. (1992) six-week research study that investigated online academic argumentative interactions among 31 Finnish undergraduate students. The study aimed at exploring students' cognitive processes in email study environments. The necessity of this research, according to the researchers, grew form a task of higher education to socialize the students into the academic discussion culture as well as to teach them the cognitive skills needed in academic interaction: the skills to think critically and to present well-grounded arguments.

Two modes in organizing email studies were used: a tutor-led mode (seminar) and a student-led mode (discussion). The students in both groups were given the same pedagogical task: to practice academic argumentation. They were supposed to write texts that included (1) their own grounded opinions concerning the topics included in the course contents and discussions with others, (2) to engage in counterargumentation by presenting grounded criticism of the other students' arguments, and (3) to defend their own arguments when these were criticized. The quantity and quality of student-student interaction, and the factors associated with this were investigated. The results indicated that 42% of the students' messages (N=441) were interactive in nature, indicating at least one reference to fellow students' messages. When difficult contents were addressed, interaction in the tutor-led groups was more common than in the student-led groups. The student-student interaction was mainly non-argumentative: 62% of the participants' references (N=259) were irrelevant but social in nature. The students in the student-led groups grounded their disagreement more often, while the students in the tutor-led groups more often expressed agreement. The researchers also found that the majority of the students' email messages were not interactive and not argumentative in nature: only 14% (N=147) of the students expressed opinions opposed to those of fellow students, and only every tenth reference indicated grounded disagreement. These results suggested that the pedagogical aim of the email studies, to engage the students in argumentative interaction, was not realized very well. Furthermore, the results led the researcher to the conclusion that participants had very poor argumentation skills. One of the reasons cited that accounted for such undesirable results was the problem in Finnish higher education in which most of the students lacked argumentation and critical discussion experience.

It is apparent that this study supports the superiority of the student-led mode of email studying over the tutor-led mode when promoting argumentative dialogue. The study also suggests the importance of a tutor role when learning content is difficult. One of the important limitations of this study was that the majority of the participants were female. Findings may not be applicable to male online students, who may behave differently in the same kind of environment.

Andrusyszyn, van Soeren, Laschinger, Goldenberg, and DiCenso (1999) reported the results of an evaluation of a blend of educational delivery methods used over a two-year period in a one-year Primary Care Nurse Practitioner (PCNP) program in Ontario, Canada. The program was offered in English and French to students in all regions of the province using multiple delivery methods. A combination of two or more of the following were used in each course of the program: print-based modules (includes articles, learning guides, etc.) and textbooks, audio- and videotape, audio-teleconferencing (TC), video-teleconferencing (VC), Internet-based computer-conferencing (CC), and CD-ROM. Data were collected from English and French 1996 and 1997 graduates. In 1996, all graduates (N=30, from 135 admitted to the program) received a mail copy of an English or French researcher-designed, three-part questionnaire. Items included: perceived satisfaction, changes in comfort with the technology, technological support, interaction and development of relationships with others, development of a learning community, and the ability to express opinions, reflect on, and integrate new learning. Students were also asked to rate their preference for and perceived effectiveness of the various media they had experienced in the program. In 1997, the questionnaire, which was modified slightly for the second cohort based on feedback from first-year participants, was mailed to 53 graduates (from 93 admitted in 1996). Ninety percent of the 1996 graduating class (N=27) and 79% (N=42) of the 1997 graduating

class, returned completed questionnaires. Quantitative and qualitative data from graduates in both years indicated that the multiple delivery methods were well received. Learning to use various technologies was a challenge, yet graduates from both years stated they were satisfied with the available options. The greatest increase in comfort with using media over the length of the program (in both years) was with CC. This is consistent with the findings of White's (2000) research study. The researcher, who investigated students' experiences with the online courses using TopClass and WebCT courseware, found that all the difficulties that students had at the beginning of the course (e.g., using courseware to do learning activities, navigate through the course structure, email assignments, etc.) had decreased by the end of the course. Some graduates in Andrusyszyn's et al. (1999) study commented that CC was the most important single factor that decreased the sense of isolation felt as distance learning students. Computer conferencing showed the most dramatic increase in the first year, despite its being the least familiar to faculty and students at the onset of the program. Graduates of both classes generally agreed that each of the delivery modes could be used to facilitate useful student interactions and develop a learning community. They also indicated that all media provided time and space for reflection and integration of learning. Some students, however, indicated that the technology added a greater burden to their already complex personal and professional lives. The researchers believed that those were adult learners, who were grounded in more traditional approaches to teaching and learning and who preferred familiar methods. Andrusyszyn et al. suggested that dealing with computer connections to servers, which could on occasion be erratic, learning to navigate the Internet, and learning to communicate effectively through text using CC probably added to the rigors of an already intensive program.

The high response rate to the questionnaire and the collection of both quantitative and qualitative data are strengths of the study. The small population size and the geographic location of the program in one Canadian province are obvious limitations that may preclude generalizability of results. Furthermore, participants from both years were graduates who were part of a leading-edge program with academic rigor. It is possible that responses from this group of selected individuals who were mature adult learners and who probably already possessed the internal motivation to deal with the challenges of the program were biased in a positive direction.

Carswell, Thomas, Petre, Price and Richards' s (2000) research study described the use of the Internet on a distance-taught undergraduate Computer Science course. The researchers examined students' experience of a large-scale trial in which students were taught using electronic communication exclusively.

In the study, the Internet was used for communication in every aspect of the course's presentation. Internet students communicated with their tutors and fellow students via email and HyperNews (a simple electronic news system used for conferencing). In practice, the students used email for one-to-one asynchronous communication, and conferencing for communication with either their tutorial group or their peer group. The student's final grade was used as an indicator of learning outcomes. To further investigate the effect of the Internet on students' experiences, "course experience" questionnaires that covered attitudes and expectations, learning, technical problems, and social aspects, were administered. The researchers analyzed all of the electronic communication between students and tutors. The analysis was largely qualitative and data driven, seeking to identify factors affecting the students' experiences and factors associated with a presentation medium. The study revealed that electronic assignment handling provided students with greater flexibility and convenience. Students liked "no fuss, no

bother" approach to sending assignments as well as "desk-top" assurance that their assignments had been received. Other comments indicated students' satisfaction with email as a tool for problem sharing. Students felt that email made it easier to get in touch and discuss issues with other students. Other students believed that being in wider contact with other students caused them to explain concepts to others more often, which helped their own understanding of the subject.

The results also showed that there were some occasional problems as well. For instance, not all students found it easy to communicate using Internet. One student reported being afraid to send email, and another reported that lack of confidence affected his participation. Furthermore, even though a majority of students completed the course successfully, 19% failed. The researchers did not have any explanation for this. They only conjectured that the extra burden and time required to deal with the Internet was enough to distract some students from attaining a good grade. Other limitations included low response rate and slightly higher number of women enrolled in the online course.

Email: Mixed and Negative Outcomes

Even though a majority of studies investigating the impact of email on students reported positive results, a few studies, investigating effectiveness of CMC technologies, resulted in mixed and negative outcomes. Students' periodic distressing experiences such as frustration, anxiety and confusion with using email were also reported (Hara & Kling, 2000; Smith et al., 1999).

A qualitative study conducted by Hara and Kling (2000) investigated students' experiences in a Web-based course at a major U.S. university. The focus of this research study was to examine the conditions that led these students to be distressed and some consequences of

their distresses. Eight participants (six of them completed the course) were enrolled in an educational technology course in which students learned how to use information technologies in their areas of expertise. Only one student had taken a DE course prior to this one. The empirical case study used three different methodologies: observation, interview, and document review.

In email messages, some students expressed frustrations. The course students were enrolled in did not have video support and the absence of physical cues led to some confusion and anxiety for the students. Students commented on feeling a lack of assessment and complained that they could not get this information from the instructor's email messages to them. According to the researchers, some of the student anxiety was caused by a lack of feedback from the instructor. Furthermore, Hara and Kling (2000) suggested that not being able to see the instructor physically and determine the instructor's expectations was likely increasing students' anxiety level. These anxieties and communicative confusions that are a byproduct of limited social cues such as gestures and facial expressions have been identified in the research literature (Kuehn, 1994; McIsaac & Gunawardena, 1996). Feenberg (1987) refers to these experiences as "communication anxiety."

Another problem that emerged during the course instruction was ambiguity of email messages. Research suggests that much of human communication is inherently ambiguous. However, people can often adequately resolve key ambiguities when they are face to face. When the primary communication medium is written text, resolving ambiguities may be more difficult for many people. In this study, the students complained that even though they understood each sentence and word in the email that the instructor sent to them, they did not know how to use the instructions to compose the programming. Furthermore, they did not know exactly what the instructor wanted. In the interview, the students identified a recurrent source of communicative

ambiguity. They had trouble adequately interpreting both the instructor's weekly emailed instructions as well as the instructions on the course website.

This study had some limitations that might have influenced the outcomes. A few Information and Communication Technology (ICT) professionals claimed that the course described above was "designed to fail" from the start because of alleged limitations in the instructional design, student selection, or the instructor's preparation. For example, the instructor was a Ph.D. student. She was an experienced school teacher, but this was her first experience teaching in higher education and by distance education. Furthermore, the website was used in a traditional class version of the same course during the previous summer and was not substantially altered for the online version of the course.

Smith et al. (1999) reported on a three-year study of the use of email for teaching purposes within two courses forming part of a psychology degree. The researchers compared course delivery via email with delivery via "traditional" lectures. In the first part of the study (1994-1995), 72 students took a psychology course that was completely email delivered. Most of the students passed the course, only seven failed. A request for feedback produced only ten responses, however, all of those responses were positive. Based on those responses, the researchers concluded that email could be used successfully to deliver course materials, receive course work, and give feedback.

In the second study (1995-1996), 129 students -- 82 full-time and 30 part-time -- enrolled in the course part of which was delivered traditionally and only the remaining three lectures were email delivered. At the end of the course, students were asked to complete the Module Evaluation Questionnaire (MEQ) that contained items about the use of email in the course. Respondents were asked to indicate their level of satisfaction. The results showed greater overall

satisfaction (66%) than dissatisfaction (34%) with the email lectures. When asked what the best feature of the module was and which was liked least about the module, email was the most nominated feature in each category. It was suggested by the researchers that this apparent polarization of views might have reflected different attitudes toward email between the full- and part-time students. The full-time students tended to use email as a resource that they could access at any time, whereas the part-time students were forced to use printed material, because most of them had no access to email at times. Other results showed that the use of email for general communication of module-related information was generally regarded positively (62%) and attracted fewer "very dissatisfied" responses (14%).

In the third study (1996-1997), 150 students took a psychology course. Only full-time students participated in the course. The methods, formats and pattern of the delivery of the course lectures were identical to that of the previous year. The response rate was 53%. The most notable difference between 1995-1996 and 1996-1997 figures was that the general level of satisfaction had risen from 66% to 82.5%. Smith et al. (1999) suggested that this was because there were no part-time students in the course, for whom the emailed lectures seemed to cause particular problems. The results also showed that even though general approval of the use of email for communication increased by 2%, 27 students said that they did not like email lectures. Nine of those 27 students said explicitly that the email lectures were too long and that brief summaries to support lectures would be preferable. Seventeen students expressed a preference for traditional lectures. The researchers were aware that the data were limited in many respects and this resulted in conflicting evidence of the effects of email delivery on student performance.

Hypertext

The World Wide Web (WWW) operates as one part of the Internet using a method to move information known as hypertext transfer protocol (http). The advantage of hypertext -- a text with pointers to other text -- is that in a hypertext document, if you want more information about a particular subject mentioned, you can "just click on it" to read further detail (Fleischman, 1996). Working at a computer screen, readers of hypertexts make their own decisions about how to handle information in the hypertext database choosing when to access related information that the author provided as well as when to link to related information beyond what the author provided (Paez, Bezerra da Silva-Filho, & Gary, 1996). The WWW makes such reading even more extensive and gives readers more choice. Readers become engaged in navigation decisions in such environments. According to Kim and Hirtle (1995), hypertext, unlike printed text, does not provide the reader with a method to get from tables of contents and indexes to specific pages in the document because there is no pagination. Furthermore, it does not have "discourse" cues to help the user determine what should be read in detail and what can be skimmed. Paez et al. believed that users might find that they frequently get lost while following nodes in the display network. The more nodes available, the more likely readers would become disoriented and would feel lost while navigating the text.

Research suggests that one well-known side effect of hypertext interfaces is user disorientation (Nielsen, 1995), that is, not knowing where to go next, not knowing how to get there, and not knowing where you are at a given time in relation to the whole (Edwards & Hardman, 1989). In addition, the conceptual feeling of losing one's way in a cognitive sense might occur (Paez et al., 1996). Paez et al. explored the hypothesis that reading a document using a zooming graphical interface would minimize user disorientation as compared to reading it

using a typical jump-based hypertext interface. Questionnaires, observations, and taped interviews were used to compare and evaluate the use of two interfaces with regard to learning time, performance, and user satisfaction. The population from which the sample of 36 students was drawn were graduate students at the University of Maryland. The participants were asked how easy it was to learn to use the Pad++ system and to rate their feelings about being lost and their ability to recover from feeling lost. The results indicated that the jump group felt lost less often, however, the difference was not statistically significant. The zoom group also felt that it was easier to recover when they felt lost than did the jump group, however, the difference was not statistically significant. It was also found that students in the zoom group who used computers daily felt more disoriented than students who only used a computer a few times a week. On the other hand, students in the jump group who used computers daily felt less disoriented than those who only used computers a few times a week. The researchers concluded that the greater the familiarity with computer use was, the greater the level of not feeling disoriented should be. The results also suggested that regular users might be more disoriented when moving to a radically different interface mechanism. In regard to the effect of Pad++ on information comprehension, the zoom group felt very confident that the Pad++ system was conducive to finding information. The study clearly showed that the Pad++ system should be able to fulfill the goals of interactive systems such as reduce learning time, speed performance, and increase satisfaction. This study, however, had an important limitation: quantitative data did not yield statistically reliable results. Even though the study showed that users of the jump interface had generally better comprehension and used less time than those in the zoom condition, the researchers did not determine whether these trends were inherent in mechanism or a novelty effect.

Brace-Govan and Clulow's (2000) study focused on students' perceptions of the learning experience during a semester-long online marketing course. Out of the possible 35 undergraduate students, 14 (40%) agreed to take part in the study. Participants had to reflect in journal entries on their experiences in an ongoing way. As the results showed, information from the students was sketchy but the ideas were clear. One issue, identified in the development of the journal, did emerge as significant to students and that was the continued need to read text in print. All of the participants said that they used printed materials. Four students had additional comments on this issue. One student mentioned that he tended to download study notes from the online system, so that he could reduce Internet hours and have a hard copy for detailed study. Another student commented that he often referred between the textbook and the online notes, however, he found the textbook easier on the eye. A comment was made that online notes required a great deal of scrolling up and down and clicking jumps to different windows or pages, which was a little bit more tedious than having a hard copy as a reference. Generally, however, the students believed that the effort put into creating the entire website was outstanding. The researchers drew the following conclusions from their findings: (1) in spite of the students' admiration for the website, there were needs for paper-based references, not just for comfort, but also for quick and easy access to information, (2) insight for course developers came from the comment about the amount of text a learner found comfortable to read, when working through a section of material. The researchers suggested that it was an important consideration when designing course materials to decide how much and what to put into print. The implications, according to Brace-Govan and Clulow, were not only about ease of use and quality of learning, but also costs to the students who found printing the material more efficient.

Fulford (1992), working with 78 vocational education students (ages 16-67), found that text materials augmented with compressed speech were not more effective for content mastery than text materials alone. This finding supported the idea that text alone requires the learner to do more work to make sense of things, and therefore requires the learner to become more involved in the learning process.

Graphics

One of the advantages of graphics, according to Junk and Fox (1998), is that they tend to hold students' attention and help them understand and remember a concept. Using graphics can be also effective for the range of learning styles that students have, especially for visual learners for whom the graphics and movement on the screen will be helpful. Regardless of their various learning styles, students enjoy well-designed graphics. According to Large (1996), including graphics in a website can help make the site more attractive and engaging and motivate the user to explore. Graphics can also enhance the user's understanding and recall of information. To be most effective, however, the instructor must be careful not to overuse the technology. While Junk and Fox suggested that graphics do not have real disadvantages to using them except cost of equipment and time, Large (1996) cautioned that graphics used purely for decoration, that have little or no relation to the content, could distract users and prevent them from learning the material. Large suggested that graphics and visuals should be used primarily to illustrate the content of the site. Their purpose, and their relationship to the text, should be clearly explained.

Levie and Lentz (1982) identified four functions for graphics: (1) Attentional -- pictures or graphics attract attention to the material or direct attention within the material -- hopefully using graphics in this way will heighten the likelihood that a user will remember the material; (2) Affective -- pictures enhance enjoyment or affect emotions and attitudes; (3) Cognitive -- the

cognitive use of graphics involves using pictures to increase comprehension (for example, providing elaboration for a text explanation), to improve recollection and retention, or to provide information that is not otherwise available; (4) Compensatory -- the compensatory use of pictures involves helping poor readers by adding pictorial clues to decode text.

Past research has indicated that the use of graphics enhances the retention of information for learners, and that the combination of text and graphics produces a more positive effect. Randolph (1998) conducted a research study on the subject of visual information used in Web publication. The researcher wanted to see the effects of graphics and hypermedia on memory in both immediate recall and longer-term retention. Randolph created an experiment using 98 college students, over two thirds of whom were apparently beginner-level computer users. Students were divided into four groups, each group receiving one of four versions of a news story influenced by one of the following: graphics, no graphics, hypermedia links, or no hypermedia links. The website was presented on computers in a classroom lab. After the online publication was viewed, the Web browser (Netscape) was turned off and students took a quiz on the material. Students took the same quiz a week later without rereading the publication. The graphics-related results showed no significant effect on immediate recall, but did show significant effect on long-term retention. The study seemed to emphasize that the students forgot less through the graphics enhancement.

Other research studies indicated that there were no significant differences with text based information and graphics. Chao, Cannamo, and Bruanlich (1996) conducted a research study to examine the effects of graphics on student learning. An English-language lesson about American football was utilized, with one version presenting text only, while the other used still and animated graphics. A pretest and posttest was used for this study. Thirty-five international

students were chosen for this research projects. The students were divided into two groups, with each group using a different computer version of the program Authoware Professional Language. One group used a text only program, and the other group used the still and animated graphics. Twenty-four screens were demonstrated in the text only version, and twenty-eight in the animated graphics version.

The results showed that there were no significant differences between the means and standard deviations of both groups on the pretest. However, on the posttest group two, who received the graphic version of instruction, scored significantly higher than group one (text only). The animated graphics group finished in significantly less time than the text only group. The researchers concluded that the students who used the animated program retained and recalled information better than the students who used the text only program. The animated graphics illustrated the ideas of the text more clearly and efficiently. The author speculated whether the students in group two relied more on the visualization rather than the linguistic text, since the program was in English and not in their native language. One of the limitations of the study was that the results might be more mixed than those which consisted of a standard test given to English speaking students.

Spotts and Dwyer's (1996) research study examined the instructional effects of computer graphics on student achievement of various educational objectives. Sixty-three college students were randomly assigned to the three instructional treatments. The authors cited previous research, stating that sometimes graphic strategies could overestimulate the learner and not provide adequate interaction to process information efficiently or effectively. The authors in this study provided a visual simulation of the flow of blood in the heart to assist learners in understanding how blood entered the heart. The instructional content included a 2,000 word

passage about the human heart and its parts. Five different criterion measures were used in this study: the drawing test, identification tests, terminology tests, comprehension test and total test score. Results indicated that students who received textbook material complemented by specific computer graphics technologies achieved significantly higher scores than did students who received their instruction via a programmed textbook-like booklet complemented with static visuals.

New research shows that computer multimedia formats combining text with either audio or video were more effective than still graphics and text alone (Quealy & Langan-Fox, 1998), which the researchers attributed to dual coding of text with audio or video in short term memory.

Simulations

Computer simulations are one promising tool for supporting learning at all levels (Cherry, Ioannidou, Rader, Brand, & Repenning, 1999). Learners may create simulations in order to test hypotheses and explore ideas, or to communicate their ideas about a topic to others (Repenning, Ioannidou, & Ambach, 1998). Exploring simulations created by others exposes learners to ideas that may be different from their own, and gives them an opportunity to experiment with those ideas. Learning through simulations, either by creating simulations or by exploring existing ones, helps learners develop a deeper understanding of the concepts being simulated. For both students and adults, simulations provide an opportunity to work with ideas. On the one hand, a simulation is believed to be a tool to grasp ideas which are already known to the professional community but which are difficult to understand. On the other hand, a simulation can be a tool to extend current knowledge within a field (Cherry et al., 1999). While working with simulations, students interact with ideas when they view and attempt to explain simulation results. Working with simulations can promote collaboration among learners because

the simulations are concrete and can be manipulated and discussed. Cherry et al. argued that interactive simulations could accommodate a range of engagement for learners, depending on the level of interest and amount of time available. When time is limited, users may simply observe simulations created by others. The educational benefits of this type of situation are probably similar to watching an educational video clip. In a more time consuming but educationally richer mode, learners may run some number of experiments with pre-created simulations. This type of activity allows learners to explore a topic by comparing and contrasting different scenarios. When time permits, users may get a deeper exposure to the subject matter by modifying parts of an existing simulation or even building a new simulation from scratch. Repenning (2000) suggested that interactive simulations could be turned into a richer learning activity if they could be connected to other educational components such as plotters, databases, and spreadsheets.

There is a large body of research demonstrating that the way information is represented matters greatly in the learning process, at least for memory tasks (Rieber, 1996). In general, research indicates that pictures are superior to words for remembering concrete concepts. It is argued that computer simulations could promote different levels of processing depending on the type of representation used (e.g., text, graphic, animation, sound) and the purpose. Rieber and Kini (1991) suggested that animated computer graphics, in contrast to static computer graphics could provide users with additional information through two important visual attributes: motion and trajectory.

Rieber (1996) conducted a research study, the purpose of which was to explore how users interact and learn during a computer-based simulation given graphical and textual forms of feedback. The study included two experiments. In both of them, university students interacted with a simple simulation that modeled the relationship between acceleration and velocity.

Subjects interacted with the computer simulation using the discovery approach: no formal instruction on the science concepts was presented. Subjects had control over the acceleration of a simple screen object -- a ball -- in a game-like context.

In Experiment 1, the subjects were 40 undergraduate students enrolled in an introductory computer education course. Fourteen subjects served in the graphical feedback group, twelve -- in the textual, and fourteen in the graphical plus textual feedback group. The materials consisted of the three versions of a computer-based simulation of the relationship between acceleration and velocity. A 12-item test was used to measure subjects' understanding of this relationship. The students were also asked to rate their level of frustration after the ten simulation trials. The results showed no significant difference between any of the three simulation versions. However, there was a significant difference overall in subjects' pretest and posttest scores. The students increased their formal understanding of the relationship between acceleration and velocity as a result of interacting with the simulation. Furthermore, no significant differences were found between any of the simulation versions on frustration. According to Rieber (1996), a possible confound in Experiment 1 was that the subjects might not have had sufficient exposure and experience with simulation for other effects to be noticed. Experiment 2 was designed to solve this problem by doubling students' exposure to the simulation from ten trials to twenty. The subjects were 49 undergraduate students. All materials were identical to those used in Experiment 1. In contrast to the results from Experiment 1, significant differences were found between the three simulation versions on the performance test. It was found that students provided with graphical feedback or graphical plus textual feedback scored significantly higher overall on the performance test than subjects provided only with textual feedback. Also, similar to Experiment 1, there was a significant difference overall in subjects' pretest and posttest scores.

Significant differences were also found between the three simulation versions on frustration. Subjects given textual feedback reported greater level of frustration than subjects given graphical or graphical plus textual feedbacks. The researcher concluded that the simulation activity effectively promoted representational and associative processing for the visual system, but not for the verbal system. Graphical feedback aided learning, but only at a tacit or experiential level.

Online Threaded Discussions

Research suggests that web courses that include online discussion forums maximize student learning, promote student involvement and feedback, and may inadvertently provide an outlet for students to voice frustrations otherwise saved for program administrators (Markel, 2000). Markel also noted that the online discussion forum allowed students to work together on projects in small groups, participate in on-going discussions focused on course content, and to present group project products to the rest of the class. Hopperton (1998) argued that participation in online discussion forums provides opportunities for responsibility and active learning through the expectation of regular participation in online discussions. Participation in the online discussion demands that students become actively engaged with the course content and through the interaction with their peers, negotiate the meanings of the content. Students construct knowledge through the shared experiences that each of them brings to the collaborative discussions.

According to Markel (2000), discussion forums could be especially beneficial for those students who have a reflective style that does not lend itself to quick questions or comments, as online discussions give sufficient time to contribute their well thought out responses. Connections that few have time to make in the stream of classroom discourse now stand out in a discussion forum flow of asynchronous discussion. Furthermore, group work within this

environment imparts a shared sense of purpose and develops a group identity with a sense of interdependence and belonging. Markel cautioned, however, that the initiation of these tasks could be perceived as exceptionally difficult for students who were not familiar with the concept in a Web-based environment.

Carswell et al. (2000) examined experiences of 223 students using electronic communication in an undergraduate course. The participants were offered the opportunity to participate in online tutorials. They could contact their tutor and fellow students via email and computer conferencing. Tutors were asked to provide a service equivalent to 18 hours. There were three main reasons why the tutorials were provided: (1) to overcome the isolation of the long distance learner, (2) to encourage the exchange of ideas and learning experiences, and (3) to enhance the delivery and presentation of distance learning materials. The researchers also looked at what students wanted from a tutorial. It turned out that students did not want any extra teaching or content. Instead, their requirements centered around group activities: working in a learning community, seeking clarity, confidence building, and appraising themselves against their peers. Students reported that tutorials benefited them by making ideas clear, providing a wide scope of discussion (often said to be the most useful part of a tutorial), reinforcing concepts, and providing different perspectives. The majority of students said that tutorials were useful for maintaining motivation and enthusiasm. The results also showed that all students participated in electronic discussions, if only as observers -- although not all wanted to participate actively. Carswell et al. reported that online student conferences attracted a high number of "lurkers," those who followed the conference but did not participate actively. Students liked the ability to observe without revealing their presence, and they found it useful to keep track of events. This finding is consistent with the Rafaeli, Sudweeks, Konstan, and Mabry's

(1994) observations in a quantitative study of CMC. Rafaeli et al. found that many students were content to just read and listen, even in most interactive groups, while few dominated conversations. All students in Carswell's et al. research study reported lurking. Reasons given for lack of participation included: confusion as to their roles and unclear expectations. Others simply did not want to participate.

Markel (2000) conducted a qualitative analysis concerning the use of discussion forums in a 15-week Web-based course delivery. Weekly discussion topics were coordinated with the web course assigned readings for each week. Students were asked to respond to one or two open ended questions designed to elicit discussion about the topics. Requiring students to respond to at least three other student postings initiated a round of discussion among the participants. Each student's posting was listed in the forum under the weekly topic. The researchers found that students quickly discovered that their peers were also holders of knowledge and they initiated discussions and responded to one another's postings. The instructor was only a facilitator in this environment and was not viewed as having all of the knowledge and the answers. Students often noted after the third week of a semester that they were attending to the discussions more than just the required twice a week, as they were eager to see if anyone responded to their postings. One of the things that students liked the most about the online discussions was the fact that the discussion forum allowed as many replays as a participant wanted of what was said. A discussion could be revisited and commented on as long as the forum was open, while in a classroom, often the moment was lost and was difficult to revisit.

While investigating students' experiences in a Web-based course, Hara and Kling (2000) found that students and instructor relied upon email as a primary means of communication. In fact, the instructor required that students post email to the class discussion forum at least five

times during the course. The results showed that the students and the instructor generated intensive online discussions through email, and all of the students posted far more than five one-to-two page-long messages. Around 35 messages were posted by the students every week. This volume was common throughout the semester. However, even though it seemed like a lively class discussion, Hara and Kling (1999) found that there were some underlying problems with the reliance on email. It was found during interviews with students that some of them did not read other people's postings before writing their own email messages. Furthermore, some students were unable to make time to read and post email during short intensive discussion periods. It was also reported that some participants were overwhelmed by the volume of email, and that they fell behind in reading and responding online. This finding is consistent with the results of Grint's (1989) research study, who found that students thought it difficult to carry out conversations in asynchronous time and felt they were overloaded with trivial information before being able to contribute. In Hara and Kling's research study, some of the students' difficulties were a byproduct of using email differently than the more conventional way. In the "standard view," students will read their email online and reply immediately from their computers. The researchers' observations of the students revealed a more complex way of working with email. Some of them tended to print out all the course-related email messages in a word-processing document, then print out all the readings for this course and only then read the email and reading assignments at home. They would reply to messages on another day when they returned to the campus computer lab.

According to Hara and Kling, it appeared that all the participants were competing with each other, or felt obligated to produce a notable number of thoughtful and detailed email messages. The category "email messages" consolidated diverse communications: short

conversational notes and more elaborate multi-screen memos. These were mixed into the students' other more general email flow, such as messages from co-workers, other students, friends, and administrative announcements. The research literature indicates this complication of asynchronous computer-mediated communication (CMC). Wegerif (1998) also reported a student's comment of a "daunting prospect" of being behind reading messages. While the advantage of CMC is that it reduces the constraints of time and location (Ahern & Repman, 1994; Burge, 1994; McIsaac & Gunawardena, 1996), it is also very demanding for students and instructors to read all their messages (Hara, Bonk, & Angeli, 2000; Wiesenberg & Hutton, 1995).

Chat

When synchronous or same-time interaction is desired, computers support what is commonly referred to as a chat function. A chat room allows multiple individuals to interact simultaneously. Internet Relay Chat (IRC) is an example of a synchronous communication program that is international in scope and is available to anyone with access to a client program and who can log on to any one of the IRC servers located across the Internet. It is commonly used for recreation and social interaction. Synchronous online communication can also occur in "members only" situations like the "chat rooms" on commercial services like CompuServe or America Online. It can also be a feature of closed groupware systems, like LotusNotes, FirstClass and other systems used for computer supported collaborative work in education, where the norms of academic discourse usually prevail.

Since the late 1980s, there was increasing interest in the use of chats for instructional purposes through virtual classes such as those at Athena Online University and Diversity University, using a highly structured Multi-User Domain (MUD) or MUD Object-Oriented (MOO) format. Both MUD and MOO are Internet accessible, text mediated virtual

environments. Instructional electronic chats (IEC) can also supplement distance coursework. Murphy and Collins (1997) argued that IECs could pose challenges for educators because the verbal and non-verbal communication protocols used in face-to-face or in video-based distance education settings might not be sufficient for quality educational exchange with and among participants. The design of most forms of IRC software is such that multiple, disjointed conversational threads can quickly develop as various members of the group form smaller conversational groups, each focused on their own topic and ignoring, or only intermittently joining in others. This may result in conversational chaos. Research suggests that chat rooms are best with small groups only. Large groups should use threaded discussion on the bulletin board (Stith, 2000). Bork (2000) also believed that chat rooms could be effective only with small numbers of students. Bork's experiences with a chat room for twenty students in educational technology at John Hopkins University showed that one person could not type faster than twenty.

The use of synchronous electronic communications programs in instruction is relatively new (Murphy & Collins, 1997). While it has been used in college writing classes (Day & Batson, 1995) and to teach literature (Harris, 1995), the more common use of synchronous chat programs among undergraduate students is to communicate with one another (Archee, 1993; Newby, 1993) for social and recreational purposes (Aoki, 1995) using IRC and similar public synchronous communications programs.

With respect to the advantages of chats, Aoki (1995) noted that brainstorming and other activities requiring spontaneity could be handled effectively in a synchronous chat. Siemieniuch and Sinclair (1994) argued that decision-making that required a quick turn-around time rather than extended discussion could be handled in chats as well. Furthermore, research suggests that

synchronous communication adds the excitement of interacting with others in real time and builds a sense of social presence (Aoki, 1995).

Chat has a number of limitations. Some researchers have suggested that IRC software provides each participant with a small window (approximately two lines deep across the screen) in which to type their contributions, which is input in its entirety into the conversation when the "return" or "enter" key is pressed. Turn-taking in synchronous communication is problematical as there are no observable kinesthetic or para-verbal cues to indicate when someone wants to enter the conversation or to change the subject. Siemieniuch and Sinclair (1994) suggested that verbal and non-verbal protocols currently used in face-to-face meetings might be inadequate for synchronous computer-mediated communication, and perhaps some controls must be built into the software to rationalize the passing of control from one participant to another to permit efficient interaction. Further, synchronous communication requires substantial typing skills to communicate effectively, and the conversation may move too fast for non-native speakers of English, who have no time to reflect, frame questions and compose responses as the text incessantly scrolls up the screen (Aoki, 1995). Another limitation comes from the fact that frequent users may have skills that novices have not had time to develop (Newby, 1993).

Murphy and Collins (1997) conducted a research study on electronic chats that involved ten graduate students studying educational technology and distance education in the College of Education at Texas A&M University during the spring semester of 1997. The students were masters and doctoral students primarily from education. The course was delivered by a combination of two-way interactive (compressed) video conferencing (VTel) and computer conferencing via FirstClass software. Students enrolled in the course were required to use FirstClass for two purposes: (a) asynchronous communication through computer conferences,

email, and document sharing using attached files, and (b) synchronous chats. Asynchronous and synchronous computer conferencing was used for a number of "virtual" class meetings.

During the two semesters preceding the study, the instructor experimented with various degrees and forms of structure in the chat sessions, each time requesting reflection afterwards from the students. The students' reflections, posted in the asynchronous conference included the need to structure chat time "to make sure we don't 'trip' over each other and that things move swiftly along" and "when there is not enough structure there is little accomplished; when there is too much structure the objective could just as well be accomplished asynchronously."

In this study, content analysis was used to examine the data. The results indicated that the instructor was responsible for 28.8% of the total inputs (N=380), and the students posted 71.2% of the inputs. Of the student inputs: 42% were made by males, 58% by females (the gender split in the course was 40% male, 60% female, so the contributions were proportional); 25% were made by ESL speakers, 75% by native English speakers (there were 3 ESL students, so their contribution was slightly less than proportional).

The study determined that the students recognized a need to use their communication conventions and protocols to communicate clearly and minimize misunderstandings in their online transactions with others. The more obvious conventions included using keywords and names of individuals, shorthand techniques, non-verbal cues in text, and asking questions and seeking clarification. Students, particularly those from other countries, recognized the challenges of the constant and rapid flow of text on their screen during chats. Another technique that students recognized as important in reducing transactional distance was self-disclosure, perhaps from their desire to present themselves on an equal footing to those without excellent telecommunication skills.

As the semester progressed, the students became more proficient in using IECs for brainstorming and group decision-making. The students demonstrated their developing competencies in communicating with each other and with the instructor during the second large group chat of the semester. It was also noted that the students in this course typically checked to see if any of their classmates, or their instructor, were logged on when they were, with the result that they engaged in numerous spontaneous small group chats. Such chats helped the students to improve their skills in a non-threatening setting as well as enhance their communication with the individuals involved in the chats.

According to the researchers, because the course required the students to work collaboratively in small and large group endeavors throughout the semester, the chats in FirstClass provided regular opportunities for the students to ask questions, establish work schedules, make decisions, and stay in touch with their classmates and with the instructor. The students' metacognitive comments in the asynchronous conferences reflected their confusion when trying to follow multiple chains of discussion at once. It was particularly difficult for the slow typists and non-native speakers of English. At the same time, these metacognitive comments reflected the students' growing skill in using keywords and names of individuals, shorthand techniques, asking questions and seeking clarification, and non-verbal cues in text.

One of the limitations of this study was the fact that some participants were experienced masters and PhD students and interested in telecommunications, some of them being telecommunications professionals working in the field. At the same time, there were three students whose native language was not English.

The results of Hara and Kling's (2000) research study of students' experiences in a Web-based course showed that even though the participants were satisfied with most of the course

activities, some of those activities were distressing. One of the activities that was found to be particularly troublesome was a field trip to SchMOOze University to experience virtual space. When people join SchMOOze University electronically they see text-based screens, although this virtual university uses metaphors of location. People can explore different virtual buildings (e.g., library, Mall, and meeting rooms) to meet people from all over the world by using simple commands. The participants complained that conversations on the screen proceeded very quickly and never slowed, making them very difficult to follow. For some of the participants, the class field trip was the first time they experienced the fast pace of this kind of communication, and they found it overwhelming. Students complained that they could not figure out what to do when they could not operate the intended commands, for example, simply responding to a knock. There was no one to ask for help, so they had to attempt to resolve the difficulties by themselves. Other problems included the slow Internet connection, which significantly delayed students' responses making it difficult to participate in an online conversation. There were, however, some positive comments about the virtual field trip. Students seemed to be excited about the new technology they were experiencing, and were generally enthusiastic about the SchMOOze University activity. This study, however, had major flaws, which were discussed earlier, that might have affected the results.

Audio

A variety of new software technologies that enhance web pages are now available. Many of these software programs bring interactivity to otherwise static web pages (Fleischman, 1996). Streaming audio is one of them. It allows any type of sound to be played by clicking on a hypermedia link embedded in a web page. For learners with limited language or literacy skills, this software allows directions to be given or any text that is presented on the screen to be read.

When broadly implemented, streaming audio, together with video and CGI (Common Gateway Interface) scripts, will allow adult learners to use the web in a highly interactive fashion. Learners will be able to log on to a web server at any time and be able to do simulations, problem solving exercises, link to other sources of information, work in collaborative environment, participate in real-life chats with other learners, and much more (Fleischman, 1996).

Audio-teleconferencing is a distance education technology that overcomes the one-way limitation of radio. It is an extension of a basic telephone call that permits instruction and interaction between individuals or groups at two or more locations. By using sophisticated audio equipment, members of the audience can both hear and be heard. This allows for true, live, two-way interaction between two or more physically separated sites (Newby, Stepich, Lehman, & Russell, 2000). Audio-teleconferencing is a popular and convenient way to conduct meetings or simple instructional sessions in situations where the time and cost of travel cannot be justified. It is also ideal for discussions and consultations -- when only dialogue is needed. According to Newby et al., audio-teleconferencing offers the advantage of true interaction. However, it has a significant drawback, which is the lack of a shared graphical workspace that can be manipulated in instructionally significant ways by the instructor and students (Wisher & Priest, 1998). Unless print-based or graphical materials are distributed to the participating sites in advance, visual elements are absent.

Andrusyszyn et al. (1999) suggested that audio-teleconferencing might appeal to those who rely on listening skills, whereas video-teleconferencing might suit those who use visual and auditory skills. Although these media are time- and place-dependent, they do provide greater

connectedness to colleagues than CD-ROM, which normally requires individuals to work independently.

Prior research on instructional media effects suggested that an audiographic approach to Web-based courses would optimize educational effectiveness along with cost effectiveness (LaRose, Gregg, & Eastin, 1998). Audiographics, which is defined by Willis (1993) as a sophisticated computer application relying on graphic computer interaction augmented by two-way, real time audio communication, have also been recognized to be the most preferred technologies for synchronous learning in groups (Duning, Van Kekerix, & Zaborowski, 1993). This is due to the shared nature of the visual workspace and the ability to focus and involve geographically separated groups. Hybrid audiographics uses the public-switched telephone network for voice transmission and the packet-switched Internet for graphical data transmission. With hybrid audio-data collaboration, teachers and learners can communicate by voice while interactively sharing and annotating visual information. Graphics can be simply and quickly prepared, even during delivery.

Freeman, Grimes, and Holliday (2000) conducted a study comparing the academic performance and satisfaction of groups of graduate students taking a 14-week introductory course in statistics via the following modes: (1) hybrid audio-data collaboration (Internet enabled collaboration), (2) satellite delivered instructional television, (3) face-to-face in the television studio, and (4) face-to-face in a traditional classroom. An overall assessment of the effectiveness of audio-data collaboration was also conducted. Forty-seven graduate students participating in the study completed the same traditional pencil and paper tests and questionnaires to measure satisfaction. Data on past academic performance in the form of cumulative GPA were gathered from student records to serve as surrogate pretests and indicators of the equivalency of groups.

The results showed the there was no significant difference in student learning performance between any of the modes. Therefore, hybrid audiographics appeared to be an effective alternative delivery method. Students in the Internet enabled hybrid audiographics group were also more satisfied than those in the other three groups with the technical aspects of the medium. According to the students' comments, screen picture quality, quality of audio from the instructor and adequacy of screen size contributed most heavily to their satisfaction. Freeman et al. concluded that compared to instructional television, audio-data collaboration could be a viable method of dramatically increasing access to learners while maintaining educational effectiveness and student satisfaction.

This study, however, had some limitations. There were significant gender differences between the groups. Most of students in the traditional face-to-face group were females, while male students dominated the other three groups. Even though the researchers made an attempt to create equivalent groups, the hybrid audio-data collaboration, instructional television, and face-to-face studio audience groups were all older and included more part-time students than the face-to-face traditional classroom group. The first three groups also contained more doctoral students than the face-to-face traditional classroom group.

Kroder, Suess, and Sachs (1998) reported the results of launching credit-bearing courses using the Web at the University of Dallas and Pace University in New York. Ten students agreed to participate in the 13-week long study. They were expected to log-on to get new assignments, which were posted to the Internet every week. The Internet students were also required to interact with other students and the professor on the Internet threaded discussion site.

Three methods of collecting comments and suggestions were used by the researchers: normal course evaluations, a focus group, and a detailed post-class survey from both professors

and students. The results were very encouraging. For example, eight out of ten students who responded said they would take another Internet-based course even though the same proportion said it took more time than a classroom course. At the focus group meeting, the researchers received a number of sound ideas. The most significant observation was: Implement streaming audio to enhance the lecture portion of the course. This would reduce the amount of reading and enhance the variety of delivery. This could be done by a "voice over" with a PowerPoint presentation adding interest and, perhaps, improving retention.

Video/Videoconferencing

According to Guice (1997), videoconferencing (VC) over the Internet will move into the reach of more and more educational institutions in the coming years. Some of the advantages of VC include 1) time and money saved that would have been spent on travel, and 2) students can both hear words and see the body language that accompanies them, allowing for better communication (Junk & Fox, 1998). Disadvantages include that over long distances the Internet voice transfer is sometimes choppy. Additionally, it is very difficult for several students at the same time to see what is being presented on the computer monitor. Lack of eye contact with the instructor and the quick realization by the students that only the student directly in front of the camera can be clearly seen creates an atmosphere where students often feel they are not a part of the discussion. Because it is almost impossible for the instructor to know what is really going on in the classroom, students can easily be doing something else. Improved hardware and software may solve many of these problems (Junk & Fox, 1998).

According to Freeman, Grimes, and Holliday (2000), full motion video based communications require expensive, dedicated equipment and infrastructure, as well as technical support personnel with specialized skills. It is also limited in quality of graphics due to the

requirement to compress the video images. Limitations in interactivity are caused by the latency of the compressed audio and video signal, which results in participants talking over each other. The primary advantage of video is the social aspects of seeing the movement of participants. Although Internet protocol based video systems show promise to reduce costs, the current state of the technology and lack of quality of service connectivity severely limits their effective use across the wide area network.

Wilson and Mosher (1994) developed and implemented an Interactive Multimedia Distance Learning (IMDL) model for a "virtual classroom." The model combined the rich communication capabilities of two-way video conferencing with real time, synchronous data communications for sharing of computer generated examples and data. According to the authors, video's strength lied in its ability to closely mimic "reality." The level of interaction was believed to be high and the environment offered the possibility of sharing between teacher and students and students with peers. The researchers made an attempt to recreate the "social construct" of the traditional classroom. For this purpose, the participants were offered the capability to perform the actions that they performed in traditional classrooms. The IMDL environment was tested with live participants who were located in the states across the US. The students were actually other AT&T instructors, who volunteered to participate. The participants' reactions were grouped into two areas. The first group of comments was positive about the user interface and software tools. Generally, the students enjoyed the experience. They also found that it had great potential to improve upon other modes of instruction delivery. The second group of comments described the participants' intimidation by the technology employed in delivering the course. The students felt that they would need some help in getting started using IMDL technology. It was found that IMDL model also made course more interactive and allowed

students to construct their own understanding of the material by giving them powerful online software tools and reference materials. One of the limitations of this study was that its participants were not the typical non-traditional students, but AT&T instructors who volunteered to participate. This makes it impossible to generalize the finding on regular distance students.

Andrusyszyn et al. (1999) reported the results of an evaluation of a blend of educational delivery methods used in a Primary Care Nurse Practitioner program in Ontario. The findings showed that video conferencing technology added a communication link that contributed to personal connectedness among the cohort of students and among faculty and students. These media were used to facilitate collaborative learning and contributed to interpretation, clarification, validation, and social construction of knowledge (Andrusyszyn & Davie, 1995).

Maguire and Matejka (1999) studied students' attitudes towards WBI. Data were collected from students in 1998, the first year of offering of the two units. These were collected from participant discussions, informal feedback, interim and formal end of unit evaluations. These data were analyzed to provide a picture of the manner in which participant's roles as learners changed over the study period. The following factors were examined: the manner in which participant experiences with the technology affected learning, participant's changes in attitudes to the technology, shifts in the participant's knowledge skills and attitudes, and how well the WBI model met participant's needs and expectations.

The results indicated that attitudes to the technology changed over the course delivery. Not all embraced the technology at the end of the first unit. Some students had obvious reservations because of their experiences with troublesome technology. However, no person who successfully completed the first unit and was enrolled for both units withdrew from that second unit. The researchers suggested that benefits of WBI must have outweighed the costs to them.

Videoconferences were a big part of the course. For most, this was a new experience -- one that was daunting for some. However, in general, videoconferences were well received by students as a means to get to know others in the virtual community. Students commented that they helped to put a "face to the name." The unanimous feeling was that videoconferences should be always used as an introductory component of each unit as well as to wrap up things at the end. Some participants observed that the videoconferences made the mode of delivery informal and personal. At the same time, some technical problems emerged. Links at times were quite slow and this meant that interactivity was not as good as it could have been.

Although the data were limited, the researchers were able to identify a number of needs and expectations of participants, which WBI system must be able to satisfy. Also, they have successfully presented some tentative ideas about the shifts in students' knowledge, skills and attitudes to technology. Maguire and Matejka (1999) offered a number of principles for the successful expansion of online learning based on their research analysis. Among them a) the importance of allowing for true flexibility in the units delivery, listening for signs of problems which are impeding participant learning and being ready to react to these in a timely and positive way, and b) build a supportive virtual community through features such as email, group discussion, cooperative learning and speedy feedback.

There is a limited body of research literature on videoconferencing that shows that VC is never as direct, lively and informal as face-to-face encounters, but rather tends to trigger lecture-like conversation, particularly when audio quality is poor, as in most low-cost systems (Finn, Sellen, & Wilbur, 1997; O'Conaill & Whittaker, 1997).

As the present review of literature showed, themes drawn from adult education, that also dominate the distance education literature, included the observations that the impact of various

Web-based course and delivery components on student satisfaction and achievement varied significantly. For instance, while email was considered to be the most viable alternative means of course delivery (Smith et al., 1999), other course components, such as videoconferencing, seemed to need more standardization (Lawton, 2000). Moreover, some course components such as online discussions could have different effects upon students. For instance, while some students felt that online discussions helped them maintain their motivation and enthusiasm (Carswell et al., 2000), others complained about overwhelming amount of messages to read and respond to (Wegerif, 1998). Also, different combinations of two or more components can affect the desired outcomes in a positive way. For instance, combining text with either audio or video can increase students' level of understanding and remembering concepts better than the use of still graphics and text alone (Quealy & Langan-Fox, 1998).

Pilot Study

All the above-mentioned findings are consistent with the results of a pilot study for the current research study. The purpose of the pilot was to examine students' experiences with various components of online courses (email, text, online threaded discussions, chats, web links, audio, and video streaming). Fourteen PhD students enrolled in the online courses at the University of Windsor, Lakehead University, Brock, and the University of Western Ontario were asked to fill out an open-ended questionnaire. Twelve students out of 14 returned the completed questionnaires (response rate of 85.7%). The qualitative findings showed that the students' experiences with the online components were varied but predominantly positive. Students displayed a preference for some online course components (email, online threaded discussions, web links) over others (chat). The students valued convenience and flexibility of email, extensiveness of the dialogues provided by the online threaded discussions, and the easy access

to the course materials online. The participants also enjoyed the self-paced nature of participating in the online instruction and the increased interaction with other students. Furthermore, the results showed that students' satisfaction/dissatisfaction with the online components depended on the two groups of factors: (1) external factors, such as teacher involvement, workload, and the effectiveness of the technology used, and (2) internal factors such as students' learning styles and their motivation to learn. It was concluded that students' likes or dislikes for a particular mode of presentation might have more to do with the framework in which the mode is used or differential student qualities, rather than the mode itself (Morton & Clovis, 2002).

This literature review has clearly shown that all the factors, external and internal, should be considered prior to and during the online instruction. In the next part of the Literature Review, students' internal factors, their impact on learning outcomes and the student satisfaction with the online course components will be examined.

ONLINE STUDENTS' MOTIVATIONS

Distance Education (DE) Learner Characteristics

According to Wallace (1996), the flexibility that distance education offers in terms of where and when students learn has been particularly advantageous for two groups of students: a) those who live at a geographic distance from the institution, and b) those who are fully employed (either at home or in the workplace) and who must pursue a university education on a part-time basis. Because the fully employed tend to be older individuals, distance education has provided access for many adults who are unable to attend scheduled classes on campus. Hence, enrollment in distance education has traditionally been heavily adult. Wallace suggested that distance education became closely associated with adult education as a consequence of this history. *USA Today* (1999) found that five of every 11 students attending U.S. colleges and universities were 25 or older. USA Today also predicted that the number of college students 35 and older would exceed the number of 18- and 19-year-old students in this decade.

Despite the wide variation in the characteristics of the adult DE learners that exist in educational literature, it is still possible to identify some of the most common ones. Cranton (1989) selected the following characteristics that seemed to be true of the large majority of adult DE learners: (a) Adults usually choose to learn. This means that the adult will expect that the instructional situation will be relevant to their needs; (b) Adults enter the learning situation with a variety of life experiences. Learning is facilitated when the instruction is related to these experiences; (c) Most adults have concrete and immediate learning goals. They know what is important to them and are frustrated when others impose their ideas of what is important; (d) Usually adults prefer to be self-directed even though they may demonstrate dependent behaviors

in a classroom or formal setting; (e) Adults are different from each other and the general characteristics of adults may not all apply to individuals.

In the theory of adult learning, Knowles (1978) singled out at least four crucial assumptions (a fifth was added later) about the characteristics of adult learners that are different from the assumptions about child learners: (1) *Self-concept*: As a person matures, person's self concept moves from one of being a dependent individual toward one of being a self-directed human being; (2) *Experience*: As a person matures, he/she accumulates a growing reservoir of experience that becomes an increasing resource for learning; (3) *Readiness to learn*: As a person matures, his/her readiness to learn becomes oriented increasingly to the developmental tasks of his/her social roles; (4) *Orientation to learning*: As a person matures, his/her time perspective changes from one of postponed application of knowledge to immediacy of application, and accordingly his/her orientation toward learning shifts from one of subject-centeredness to one of problem centeredness; (5) *Motivation to learn*: As a person matures, the motivation to learn becomes internal (Knowles, 1984).

Research results also showed that adult learners usually approach learning differently than younger traditional learners (RIT, 2000): (a) They are more self-guided in their learning, (b) They bring more, and expect to bring more, to a learning situation because of their wider experience -- and can take more away, and (c) They require learning "to make sense" -- they will not perform a learning activity just because the instructor said to do it. Benshoff and Lewis's (1992) research study of nontraditional students suggested a number of factors that characteristically separated nontraditional students from younger college students. Adult learners, according to Benshoff and Lewis, tended to be achievement oriented, highly motivated, and relatively independent with special needs for flexible schedules and instruction appropriate

for their developmental level. Adults generally preferred more active approaches to learning and value opportunities to integrate academic learning with their life and work experiences. Financial and family concerns were two of the biggest considerations that impact on the adult student experience.

Gender and Age Differences

A number of research studies have indicated that age and gender can potentially influence students' satisfaction and learning outcomes in online courses (Mourtos & McMullin, 2001; Shih & Gamon, 1999). Mourtos and McMullin (2001) compared learning and satisfaction of graduate and undergraduate students in online and onground (classroom-delivered) engineering courses. A questionnaire was sent to all online students to solicit information on their background, as well as to explore students' learning style preferences. The researchers found that older students might be better prepared for the demands of an online environment than younger students. Younger students, on the other hand, perform better onground, especially when an interactive environment is fostered. The researchers concluded that the online environment might not be satisfactory for a large percentage of younger students, who need to interact with their instructor and classmates on a more regular basis, and face-to-face, to succeed in their courses. According to the authors, undergraduate students were not mature enough for the demands of online education, which required more independent learning and discipline to keep up with the material being taught.

Potential problems with this study included variations in the sample size. Specifically, the number of traditional students participating in the study was much higher (N=65) than the number of the online students (N=21). Also, since it was a quantitative study a sample of 21 online students was too small. Finally, some caution is called for when interpreting the results since the researchers were comparing graduate online students to traditional undergraduate

students. According to Stein (2000), motivations and commitments of graduate students, their economic situation, and their educational backgrounds and experiences, all potentially relevant to learning outcomes, might be different from those of the vast majority of students undertaking campus-based higher education courses.

Some researchers believe that gender differences might have an impact on experience in an online environment (Wang, Kanfer, Hinn, & Arvan, 2001). It has been suggested that females are more technophobic (Karma, 1994), have more negative attitudes toward computers (Dambrot, 1995), and are less confident in their use of computers (Culley, 1988) when they enter university. Further, there is some evidence that males used more aggressive tactics in online discussions than women (Herring, 1993; McCormick & McCormick 1992). Herring (1993) suggested that (a) women and men had recognizably different styles in posting to the Internet, contrary to the claim that CMC neutralized distinctions of gender, and (b) that women and men had different communicative ethics, that is, they valued different kinds of online interactions as appropriate and desirable.

The data was collected using electronically-distributed questionnaires which were sent to LINGUIST-L asking subscribers what they thought of the discussion and if they had not contributed, why not. Herring found that women were more likely than men to react aversively to aggression in online interaction, including falling silent and dropping out of listserv groups. Where flaming on the Internet was concerned, men and women used different value systems in rationalizing behavior. In spite of a medium of communication that is anonymous for all users (and thus should encourage less inhibition across the board), it was primarily men who flame. The results of Herring's survey on communication ethics revealed that men and women agreed on several issues. They valued expressions of appreciation, were neutral about tentative postings,

and disliked flaming. As Herring stated, "this made male flaming behavior all the more puzzling; should we conclude then that men who flame are deliberately trying to be rude?" In fact, the men were operating with a different value system, under which they assigned greater value to freedom from censorship, open expression, and debate. Women felt they had to be sensitive to the wishes of all participants for the benefit of the entire community. However, the researcher did not specify the sample size or the number of responses received.

There is some suggestion that women have been silenced and even pursued and frightened in the online medium (Campbell, 1999). Herring (2000) suggested that gender differences in online communication tend to disfavor women. In mixed-sex public discussion groups, females post fewer messages, and are less likely to persist in posting when their messages receive no response (Herring, forthcoming). The results of Wylie's (1995) research study demonstrated that there was a pattern of difference in contribution in the Internet discussion groups between males and females. Specifically, the researcher found that men contributed more consistently than women (70% vs 30%). One of the findings was that if women contributed more than 30% of conversation, they were perceived to be dominating the conversation. Even in feminist forums (such as the newsgroup alt.feminism) men contributed 74% of the postings, even on nights designated women-only.

In an important early article documenting the results of an academic listserv group's self-directed experiment with anonymity, Selfe and Meyer (1991) found that males and participants in the group who enjoyed high status off-line dominated the interaction, both under normal conditions and under conditions of anonymity, although some individual women reported feeling freer to participate when their messages were anonymous.

Prior Online/Computer Experience

There is a body of educational research arguing for a positive impact of students' prior online experiences on their online course success. Daugherty and Funke (1998) conducted a qualitative study examining students' perceptions of WBI. Thirty-six undergraduate and 19 graduate students were surveyed. Participants were asked to complete a structured survey about their online experiences. Survey questions were open-ended allowing for generated data that did not impose predetermined responses. The graduate students were public school teachers completing a master's level graduate program in education. These students completed the initial offering of an online educational research course available at a password-protected Internet site. Twenty percent of the class had little or no experience with using technology prior to enrolling in the course. Fifty percent of the students had moderate experience, whereas 30% characterized their previous experience as extensive. The 36 undergraduate students completed a traditional health science course on human sexuality that incorporated online assignments as one segment of course requirements. Forty-four percent of the students had little or no prior experience with technological tools, whereas 53% categorized their technology background as moderate. Only one student had extensive experience with computer applications prior to the course.

The results of the survey showed that there were no significant variations in responses of undergraduate and graduate students. Across all responses, the strongest learning experiences were related to technology, with content related knowledge demonstrating a secondary but supportive role. Students repeatedly rated some aspect of computer applications as the number one educational experience associated with the activities they had completed. Some of the most frequently mentioned responses were (a) learning to navigate and use the Web successfully, (b) to apply computer skills, and (c) to use conferencing tools such as email and listservs. These

findings revealed that students gained competence with technology and that their newfound capabilities were important to them. Although the participants acknowledged initial difficulties, most students described how they adapted quickly and learned appropriate procedures and processes. However, a few students were repeatedly frustrated with their experiences. Some of these respondents openly attributed their problems to lack of technological skills, and further data analysis supported this assertion. Students whose responses expressed doubts consistently indicated in the initial background questions that they had little experience with technology. Subsequently, findings revealed that previous training with computer applications was one variable that influenced how students perceived their own degree of competence when completing WBI activities. The results of this study are consistent with the findings of Mourtos and McMullin's (2001) study that attempted to compare graduate and undergraduate student learning and satisfaction in online and traditional engineering courses. Much like Daugherty and Funke (1998), Mourtos and McMullin pointed out that a previous completion of an online course was the best indicator of success in an online environment. The results of Mourtos and McMullin's (2001) study should be interpreted with caution because of the small sample size.

Qureshi, Morton, and Antosz (2002) conducted a study where four models of descriptive characteristics (Demographic, Experiential, Motivational, Inhibitory) were examined using discriminant function analysis for Online and On-Campus students. Of 240 targeted students (120 Online and 120 On-Campus), 174 responded to a questionnaire identifying characteristics of students who enroll in Web-based courses. As the data analysis showed, the groups were reliably separated (Wilks' Lambda = 0.744, Chi-square = 50.08, df = 6, $p < .001$) with a successful classification rate of 73.6% for an Experiential Model. It was concluded that it was the Previous Web-Based Instruction Experience and Use of E-Mail that distinguished between

groups. These were the only two variables loading at .33 or higher (a criterion advocated by Tabachnick and Fidell, 1996) in the Structure matrix. This research study clearly showed that online experience was important, and more so than experience with the computer.

The Distance Learner's Motivations

Educational literature usually defines motivation as an internal state that arouses, directs, and maintains behavior (Woolfolk, Winne, & Perry, 2003). Motivation may be characterized as intrinsic or extrinsic (Woolfolk, 2001). Intrinsic motivation seems to be inherent in an activity itself, as when we engage in an activity for its own sake or merely because it is fun introversion preoccupation with oneself and accompanying reduction of interest in the outside world. Extrinsic motivation, on the other hand, is created by external factors such as rewards and punishments (Woolfolk et al., 2003).

Adult Learner Characteristics

Knowles (1975, 1978) pointed out that one of the most important qualities of an adult learner is self-direction. In its broadest meaning, self-direction, according to the researcher, describes a process in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes (Smith, 2002).

According to Knowles (1975), there were three immediate reasons for self-directed learning. First, the researcher argued for convincing evidence that people who took the initiative in learning (proactive learners) learned more things, and learned better, than did people who sat at the feet of teachers passively waiting to be taught (reactive learners). "They enter into learning more purposefully and with greater motivation. They also tend to retain and make use of what

they learn better and longer than do the reactive learners" (Knowles, 1975, p.14). A second immediate reason was that self-directed learning was more in tune with our natural processes of psychological development. "An essential aspect of maturing is developing the ability to take increasing responsibility for our own lives -- to become increasingly self-directed" (Knowles, 1975, p.15). A third immediate reason was that many of the new developments in education put a heavy responsibility on the learners to take a good deal of initiative in their own learning. "Students entering into these programs without having learned the skills of self-directed inquiry will experience anxiety, frustration, and often failure, and so will their teachers" (Knowles, 1975, p.15).

Interactive capabilities of some distance learning technologies, especially those available through the Internet, may be more attractive to adults. Because online learning usually involves multiple media to present course information, adults may prefer online courses to traditional classroom-based courses or in-house training sessions conducted in a laboratory. Hiltz (1997), in a study of the impacts of college-level courses by asynchronous learning networks, found that collaborative learning increased motivation to learn. Fifty-five percent of the participants were more motivated to work hard on their assignments because other students would be reading them. Potthast (1999) has noted that cooperative learning led to higher achievement, more efficient and effective processing and exchange of information, increased productivity, positive relationships among students, and greater development of truth than do competitive and/or individualistic learning experiences.

Motivations to Enroll

A number of attempts were made to bring order and structure in the enormous variety of reasons that adults give for participating in distance education. One of the first efforts of this

kind was undertaken by Houle (as cited in Cross, 1981). The proposed three-category system of distance learners seems to be current even now, twenty years later, due to the apparent logic behind it. Three subgroups of distance learners are based on the common features running through the activities and motivation of the students. The first subgroup, *goal-oriented* learners, use learning to gain specific objectives, such as learning to deal with particular family problems and learning better business practices. For the goal-oriented learners, learning is a series of episodes, each beginning with the identification of a need or an interest. The second subgroup, *activity-oriented* learners, participates primarily for the sake of the activity itself rather than to develop a skill or learn subject matter. They may take a course or join a group to escape loneliness or boredom or an unhappy home or job situation. The third subgroup, identified by Houle, consists of those who are *learning-oriented.* These learners pursue learning for its own sake. They seem to possess a fundamental desire to know and to grow through learning, and their activities are constant and lifelong.

Some researchers showed that learners who participate in distance learning programs have a variety of educational needs (MacBrayne, 1995; Porter, 1997; Willis, 1993). Some may be interested in a one-time course, others may want to complete a degree program or meet long-term educational requirements, such as those for certification. Adult learners may work part time or full time or they may be currently un- or underemployed and want to develop more marketable skills. Adult learners may need specialized training to keep up with current job demands or they may be looking for more general education. Their motivations range from personal interests to job pressures (Porter, 1997). Willis (1993) suggested that adult students deciding whether to take a distance-delivered course might also be interested in the relevance of the content, the appropriateness of the course in meeting some long-term goals, and the

effectiveness of the instructor. Learners vary in their beliefs about success, their motivation in learning, and their responses to difficult tasks (Dweck, 1986). Liu and Ginther's (1999) research findings showed that compared to the traditional students, DE students tend to be more intrinsically motivated. This result is similar to the findings obtained by Watkins and Hattie (1981) and by Watkins (1983).

Achievement Motivation

Motivation influences how and why people learn as well as how they perform (Pintrich & Schunk, 1996). Watkins, Carnell, Lodge, and Whalley (1996) proposed the following two patterns of motivation: Positive and negative. Positive pattern of motivation -- "learning orientation" -- belief that effort leads to success; belief in one's ability to improve and learn; preference for challenging tasks; satisfaction from success at difficult tasks; problem-solving and self-instructions when engaged in task. Negative pattern of motivation -- "performance orientation" -- belief that ability leads to success; concern to be judged as able, to perform; satisfaction from doing better than others; emphasis on competition, public; helplessness: evaluate self negatively when task is difficult.

Motivation was found to be the best predictor of student achievement in the two studies that investigated factors influencing student achievement and effects of the factors on students' achievement in learning the Japanese language through the medium of satellite television (Oxford, Park-Oh, Ito, & Sumrall, 1993a; 1993b). It was also found that gender and learning styles played potentially important roles although they were not significant factors. Shih and Gamon (1999) analyzed the relationships between student achievement and the following variables: attitude, motivation, learning styles, and selected demographics. Ninety-nine students participated in this research study. The participants were enrolled in two Web-based courses

offered by the college of agriculture. Seventy-four (75%) students completed a learning style test, an online questionnaire, and received a grade by the end of the semester. It was found that learning styles did not affect student motivation and use of learning strategies. Motivation and learning strategies seemed to be the most important factors in Web-based learning and accounted for more than one-third of student achievement. Student motivation and use of learning strategies by the students correlated significantly with student achievement. The higher the student scored on motivation and a general use of learning strategies, the higher the student's overall achievement in the class. Pintrich and Johnson (1990) and Weinstein and Underwood (1985) had similar findings. They indicated that learners who used more motivational and learning strategies learned more than those who used fewer strategies. Additionally, they concluded that motivational and learning strategies could be controlled by learners and improved through instruction. The results of Shih and Gamon (1999)'s research study also showed that the two most highly rated motivations for Web-based learning were getting better grades than other students and expecting to do well.

Fukuda (2002) conducted a literature review on the effects of motivation on academic achievement for distance education students. It was found that the following factors were affecting motivation: (1) emotions were suggested to motivate students in learning, (2) motives-as-goals (Covington, 2000) was another factor. Students related to learning with goals by working toward the goal of completion of a project or paper and passing a test, (3) self-worth (Covington, 2000), (4) self-efficacy (Wlodkowski, 1999), (5) self-esteem (Colvin, 2000), (6) learning styles (Wlodkowski, 1999). How a student actually studied and learned was cited as factors influencing motivation to learn and to achieve in classes, (7) factors such as the technology itself, lack of contact with an instructor and other students, problems in

communication, and many other problems that were unique to the distance learning environment created obstacles for learning and motivation to learn for distance education students, (8) values and attitudes were also implicated in motivating students to learn.

The purpose of Bures, Abram, Amundsen's (1998) study was to explore why some students appear motivated to learn via computer conferencing (CC) and others do not. The study proposed a model of student acceptance of CC environments based on those of Hiltz (1994) and Eastmond (1994). For instance, Velayo and McKeachie (1994) found several relationships between cognitive-motivational characteristics and student perceptions of CC as a supplement to classroom instruction. It was concluded that the motivational component was more salient in the formation of student perceptions than was the cognitive component. The research study focused on two aspects of student motivation to learn via CC, namely students' expectations and goal orientation. Students' CC expectations were of two sorts: (a) to successfully learn to use CC (success expectations), and (b) using CC would help them learn the course material (outcome expectations). The researchers suspected that students' CC expectations were related to their satisfaction with CC and the frequency of their online activity. In turn, students' CC expectations might be related to students' general expectations about the use of technology in learning and anxiety toward computers. With respect to goal orientations, Bures et al. (1998) hypothesized that students with higher mastery orientation would tend to have higher CC outcome expectations, whereas students with higher performance orientation would tend to have lower CC outcome expectations.

Participants were volunteers from five graduate-level face-to-face courses and from one undergraduate distance education course during the 1996/1997 academic year (N=79). Students were assessed at the beginning and at the conclusion of the course. Analyses were conducted on

the number of online messages sent to course-related conferences. The researchers distinguished between graded and ungraded messages. Bures and his colleagues found evidence that: (1) students' expectations were related to their satisfaction with CC and to their total online messages, (2) students' success expectations were related to the number of graded messages they sent, and (3) students' outcome expectations were related to their satisfaction with CC and to the number of ungraded messages they sent. No significant relationship was found between goal orientation and students' CC outcome expectations. Furthermore, computer attitudes were significantly correlated to students' expectations, and success expectations in particular. Computer anxiety and students' success expectations were also found to be correlated.

Attribution Theory

One of the theories that can help investigators understand behavior and motivation is attribution theory. Attribution theory emerged from Heider's (1958) "naïve" or "lay" psychology and subsequent reformulations by Jones and Davis (1965), Kelley (1967), and Weiner (1980). In both failure and success situations, research showed that learners attributed their outcomes to one of four sources. These are the four types of attributions: effort, ability, level of task difficulty, and luck (Galbraith, 1994). Further investigation (Weiner, 1980) has revealed the three dimensions of attributions: (1) locus, the locations of the cause as internal or external to the person, (2) stability, whether the cause stays the same or can change context, and (3) whether the person can control the cause (Woolfolk, Winne, & Perry, 2003).

According to attribution theory (Weiner, 1980), a high achiever will: (1) Approach rather than avoid tasks related to succeeding because he/she believes success is due to high ability and effort, which he/she is confident of. Failure is thought to be caused by bad luck or a poor exam, that is, not his/her fault. Thus, failure does not hurt his/her self-esteem but success builds pride

and confidence; (2) Persist when the work gets hard rather than giving up because failure is assumed to be caused by a lack of effort, which he/she can change by trying harder; (3) Select challenges of moderate difficulty (50% success rate) because the feedback from those tasks tells you more about how well you are doing, rather than very difficult or very easy tasks which tell you little about your ability or effectiveness; (3) Work with a lot of energy because the results are believed to be determined by how hard you try.

According to Galbraith (1994), not only do the learners' own perceptions affect future success expectancy, but the teacher's reactions also impact the students' attributions. These teacher reactions and expectancies, verbal and non-verbal, play an important role in the formulation of student perceptions and motivation. Categories of teacher behaviors include the setting of task difficulty and assistance provided to the students, feedback, goal structures as perceived by the students, and teacher reaction to different student characteristics (for example, self-concept, developmental level, gender). The task difficulty should be challenging, but achievable for all students. Teachers should also expect the same performance from all students, positive outcomes.

Learning Styles

Meighan (1996) has claimed that adult learners represent a variety of learning styles. An example is the difference between those who learn better with some background noise and those who learn better in quiet conditions. Individuals also differ in the kind of light conditions, temperature conditions, bodily positions, food intake and type of companions needed for efficient learning. Bio-chronology is another factor. Some people are early-day learners and some are late-day or even evening/night learners. Some are impulsive learners and others are

reflective. Some may find that traditional educational methods, such as lecture and discussion, are not the best ways to help them learn.

Mosher (2002) stressed out the importance of knowing a learning preference relative to the modality chosen. Many self-study options, as Mosher proposed, both online and off, require a high degree of self-motivation and discipline. They may also require a great deal of time during or after work, possibly more than a formal class may have taken. Therefore, if learners really wish to succeed, they have to pay attention to innate learning needs, deciding how one learns best, and using this information to plan an individual path toward job success. For example, some learners may need to supplement self-paced, Web-based courses with chat forums, mentoring or email support services, because they know that they need to have the opportunity to ask questions and discuss lessons. Other learners may need to regularly intersperse Web-based training with real-world, hands-on applications in virtual classrooms with live instructor interaction, because they need to practice, tape it, then watch the replay several times. Distance education, according to the researchers, allows maximum freedom for using preferred learning styles.

Learning Style Definitions

The definitions and terminology related to a learning style (LS) are as varied as the individuals dealing with the concept (James & Gardner, 1995). According to Dunn and Dunn (1987), LS is a way in which a learner begins to concentrate on, process, and retain new and difficult information. Felder (1996) defined LS as characteristics and preferences in the way students take in information. Krahe (1993) defined it as an individual's characteristic method of responding to and processing learning events as he/she experiences them. Based on the above definitions, LS refers to the individual's consistent and characteristic predispositions of

perceiving, remembering, organizing, processing, thinking, and problem solving. The term LS is used by others (Watkins et al., 1996) to describe a learner's preference for particular modalities of learning (e.g. visual, auditory ways of processing).

Comparison of Learning Styles of Traditional and Distance Students

The purpose of Ouellette's (2000) research was to review the role of LS and to assess its role in impacting on the student performance. Out of 1,000 online and face-to-face students chosen to participate, around 400 responded -- a return rate of 40%. Students were asked to read supplementary material and report on what they learned by creating a graphic presentation rather than reporting in a textual or a verbal fashion. The results indicated that the students were very good at graphical understanding and representation. It was also found that about half of the online students were "global thinkers," while the other half were sequential learners. The results also showed that the students in the face-to-face environment worked well in groups whereas the online students found it very difficult.

Based on the findings the following conclusions were made: (1) Students appear to be substantially different in terms of intelligence, ability, aptitudes, attitudes and experience. This means that instructors must incorporate in their class material enough material and methods of delivery to address the need of each and all students. This can be achieved by developing a comprehensive knowledge of students' LS. (2) The teacher has to put the information often in more than one format (for global and sequential types of learners) and use more active techniques that will get the student motivated to participate in the learning process. (3) When one is online, which is so very largely a textual format where people just post notes and words, it is very important to have a lot of graphics.

The purpose of Diaz and Cartnal's (1999) research was to compare the student LS of two WB health education classes (N = 68) with an equivalent face-to-face class (N = 40). The Grasha-Riechmann Student LS Scales was administered to determine student social LS preferences in six LS categories. It was found that students enrolled in a WB class were likely to have different LS than equivalent face-to-face students. Online students were more independent in their styles as learners. This is consistent with James and Gardner (1995) who suggested that DE students who favored reliance on independent learning skills would be more suited to a distance format.

Correlational analysis revealed that face-to-face students displayed collaborative tendencies that were positively related to their needs to be competitive and to be good class citizens. Thus, face-to-face students appeared to favor collaborative styles to the extent that it helped them to obtain the rewards of the class. In contrast, WB students were willing and able to embrace collaborative teaching styles if the instructor made it clear that this was expected, and gave them form and guidance for meeting this expectation. Online students appeared to be driven more by intrinsic motives and clearly not by the reward structure of the class. One of the limitations of this study was the utilization of a non-probability (convenience) sampling technique. Non-probability sampling is used when it is impossible or impractical to use systematic sampling techniques.

Learning Styles and Motivation

A taxonomy of learning styles developed by Curry (1990) used the concepts of learning styles, student achievement, and motivation to describe the process of learning. According to the researcher, learning styles consist of a combination of motivation, engagement, and cognitive processing habits, which then influence the use of metacognitve learning strategies such as

situation analysis, self-pacing, and self-evaluation to produce a learning outcome. Curry's taxonomy (1990) suggested that motivation, learning styles, learning strategies, and student learning outcomes are associated. Current research, however, shows mixed results. For instance, the purpose of Shih and Gamon's (1999) research study was to examine how students with different styles learned in Web-based courses and what factors influenced their learning. One of the objectives of this research was to identify how students' motivation, learning strategies, and achievement differed by their learning styles. Ninety-nine students were surveyed using (a) the cognitive style test (Group Embedded Figures Test -- GEFT), which classified students as either field-dependent or field-independent and (b) the online questionnaire that consisted of two scales (motivation and attitude). The results showed that student learning styles and student characteristics did not relate to their Web-based learning achievement. The conclusion was that students with different learning styles and backgrounds learned equally well in Web-based courses. Moreover, learning styles did not affect student motivation and use of learning strategies. The researchers cautioned though that findings related to learning styles might not accurately represent the learning styles of the population. These results are consistent with the findings of Day, Raven, and Newman's (1997) study of the effects of learning styles on achievement in a WWW course. The researchers found that learning styles had no effect on student achievement or attitude in Web-based instruction. Liu and Reed (1994) had similar findings as well. They found that LS did not affect students' achievement in a hypermedia environment.

In contrast, Wlodkowski (1999), in the analysis of adult motivations to learn, saw a wider range of learning styles that were accommodated by learning through the World Wide Web. The researcher noted that classroom-based instruction, or classes conducted in a traditional classroom

could inhibit certain learning styles, such as slower learners, shy or introverted students. These students seemed to flourish in both asynchronously and synchronously taught classes on the Internet. They seemed to have greater rates of discussion in chat rooms or posted messages, and produced higher qualities of discussion and writing than if they had learned in a traditional classroom (Wlodkowski, 1999). Gees (as cited in Sankaran & Bui, 2000), found that learning outcomes were positively affected by the students' preference for course formats, suggesting that a fit with the learning technology and personal learning style could have been a factor as well as attitude towards the learning format.

Mourtos and McMullin's (2001) attempted to compare student learning and satisfaction in online and traditional engineering courses. Twenty-one graduate and 65 undergraduate students were surveyed. An important finding was that success in an online course might depend on student's learning style. Intuitive and global types of learners might be better suited for the online environment, compared with the rest of the types. Overall, students who are more balanced learners in all four dimensions of the LS are more likely to enroll and succeed in online courses.

According to Fukuda (2002), research studies conducted on different aspects of learning and learning style preferences do not show similar results due to differing conditions of learning for students and due to the diversity of the students themselves. Therefore, researchers should exercise caution in drawing generalizations on any particular aspect of distance education, as well as on online and distance education students.

As the review of literature on student motivations and learning styles showed, online students are different in terms of development, experience, and motivations from traditional students. What is obvious though is that only those students who can identify a specific learning

style preference, recognize what motivates them, and learn how to use it appropriately are more capable of taking responsibility for their own learning.

Because online students face challenges in learning such as isolation, frustration, lack of interactivity, and various problems with technology, motivation to learn then becomes a powerful driving force for these students. A number of research studies found motivation to be the best predictor of student achievement (Oxford, Park-Oh, Ito, & Sumrall, 1993a; 1993b; Shih & Gamon, 1999) and course satisfaction (Bures et al., 1998). Motivation to learn is affected by numerous factors: interest in the subject matter, perception of its usefulness, general desire to achieve, self-confidence and self-esteem, as well as patience and persistence. Not all students are motivated by the same values, needs, desires, or wants. Some students are motivated by the approval of others, some by overcoming challenges (Gross-Davis, 1993). A few research studies have demonstrated that learning styles might affect students' motivations as well (Wlodkowski, 1999). However, a majority of studies found no significant difference in the academic achievement of students with different learning styles in the online environment (Merisotis & Phipps, 1999; Shih & Gamon, 1999). It can be concluded that motivation is certainly one of the key components to a successful online learning.

Summary

This Literature Review has attempted to engage with and reflect upon some of the issues current in the field of Web-based instructional design. This research first overviewed several instructional design theories. It was seen that a case could be made that there is a critical need for significantly improved methodology and tools to guide the design and development of high quality Web-based courses. Researchers (Jonassen et al., 1997) agree that instructional design may not need a scientific revolution, but it would probably benefit from a theoretical adjustment.

This necessity comes from the widespread growth of interactive instructional technologies to deliver education and training. Courses in WBI are the forefront of every higher education institution (Dabbagh & Burton, 1999) and the need for guidelines on how to design, develop and implement such courses is eminent. However, in order to design more effective courses for Web delivery and truly determine their effectiveness, educators need to look at and evaluate the process and attitudes toward this delivery method.

Many educators believe that the mere use of the WWW constitutes an engaging learning experience. As the review of literature showed, it is not always true. The use of this medium in a specific course does not automatically imply effective instructional activities or quality instruction for the intended learners. Andrusyszyn and Davie (1995) argued that because each delivery medium has unique characteristics, not all would suit every learner or educator. As stated earlier, adult learners have different learning styles, multiple roles, and complex lives. Some may prefer experiential and/or experimental teaching-learning activities, whereas others need a more traditional visual or auditory method. Some may value interaction with others in small and/or large groups, whereas still others may prefer to learn on their own. Educators, on the other hand, may be skilled in the lecture-discussion method, whereas others may thrive on more facilitative approaches to knowledge development. Similarly, various delivery media have inherent features that may or may not appeal to all learners or educators. However, as Junk and Fox (1998) pointed out, the advantages will outweigh the disadvantages if the end product is effective presentation of materials reflected by evidence of increased learning.

It is obvious that none of the course or delivery components alone guarantee good instruction and positive learning outcomes, since it is the instructional design methods that ultimately determine a specific site's effectiveness in producing effective learning. However, the

impact of various online course components on students' learning and satisfaction cannot be ignored completely. An important conclusion is that the only way to maximize Web-based learning is to combine the concepts of instructional design and the knowledge about students' motivations and learning styles with the attributes of web technology.

This literature review has clearly shown that besides the various external factors that can affect students' learning, there are other factors, such as online students' personal characteristics, prior online experience, students' motivations, and learning styles. Age and gender are believed to be potentially important factors for students' satisfaction with the online courses (Mourtos & McMullin, 2001; Shih & Gamon, 1999). Mourtos and McMullin (2001) found that older students might be better prepared for the demands of an online environment than younger students. Moreover, the online environment might not be satisfactory for a large percentage of younger students, who need to interact with their instructor and classmates on a more regular basis, and face-to-face, to succeed in their courses. With respect to the gender differences, the results of Wylie's (1995) research study demonstrated that there was a pattern of difference in contribution in the Internet discussion groups between males and females. Specifically, the researcher found that men contributed more consistently than women (70% versus 30%).

A number of research studies (Mourtos & McMullin, 2001; Qureshi, Morton, & Antosz, 2002) have demonstrated that one of the indicators of success in an online course for any student was a previous completion of another online course. Furthermore, the previous training with computer applications might be one variable that influenced how students perceived their own degree of competence when completing WBI activities (Daugherty & Funke, 1998).

There is a body of educational research showing evidence that motivation is one of the key components to a successful online learning (Fukuda, 2000; Shih & Gamon, 1999). The

empirical research on motivation has shown that a number of factors can have significant influences on students' motivations and learning. Students' perceptions of choice, challenge, control, and collaboration given to them in the online environment are critical for their sustained motivation. According to Paris & Turner (1994), methods of instruction and assessment that support these aspects of motivation promote students' sense of ownership, responsibility, and self-regulated learning.

Researchers show that the most successful online learners are self-motivated. They want to learn and they make sure they participate fully in the course. Motivation was found to be the best predictor of student achievement in a number of research studies that investigated factors influencing student achievement (Oxford, Park-Oh, Ito, & Sumrall, 1993a; 1993b; Shih & Gamon, 1999).

As some researchers suggested (Gross-Davis, 1993), in order to motivate online students, a course should be structured in the following way: (1) increase the difficulty of the material as the semester progresses, (2) work from students' strengths and interests, and (3) vary teaching methods. The analysis of various ID models showed that a number of current instructional models, including Reigeluth's Elaboration Theory, do consider these aspects of an effective online course design.

Learning styles are believed to play a potentially important role for students' success in an online environment as well (Ouellette, 2000; Shih & Gamon, 1999). Martinez (as cited in Mosher, 2002) stressed out that if learners really want to succeed, they have to pay attention to innate learning needs, figuring out how one learns best, and using this information to plan an individual path toward job success. A majority of research studies, however, showed no significant relationship between learning styles of online students and their achievement (Shih &

Gamon, 1999). The conclusion was that students with different learning styles and backgrounds learn equally well in Web-based courses (Day, Raven, & Newman, 1997; Shih & Gamon, 1999).

To conclude, five quasi-models that might potentially have an impact on students' satisfaction with the various online course components (email, hypertext, online threaded discussions, web links, chat, video, audio, simulations, and graphics) have emerged. They are the following:

1. Demographic Quasi-Model
2. Experiential Quasi-Model
3. Learning Style Quasi-Model
4. Motivational Quasi-Model
5. ID/Teaching Quasi-Model

Research Questions and Hypotheses:

The purpose of this research study was to investigate factors that affect the online students' satisfaction with the online course components. To accomplish this purpose, the following research questions have been posed:

1. Is there a relationship between students' demographic characteristics (gender, age, marital status, employment status, student status, and number of dependents) and their satisfaction with the following online course components: email, web links, online discussions, chat, graphics, simulations, audio, video, and hypertext?
2. Is there a relationship between students' prior online/computer experiences and their satisfaction with online course components?
3. Is there a relationship between students' preferred learning styles and their satisfaction with online course components?

4. Is there a relationship between students' motivations and their satisfaction with online course components?
5. Is there a relationship between the elements of the online course design and students' satisfaction with online course components?

As working hypotheses, it was predicted that:

(a) There is a relationship between online students' personal characteristics and their satisfaction with online course components; specifically, older students are more satisfied than younger students; males are more satisfied than females; marital, employment, and student status also impact students attitudes towards online course components.

(b) There is a relationship between students' prior online experiences and students' satisfaction with online course components: students who have taken more online courses have more positive attitude about the course components.

(c) There is a relationship between students' learning styles and students' satisfaction with online course components: global learners and students who are generally well-balanced in their learning styles are more satisfied with online components.

(d) There is a relationship between online students' motivations and their satisfaction with online course components: online students who are more motivated to learn also have a more positive attitude about the course components.

(e) There is a relationship between the elements of the online course design and students' satisfaction with online course components: those online courses that include various components typical of the constructivist learning environment will have a favorable effect on students overall satisfaction with the online course components.

CHAPTER III

RESEARCH DESIGN AND METHODOLOGY

The Rationale

Quantitative research methodology was chosen for this research study. Quantitative (QUAN) researchers are concerned with the relationships among variables and testing those relationships. Before they can begin a study, they must first know what variables are important, and then know how to interpret the findings by predetermined modes of testing (Strauss & Corbin, 1990). The main goal of quantitative research is to identify general patterns rather than account for subtleties of individual behavior.

The correlational research methodology was used for this research study. This methodology was chosen since the study attempted to determine whether or to what degree a relationship might exist between the predictor variables (students' motivations, learning styles, demographics, prior experiences, online course design) and the measure of student satisfaction with various online course components (email, hypertext, graphics, simulations, online discussions, chats, web links, audio, and video). The study did not determine the cause-effect among variables since it is impossible to determine causality in a cross-sectional study. The study examined only the relationship.

Subjects

Subjects for this research study were selected from a population of undergraduate students enrolled in the Web-based courses at the University of Windsor. Six online courses (Principles & Methods of Sociology, Computer Concepts for End Users, Principles of Management, Marketing Problems -- Applications and Decisions, Principles and Practices of Arts Administration, Intro to the Internet) that included various combinations of delivery and

course components, such as email, hypertext, graphics, simulations, online discussions, chat, web links, audio, and video, were selected for this research study. Subjects were the students enrolled in those professor's courses who gave their consent to participate. This provided a sample size of 401 students. A total of 240 questionnaire response forms were completed by subjects and returned. This corresponds to a 59.8% response rate. Almost 59% of the participants were between 18 and 25 years of age, 31% were older than 25. Female (N=176) students prevailed over male (N=64) almost 3 to 1.

Instrumentation

Data for this study were collected from the students with the use of an online questionnaire (see Appendix A). The questionnaire developed for the present study included six sections. Section I requested background information about the participants such as gender, age, marital status, employment, major, students status, and others. Section II collected information about students' email, Internet, and Word processing skills, as well as requested information about the number of prior online courses taken. The purpose of Section III was to collected information about students' preferred learning styles. Section IV required students to answer questions on a 5-point Likert scale that best represented their response to a number of statements pertaining to their motivations to learn. Section V intended to elicit information pertaining to students likes and dislikes of online course components including email, web links, chat, online threaded discussions, hypertext, graphics, simulations, audio, and video. Finally, Section VI collected data related to the specifics of online course design. A 5-point scale was used throughout this study in order to maintain consistency. An answer of 5 on this scale would indicate strong agreement and an answer of 1 strong disagreement.

The online questionnaire was an adaptation of the following instruments: the Index of Learning Styles (Felder & Soloman, 1991), A Manual for the Use of the Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich, Smith, Garcia, & McKeachie, 1991), and the University Social Constructivist Learning Environment Survey (USCLES) (Fisher, Taylor, & Fraser, 1996). The researchers who developed the various instruments were contacted, and permission was granted to use their respective questionnaire in this study. Information pertaining to each of these instruments is provided below.

Index of Learning Styles

The *Index of Learning Styles* is an instrument used to assess preferences on four dimensions (active/reflective, sensing/intuitive, visual/verbal, and sequential/global) of a learning style model formulated by Richard Felder and Linda Silverman. The instrument was developed by Barbara Soloman and Richard Felder of North Carolina State University. The results provide an indication of an individual's learning preferences. A student's learning style profile provides an indication of probable strengths and possible tendencies or habits that might lead to difficulty in academic settings. The profile does not reflect a student's suitability or unsuitability for a particular subject, discipline, or profession. The ILS is designed to help students discern what kind of learner they are. The results are categorized into four different areas: active/reflective, sensing/intuitive, visual/verbal, and sequential/global.

Explanation of Scores. Questions 1, 5, 9, 13, and 17 reflect Active/Reflective preferences, questions 2, 6, 10, 14, and 18 reflect Sensing/Intuitive preferences, questions 3, 7, 11, 15, and 19 reflect Visual/Verbal preferences, and finally, questions 4, 8, 12, 16, and 20 reflect Sequential/Global learning styles preferences. For each of the questions, students were asked to select either "a" (active, sensing, visual, sequential preferences) or "b" (reflective, intuitive,

verbal, global preferences) to indicate their answer. The total number of the "a" and "b" answers was calculated for each scale separately. The higher number indicates the higher preference for a certain learning style. "A" and "b" indicators serve to point which particular pole out of the two students favor the most. Those students whose score on a scale was 0 or 1 are characterized as having a mild preference for one or the other dimension, but they are essentially well balanced. For example, a 1a in the Active/Reflective category indicates a mild preference for active learning. Those participants whose score on a scale was 2 or 3 are characterized as having a moderate preference for one dimension of the scale and will learn more easily in a teaching environment that favors that dimension. Finally, those participants whose score on a scale was 4 or 5 are characterized as having a strong preference for one dimension of the scale. They may have real difficulty learning in an environment that does not support that preference.

Active and Reflective Learners: Active learners tend to retain and understand information best by doing something active with it -- discussing or applying it or explaining it to others. Reflective learners prefer to think about it quietly first. "Let's try it out and see how it works" is an active learner's phrase; "Let's think it through first" is the reflective learner's response. Active learners tend to like group work more than reflective learners, who prefer working alone. Sitting through lectures without getting to do anything physical but take notes is hard for both learning types, but particularly hard for active learners.

Sensing and Intuitive Learners: Sensing learners tend to like learning facts, intuitive learners often prefer discovering possibilities and relationships. Sensors often like solving problems by well-established methods and dislike complications and surprises; intuitors like innovation and dislike repetition. Sensors are more likely than intuitors to resent being tested on material that has not been explicitly covered in class. Sensors tend to be more practical and careful than

intuitors; intuitors tend to work faster and to be more innovative than sensors. Sensors do not like courses that have no apparent connection to the real world; intuitors do not like courses that involve a lot of memorization and routine calculations.

Visual and Verbal Learners: Visual learners remember best what they see -- pictures, diagrams, flow charts, time lines, films, and demonstrations. Verbal learners get more out of words -- written and spoken explanations. Everyone learns more when information is presented both visually and verbally.

Sequential and Global Learners: Sequential learners tend to gain understanding in linear steps, with each step following logically from the previous one. Global learners tend to learn in large jumps, absorbing material almost randomly without seeing connections, and then suddenly "getting it." Sequential learners tend to follow logical stepwise paths in finding solutions; global learners may be able to solve complex problems quickly or put things together in novel ways once they have grasped the big picture, but they may have difficulty explaining how they did it.

The ILS instrument was chosen for a variety of reasons. The ILS has been developed specifically during the past ten years to examine college students' learning style profile and suggest probable strengths and possible tendencies or habits that might lead to difficulty in academic settings. Recent studies showed that the ILS has moderate internal consistency and test retest reliability coefficients. For instance, Livesay, Dee, Felder, Hites, Nauman, and O'Neal (2002) in a study of 255 engineering students at Tulane University of New Orleans, found alpha to be in the range of 0.54 to 0.72. They also found moderate test-retest reliability in repeated measurements over time, and concluded that the ILS was an appropriate and statistically acceptable tool for characterizing learning preferences. Livesay et al. (2002) repeatedly tested a group of engineering students (N =24) at four, seven, twelve and sixteen month intervals. They

observed a linearly dropping off correlation of the repeated ILS scores, although learning preferences are thought to be a constant individual characteristic (Dunn, Giggs, Olson, Beasley, & Gorman, 1995). However, the small sample size made these results difficult to interpret. Pearson's correlation coefficients at seven months were at 0.73, 0.75, 0.68, and 0.60, respectively. Further, in an unpublished study, Felder and Spurlin (2002, as cited in Zwyno, 2003) examined the ILS responses of 584 students at North Carolina State University and found Cronbach's alpha coefficients to be in the range of 0.55 to 0.76.

Zwyno (2003) collected ILS responses for several hundred students (N=557) and assessed test-retest reliability, internal consistency reliability, and several quantities related to the independence and construct validity of the four instrument scales. The research in which ILS questionnaires were collected took place at Ryerson University, Toronto, Canada, during three consecutive offerings (2000-2002) of a course in control systems in the undergraduate Electrical and Computer Engineering program. The research dealt with efficacy of hypermedia-assisted instruction and the relationship of learning styles, hypermedia and achievement (Zwyno, 2003). In order to validate the ILS, a test-retest and Cronbach's alpha/factor analyses were conducted.

In estimating test-retest reliability, the same test was administered to the same sample twice. The time lapse between the tests was eight months. The results showed a moderate to strong correlation between the test and the retest scores.

Table 1: Pearson's Correlation of Test-Retest Scores for the ILS (Zwyno, 2003)

Active Scores	0.683**	n=124
Sensing Scores	0.678**	n=124
Visual Scores	0.511**	n=124
Sequential Scores	0.507**	n=124

**Statistically significant at the 0.01 level, 2-tailed.

The internal consistency of single-dimensional additive scales such as in the Felder Model can be tested using Cronbach's alpha, a coefficient assessing how well a set of items on the scale measures a single "underlying construct" (Trochim, 1999). The higher the score, the more reliable the generated scale is. The widely accepted social science cut-off is that alpha should be 0.70 or higher for a set of items to be considered a scale, because at $\alpha = 0.70$, the standard error of measurement will be over half of a standard deviation (Trochim, 1999). However, lower thresholds are sometimes used in the literature. For example, Tuckman (1999) stated that alpha test reliability should be above 0.75 for achievement tests but only above 0.5 for attitude tests.

Zwyno (2003) also performed an analysis of internal reliability of scales on the items for all 557 valid ILS questionnaires (Table 2). Cases with missing items were excluded from the analysis, and thus the number of cases shown varies. The internal reliability of the scales was found to range from 0.53 to 0.70. The resulting coefficients met acceptable limits as suggested by Tuckman (1999).

Table 2: Internal Consistency Reliability for the ILS -- Cronbach's Alpha (Zwyno, 2003)

	Cases	Items	Scale Mean	Scale Variance	Scale STD	Avg.IIC*	Avg.ITC**	Stand. *a*
Act/Ref	540	11	5.7889	5.6177	2.3702	0.1179	0.264	**0.595**
Sen/Int	539	11	6.2430	7.0245	2.6504	0.1730	0.349	**0.697**
Vis/Ver	544	11	8.1801	4.4537	2.1104	0.1354	0.289	**0.633**
Seq/Glo	532	11	5.7726	4.7900	2.1886	0.0927	0.217	**0.530**

*IIC: Inter-Item Correlations, **ITC: Item-Total Correlations

Zwyno (2003) concluded that test-retest analysis of the ILS scores suggested a moderate reliability of all scales. The internal reliability of the scales ranged from 0.53 to 0.70. Cronbach alpha coefficients met acceptable limits (Tuckman, 1999) and correlational and factor analyses

suggested that the model scales assess separate qualities, as theoretically predicted. Zwyno also argued that while longer questionnaires such as MBTI and Kolb's LSI typically yield higher Cronbach's alpha measures for collected data their usefulness in a classroom setting might be limited. The author observed that any voluntary survey that took longer than 10 minutes was much less likely to be completed and returned by students and faculty alike. As well, when the Kolb's LSI I was administered, on a trial basis, together with the Felder-Soloman LSI to students in the 2000 and 2001 studies (Zwyno, 2002), many kept asking questions regarding the meaning of the words they were supposed to rank. Moreover, many, instead of ranking words, simply chose one, despite repeated explanations of instructions. This suggested that the students were having trouble understanding the wording used in the questionnaire, making any subsequent results questionable. This might be specific to the demographic sample of students in the study. However, should such observations be typical of other students, the clarity of the ILS might help explain in part its popularity. The Web-based, self-scoring version of the questionnaire (at: http://www2.ncsu.edu/unity/lockers/users/f/felder/public/ILSpage.html) gets approximately 100,000 hits per year and has been translated into several languages. Zwyno (2002) concluded that the ILS met criteria of acceptability for instruments of its type.

A Manual for the Use of the Motivated Strategies for Learning Questionnaire (MSLQ)

One of the main reasons the MSLQ (Pintrich, Smith, Garcia, & McKeachie, 1991) was chosen for this study to collect data, was because this instrument is reported to have high internal consistency and test retest reliability coefficients. In addition, numerous research studies have demonstrated its validity.

The MSLQ is a standardized 81-item Likert-type self-report instrument designed to measure students' motivational orientations for learning and learning strategy use. Students rate

these items using a 7-point Likert scale (ranging from "not true of me" to "very true of me") indicating how well the item described the respondent. For this particular study, a 5-point Likert scale was used throughout all the parts of the online questionnaire in order to maintain measuring consistency. Other researchers (Shih & Gamon, 1999) have reported making the same adjustments to this instrument without jeopardizing its validity. In Shih and Gamon's (1999) research study, content and face validity for the questionnaire were established by a panel of three faculty associated with their project and three graduate students in Agricultural Education. The 5-point scales were pilot-tested for reliability with 38 students taking a different undergraduate Web-based Biology 201 course. Cronbach's alpha coefficients were .71 and .80 for the motivation, and learning strategy scales respectively. When a post-hoc reliability analysis was performed, the reliabilities for the two scales were .70 and .79 respectively.

The MSLQ consists of two sections – Motivation and Learning. The Motivation section is made up of three scales namely, value, expectancy, and affective components. The Learning Strategies section is also made up of three scales namely, cognitive, metacognitive, and resource management. The scales are designed to be modular and thus, can be used together or singly, to fit specific needs (Pintrich et al., 1993). Accordingly, only two scales -- value and expectancy -- from the Motivation section were used. Other scales were irrelevant to this study. Expectancy components refer to students' beliefs that they can accomplish a task. Two expectance-related subscales were constructed to assess students' (a) perceptions of self-efficacy and (b) control beliefs for learning. Value components focus on the reasons why students engage in an academic task. Three subscales are included in the MSLQ to measure value beliefs: (1) intrinsic goal orientation (a focus on learning and mastery), (2) extrinsic goal orientation (a focus on grades

and approval from others), and (3) task value beliefs (judgments of how interesting, useful, and important the course content is to the student).

The number of questions comprising each motivational scale was reduced from 5 to 3 questions in order to reduce the overall length of the online questionnaire and to increase the response rate. Redundant questions were eliminated. Reliability tests were performed in order to compare the actual reliability rates of the original scales with the adjusted ones. They are reported below.

Value Component: Intrinsic Goal Orientation (Original Alpha: .74; Adjusted Alpha: .85).

Goal orientation refers to the student's perception of the reasons why she is engaging in a learning task. On the MSLQ, goal orientation refers to student's general goals or orientation to the course as a whole. Intrinsic goal orientation concerns the degree to which the student perceives herself to be participation in a task for reasons such as challenge, curiosity, and mastery. Having an intrinsic goal orientation toward an academic task indicates that the student's participation in the task is an end all to itself, rather than participation being a means to an end.

Value Component: Extrinsic Goal Orientation (Original Alpha: .62; Adjusted Alpha: .80).

Extrinsic goal orientation compliments intrinsic goal orientation, and concerns the degree to which the student perceives herself to be participating in a task for reasons such as grades, rewards, performance, evaluation by others, and competition. When one is high in intrinsic goal orientation, engaging in a learning task is the means to an end. The main concern the student has is related to issues that are not directly related to participating in the task itself (such as grades, rewards, comparing one's performance to that of others). Again, this refers to the general orientation the course as a whole.

Value Component: Task Value (Original Alpha: .90; Adjusted Alpha: .86).

Task value differs from goal orientation in that task value refers to the student's evaluation of the how interesting, how important, and how useful the task is ("What do I think of this task?"). Goal orientation refers to the reasons why the student is participating in the task ("Why am I doing this?"). High task value should lead to more involvement in one's learning. On the MSLQ, task value refers to students' perceptions of the course material in terms of interest, importance, and utility.

Expectancy Component: Control of Learning Beliefs (Original Alpha: .68; Adjusted Alpha: .86).

Control of learning refers to students' beliefs that their efforts to learn will result in positive outcomes. It concerns the belief that outcomes are contingent on one's own effort, in contrast to external factors such as the teacher. If students believe that their efforts to study make a difference in their learning, they should be more likely to study more strategically and effectively. That is, if the student feels that she can control her academic performance, she is more likely to put forth what is needed strategically to effect the desired changes.

Expectancy Component: Self-Efficacy for Learning (.76) and Performance (.82) (Original Alpha: .93; Adjusted Alpha .87).

The items comprising this scale assess two aspects of expectancy: expectancy for success and self-efficacy. Expectancy for success refers to performance expectations, and relates specifically to task performance. Self-efficacy is a self-appraisal of one's ability to master a task. Self-efficacy includes judgments about one's ability to accomplish a task as well as one's confidence in one's skills to perform that task.

The University Social Constructivist Learning Environment Survey (USCLES)

The University Social Constructivist Learning Environment Survey (USCLES) was developed by Fisher, Taylor, and Fraser (Fisher, Taylor, & Fraser, 1996). The instrument was chosen to collect data for this study because it can provide valuable information about students' perceptions of their online learning environment. Also, the instrument is relatively easy to administer without requiring large amounts of valuable classroom learning time (Johnson & McClure, 2001). According to Taylor, Fraser and Fisher (1997), USCLES highlights (1) the key role of students' prior knowledge in their development of new conceptual understandings, and (2) the reflective process of interpersonal negotiation of meaning within the consensual domain of the classroom community.

The USCLES combines scales adapted from earlier questionnaires -- *Constructivist Learning Environment Survey (CLES), Questionnaire on Teacher Interactions (QTI).* The scales of the USCLES were designed from a social constructivist perspective on learning to highlight important psycho-social dimensions of a university classroom environment in which communicative and reflective learning are valued activities. Each scale was designed to obtain measures of students' perceptions of the frequency of occurrence of the following key dimensions of a *critical constructivist* learning environment: Personal Relevance, Reflective Thinking, Negotiation, Empathy, Support. The USCLES contains 30 items altogether, with six items in each of the five scales. Responses are measured on the 5-point Likert scale.

Relevance (.87)

This scale focuses on the perceived relevance of learning to students' own experiences, background knowledge and aspirations.

Reflective Thinking (.86)

This scale examines the perceived press for reflecting critically on background knowledge, new ideas and understandings, and role as a learner.

Negotiation (.89)

This scale assesses the extent to which opportunities exist for students to explain and justify to other students their newly developing ideas, to listen attentively and reflect on the viability of other students' ideas and, subsequently, to reflect self-critically on the viability of their own ideas.

Empathy (.84)

This scale focuses on the perceived way in which instructor understands, listens with interest and shows confidence in students.

Support (.90)

This scale assesses the perceived extent to which instructor assists, shows interest and inspires confidence and trust in students.

Two scales were added to the original instrument to reflect the specificity of the online constructivist learning environment. They are:

Instructor Effectiveness (.85)

This scale examines the perceived leadership qualities of the online instructor, such as, organization, setting tasks, and facilitating course Discussions.

Adequacy Of Technical Support (.91)

This scale assesses the perceived extent to which technical support was provided.

The first three scales--Relevance, Reflection, Negotiation--are concerned with opportunities provided by the university teacher to engage students in communicative activity

and reflective thinking leading to their development of deep conceptual understandings within the discipline. The second two scales -- Empathy, Support -- are concerned with important interpersonal qualities that need to be displayed by a university teacher interested in persuading students to transform their established epistemologies and approaches to learning. The USCLES provides a useful interpretive framework for examining students' perceptions and preferences (Taylor, 1995). In order to determine the efficacy of the USCLES for generating plausible accounts of university learning environments, the questionnaire was trialed a few times (Fisher & Taylor, 1997).

Johnson and McClure (2001) conducted a research study, the purpose of which was to gain an understanding, over a three-years period, of the learning environments of our graduates' classrooms during their first years of teaching. Classroom observations and interviews were accompanied by the use of an existing instrument, the Constructivist Learning Environment Survey (CLES) (Taylor, Dawson, & Fraser, 1995; Taylor, Fraser, & Fisher, 1993), to provide insights into teachers' and students' perceptions of their classroom learning environment. The CLES was administered to a wide range of people, including 292 inservice and preservice elementary and secondary science and math teachers and 184 elementary and secondary science and math students. Once the data was screened and prepared, several analyses were conducted. The first was an exploratory factor analysis (EFA). EFA was used to analyze the relationships between items. Principal axis factoring (PAF) and oblimin rotation were used. These methods were selected because there was an underlying theoretical factor structure (six scales) and because it was also assumed that the scales might be related in a larger factor, classroom learning environment. Since five scales were hypothesized, the analysis was constrained to five factors. The factors were then rotated to maximize their variance. An examination of items that loaded

strongly on each factor was then made to see if the items actually fit together. Internal consistency of the CLES as a whole and of items within each scale was also investigated by running an alpha reliability analysis. Written comments from respondents were also read and considered. Items which participants felt were confusing or overly redundant were noted. Informal comments from teachers after survey administration and during interviews were also considered. An examination of the factor loadings was made. Most items loaded strongly on their hypothesized scale. Loadings of less than .30, a commonly used cut-off, were eliminated.

Alpha reliability coefficients for the five scales were also examined (see Table 3). In learning environment research, alpha coefficient values in excess of 0.70 are regarded generally as indicating satisfactory degrees of internal consistency (Fraser, 1986).

Table 3: Internal Consistency Results of the CLES (Fraser, 1986)

Scale (factor)	Alpha coefficient
Personal Relevance	.80
Reflective Thinking	.83
Student Negotiation	.91
Empathy	.81
Support	.85
Overall Instrument	.88

Relatively few participants chose to write comments on the survey forms. A review of those who did, however, as well as conversations with some of the participating teachers, revealed a common comment: many participants felt there was too much redundancy. Some participants questioned the need for six items asking essentially the same thing. The results were

presented to the TRN team at a meeting following the end of the academic year. Discussions revealed a consensus on the answers to the two questions. The CLES provided valuable information, and it needed to be revised to reduce redundancy and eliminate confusing items. A decision was made to keep the five scales but reduce the number of items in each to four.

Procedures

Prior to the beginning of this research study, letters requesting permission to conduct the study were sent to the University of Windsor Research Ethics Board. After having received approval for the study, letters requesting permission to a) post a link to the online questionnaire on the course website and b) post a message that contained brief information about the study and encouraged students enrolled in the course to participate in the survey were sent to five selected professors (see Appendix B).

The online form of data collection was chosen to ensure complete confidentiality, which in turn might have positively affected the response rate. Furthermore, among the potential advantages of online questionnaires are low-cost delivery and return, wide potential coverage, ease of completion, submission and data capture, appropriateness to particular population of WB students, and even novelty. Potential difficulties included technical difficulties and sampling. In order to prevent multiple response submissions by the same person, a "cookie" was created on a client machine the first time he/she completed and submitted the questionnaire.

It took four weeks to get students' responses back. Students were provided with the online consent form (see Appendix A). The online consent form also contained instructions on how to fill out the questionnaire. Data collection for this research study took place during the second half of the Spring 2003 semester, before the examination week. The questionnaire required approximately 30 minutes to complete.

CHAPTER IV

RESULTS

The purpose of this research study was to identify factors that are related to students' satisfaction with various online course components in order (1) to build a profile of two groups (satisfied and unsatisfied), (2) to explore the predictive potential of some preliminary quasi-models, and (3) to explain the potential for correct categorization of the two groups as a function of various independent variables. The methodology employed a survey of a sample of an online student population enrolled in Web-based courses at the University of Windsor in the Spring semester of 2003.

The data collection instrument was a 111-item self-administered online questionnaire. Data were analyzed using the SPSS 11.0 statistical program for personal computers. A total of 240 questionnaire response forms (out of 401 selected to participate) were completed by subjects and returned. This corresponds to a 59.8% response rate. The data from the forms were read into a computer data file for later analysis. Statistical tests were applied in accordance with specific research questions and hypotheses. For descriptive purposes, where appropriate, arithmetic means and standard deviations were reported. Given the large number of statistical tests in this study, a conservative significance level of .01 was selected, and a significance level of .001 was also reported.

Demographic Information

Almost 59% of the participants were between 18 and 25 years of age, 31% were older than 25, and 10% did not answer this question. The proportion of female (N=176) students to male (N=64) students was almost 3 to 1. A majority of students (73.8%) were single (N=177) and did not have any dependents (78.3%). With respect to employment status, about 20% of the

students were unemployed, whereas 34% were employed full-time and 46% were employed part-time. Over 60% of the participants identified themselves as students and 30% reported being professionals. A majority of participants (55%) were enrolled on a full-time basis. Almost 26% of the participants reported that they had not taken any prior online courses. Thirty-five percent had completed only one or two online courses, and almost 39% had completed more than three. With respect to the online course components, 86.7% of the participants (N=208) used email in the course in which they were enrolled, 32.9% (N=79) used web links, 74.2% (N=178) participated in online discussions, 15.8% (N=38) had an option of using chat, 39.2% (N=94) used graphics, 19.2% (N=46) used simulations, 40% (N=96) used audio, 13.3% (N=32) used video, and 18.8% (N=45) used hypertext. The figure below represents the percentages of nine online components.

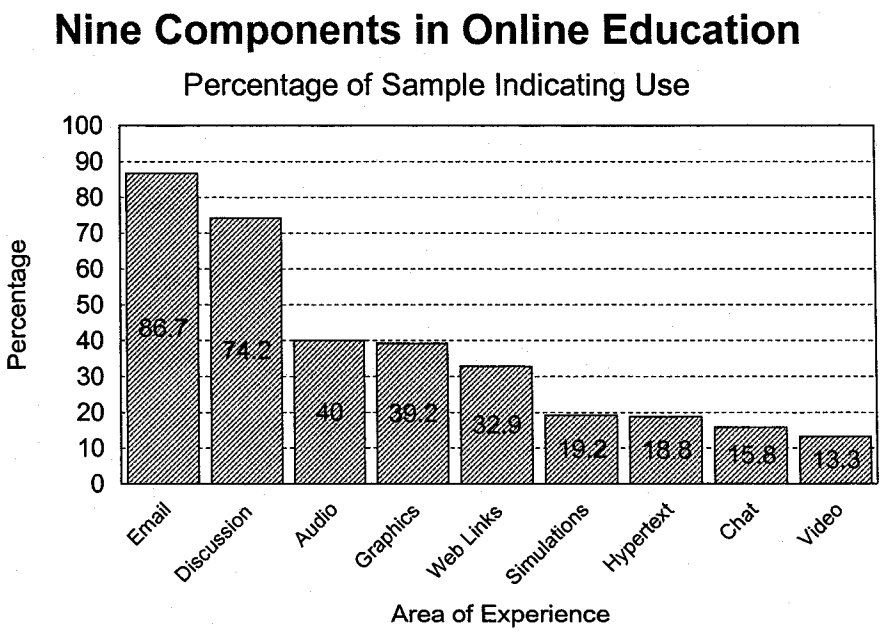

Figure 3. Ranked according to frequency of occurrence showing which components are used frequently and which get minimal exposure.

The next figure represents the relative proportion within each online component for those students who used it and indicated liking or disliking it. The email component appears to be the

mostly liked component, followed by the web links, audio, and discussion components. Chat is the only online component that received more negative than positive feedback from the participants.

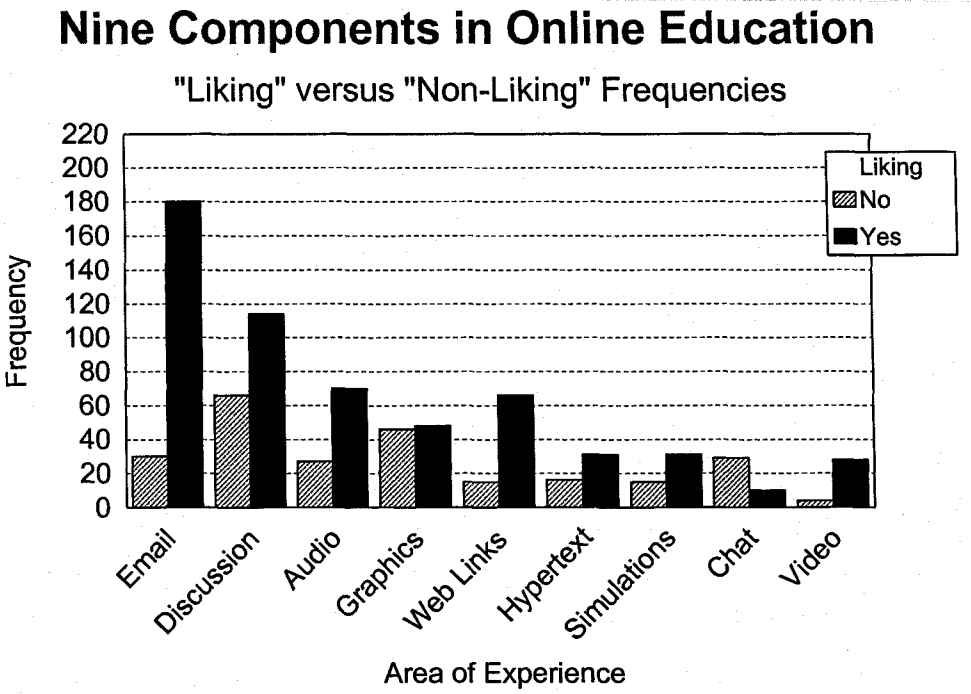

Figure 4. Showing the relative proportion within each component for those who experienced that component and who indicated "Liking" and "Non-Liking."

Since Gender and Age are potentially important variables according to the existing literature, and may interact with many of the profile-building variables, they were examined in two preliminary analyses.

In the first preliminary analysis, two-way MANOVAs were used with Gender of the student (Male, Female) and Liking (Yes, No) online components (email, web links, online discussions, chat, graphics, simulations, audio, video, and hypertext) as independent variables (IV). Initially, 27 variables were used to build a profile (see Table 4 below). Of these, the MANOVAs were computed for each of four quasi-models (Experiential, Learning Styles, Motivational, and Instructional Design).

Table 4: Summary of the Initial 27 variables.

Demographic Quasi-Model	
	Age
	Gender
	Marital Status
	Children
	Employment
	Student St (FT/PT)
Experiential Quasi-Model	
	Prior Online Courses Taken
	Word Processing
	Email Usage
	Internet Experience
Learning Styles Quasi-Model	
	Active/Reflective
	Visual/Verbal
	Sequential/Global
	Sensing/Intuitive
Motivational Quasi-Model	
	Intrinsic
	Extrinsic
	Task Value
	Control of Learning Beliefs
	Success
	Self-Efficacy
Instructional Design Quasi-Model	
	Relevance of Learning
	Reflective Thinking
	Negotiation
	Empathy
	Support
	Adequacy of Technical Support
	Instructor Effectiveness

As indicated repeatedly in the data analyses, the Gender of the online students did not play a significant role in regard to any of the dependent variables (DV) being examined that relate to student satisfaction with online components (See Appendix D).

In the second set of preliminary analyses, two-way MANOVAs were used with Age (18-25 and >25) of the student and Liking (Yes, No) an online component (email, web links, online discussions, chat, graphics, simulations, audio, video, and hypertext) as independent variables. Contrary to the Gender variable, the Age variable showed significant main effects ($p < .01$) on a number of occasions with respect to variables in the Experiential Quasi-Model, the Motivational

Quasi-Model, and the Instructional Design Quasi-Model. Specifically in the Experiential Quasi-Model, the Age variable showed a significant main effect for Prior Online Courses Taken (email, discussions, chat, graphics, simulations, and audio). In each case older (>25 years old) students had taken more online courses, which would be expected.

The main effect for Age was evident in the Motivational Quasi-Model. Almost all the motivational variables were rated higher by the older students (>25 years old). "Maturity" might explain this demographic propensity: older students appear to be more motivated to learn.

In the Instructional Design Quasi-Model, Age was significant for Relevance of Learning, Negotiation, Technical Support, and Instructor Effectiveness ($p<.01$) with older students showing more favorable ratings. It appears that older students value all the online course design components more than younger students.

While there were several main effects for Age, there was only one significant interaction effect between Age (18-25 and >25) and Liking (Yes, No), and that was for Liking the audio component and limited to only one dependent variable (Adequacy of Technical Support) in the Instructional Design Quasi-Model, F (7, 89), $p<.05$. The subsequent univariate analysis for interaction effects showed a significant effect for the Adequacy of Technical Support ($p<.05$) with the higher ratings for the >25 years old online students who like audio component. This result, however, should be considered cautiously due to the more liberal level of significance. Since the results of the two-way MANOVAs (1) failed to reveal the significance of student Gender as an independent variable and (2) showed only one significant interaction effect for the Age variable, it was decided to conduct a correlational analysis to find out what variables are related. Pearson Product Moment Correlations between the Liking Variables and five clusters of variables (Demographic, Experiential, LS, Motivational, and ID) are reported below.

Table 5: Pearson Product Moment Correlations between the Liking Variables and the Demographic Cluster of Variables.

Demogr Variables / Liking Variables	Age	Gender	Children	Student Status	Employment Status	Marital Status
Email	.22*** (N=236)	-.14* (N=237)	.20** (N=238)	.37*** (N=235)	.32*** (N=238)	.20** (N=238)
Web Links	.12 (N=86)	-.03 (N=88)	.11 (N=88)	.22* (N=87)	.19 (N=88)	.11 (N=88)
Discussion	.25*** (N=202)	.09 (N=203)	.28*** (N=204)	.31*** (N=202)	.25*** (N=204)	.35** (N=204)
Chat	.24 (N=43)	-.01 (N=44)	.19 (N=44)	.07 (N=43)	.19 (N=44)	.07 (N=44)
Graphics	.29** (N=105)	.12 (N=105)	.15 (N=105)	.21* (N=103)	.19* (N=105)	.13 (N=105)
Simulations	.07 (N=50)	-.18 (N=49)	-.02 (N=50)	.11 (N=49)	.28 (N=50)	.05 (N=50)
Audio	.19* (N=110)	.03 (N=110)	.15 (N=111)	.22* (N=110)	.24* (N=111)	.22* (N=111)
Video	.36* (N=34)	-.13 (N=34)	.34 (N=34)	.31 (N=34)	.24 (N=34)	.36* (N=34)
Hypertext	-.08 (N=52)	-.03 (N=54)	-.13 (N=54)	.05 (N=53)	-.10 (N=54)	-.03 (N=54)

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

Table 6: Pearson Product Moment Correlations between the Liking Variables and the Experiential Cluster of Variables.

Experiential Variables / Liking Variables	Prior Experience	Word Processing	Email	Internet
Email	.40*** (N=238)	.15* (N=238)	.16* (N=238)	.18** (N=238)
Web Links	.37*** (N=88)	.03 (N=88)	.13 (N=88)	.13 (N=88)
Discussion	.26*** (N=204)	.21** (N=204)	.02 (N=204)	-.10 (N=204)
Chat	.04 (N=44)	.10 (N=44)	-.11 (N=44)	-.05 (N=44)
Graphics	.16 (N=105)	.15 (N=105)	.03 (N=105)	-.07 (N=105)
Simulations	.26 (N=50)	.06 (N=50)	.36** (N=50)	.31* (N=50)
Audio	.04 (N=111)	.16 (N=111)	-.10 (N=111)	-.10 (N=111)
Video	.23 (N=34)	-.01 (N=34)	.01 (N=34)	-.17 (N=34)
Hypertext	-.00 (N=54)	.14 (N=54)	.15 (N=54)	.08 (N=54)

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

Table 7: Pearson Product Moment Correlations between the Liking Variables and the Learning Styles Cluster of Variables.

Learning Styles Variables	Reflective	Intuitive	Visual	Global
Liking Variables				
Email	.22*** (N=238)	.24*** (N=238)	.30*** (N=238)	.30*** (N=238)
Web Links	-.13 (N=88)	-.11 (N=88)	.13 (N=88)	.07 (N=88)
Discussion	.20** (N=204)	.16* (N=204)	.26*** (N=204)	.28*** (N=204)
Chat	-.15 (N=44)	-.16 (N=44)	.15 (N=44)	-.05 (N=44)
Graphics	.09 (N=105)	.05 (N=105)	.47*** (N=105)	.03 (N=105)
Simulations	-.19 (N=50)	.03 (N=50)	.21 (N=50)	.24 (N=50)
Audio	.18 (N=111)	-.06 (N=111)	.19* (N=111)	.08 (N=111)
Video	-.35* (N=34)	.28 (N=34)	.01 (N=34)	.19 (N=34)
Hypertext	-.08 (N=54)	-.40** (N=54)	.18 (N=54)	-.07 (N=54)

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

Table 8: Pearson Product Moment Correlations between the Liking Variables and the Motivational Cluster of Variables.

Motivational Variables	Intrinsic	Extrinsic	Task value	Control of Learning Beliefs	Success	Self-Efficacy
Liking Variables						
Email	.29*** (N=237)	.28*** (N=237)	.348*** (N=229)	.27*** (N=237)	.23*** (N=237)	.28*** (N=237)
Web Links	.10 (N=88)	.13 (N=88)	.22* (N=87)	.18 (N=88)	.15 (N=88)	.14 (N=88)
Discussion	.42*** (N=204)	.29*** (N=203)	.40*** (N=196)	.28*** (N=203)	.15 (N=203)	.28*** (N=204)
Chat	.38* (N=44)	.48*** (N=44)	.38* (N=44)	.27 (N=44)	.19 (N=44)	.20 (N=44)
Graphics	.29** (N=105)	.28** (N=105)	.20* (N=100)	.18 (N=105)	.20* (N=105)	.32*** (N=105)
Simulations	.19 (N=50)	.03 (N=49)	.18 (N=50)	.05 (N=50)	.03 (N=50)	.11 (N=50)
Audio	.23* (N=111)	.19* (N=110)	.15 (N=107)	.26** (N=111)	.06 (N=110)	.12 (N=110)
Video	.23 (N=34)	.26 (N=34)	.24 (N=34)	.52** (N=34)	.35* (N=34)	.43* (N=34)
Hypertext	.08 (N=54)	.17 (N=54)	-.28* (N=53)	-.08 (N=54)	-.01 (N=54)	-.01 (N=54)

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

Table 9: Pearson Product Moment Correlations between the Liking Variables and the Instructional Design Cluster of Variables.

	ID Var	Relevance of Learning	Reflective Thinking	Negotiat	Empathy	Support	Adequacy of Tech Support	Instructor Effect
Liking Variables								
Email		.30*** (N=235)	.28*** (N=232)	.27*** (N=234)	.22*** (N=232)	.27*** (N=235)	.40*** (N=232)	.34*** (N=228)
Web Links		.21* (N=87)	.20 (N=86)	.06 (N=87)	.11 (N=86)	.19 (N=87)	.35*** (N=87)	.26* (N=82)
Discussion		.37*** (N=202)	.30*** (N=199)	.42*** (N=201)	.32*** (N=199)	.35*** (N=203)	.28*** (N=199)	.34*** (N=195)
Chat		.32* (N=44)	.20 (N=44)	.13 (N=44)	.12 (N=43)	.35* (N=44)	.33* (N=44)	.23 (N=40)
Graphics		.26** (N=104)	.21* (N=102)	.34*** (N=105)	.36*** (N=104)	.23* (N=105)	.17 (N=104)	.19 (N=102)
Simulations		.44*** (N=50)	.14 (N=50)	-.30* (N=49)	-.24 (N=50)	-.23 (N=49)	.23 (N=50)	-.39** (N=48)
Audio		.15 (N=110)	.11 (N=109)	.29** (N=110)	.10 (N=109)	.10 (N=111)	.16 (N=108)	.13 (N=108)
Video		.27 (N=34)	.48** (N=34)	.60*** (N=34)	.27 (N=34)	.20 (N=34)	.22 (N=34)	.30 (N=32)
Hypertext		-.04 (N=54)	-.24 (N=53)	.14 (N=54)	.07 (N=54)	.25 (N=54)	-.09 (N=54)	-.02 (N=48)

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

The above correlations were used to present a bigger picture. They clearly show that only certain variables correlate prompting a more fine-grained analysis. As a result, it was decided to proceed with the Discriminant Function analysis (DFA), which is a close kin to a multiple regression analysis and somewhat to MANOVA. The interest at this point is not in knowing the degree of liking various online components, but being able to discriminate those who favor a technique (or value it) from those who do not. In this sense, the DFA appears to be an appropriate statistical approach, as it is concerned with the problem of assigning individuals (for whom several variables have been measured) to certain groups that are already identified in the sample: those who value using certain components versus those who do not. Also, the usage of the DFA can be justified by being able to get an estimate of how many can be correctly classified using such

variables. To sum up, there are several purposes for the Discriminant Function analysis in this study:

1. To investigate which independent variables (Age, Gender, Marital Status, Children, Employment, Student Status (FT/PT), Prior Online Courses Taken, Word Processing, Email Usage, Internet Experience, Active LS, Sensing LS, Visual LS, Sequential LS, Motivation (Intrinsic), Motivation (Extrinsic), Motivation (Task Value), Motivation (Control of Learning Beliefs), Motivation (Success), Motivation (Self-Efficacy), Relevance of Learning, Reflective Thinking, Negotiation, Empathy, Support, Adequacy of Tech Support, and Instructor Effectiveness) discriminate between groups formed by the dependent variable (Liking/Not Liking) in order to build a profile of the two groups.
2. To discard variables which are least related to group distinctions.
3. To determine the most parsimonious way (the fewest dimensions) to distinguish between two groups (those who like online component versus those who do not) and classify them.
4. To infer the meaning of the dimensions that distinguish groups, based on discriminant loadings.
5. To assess the relative importance of the independent variables in classifying people on the dependent variable.

Initially, the Discriminant Function analysis was conducted for 27 variables. A large number of variables failed to indicate any significant difference on all the occasions, as a result they were removed from further analyses. The final number of variables used in this study was 14. They are the following: Age, Employment, Student Status, Prior Online Courses Taken, Active LS, Visual LS, Sequential LS, Motivation (Intrinsic), Task Value, Self-Efficacy, Relevance of Learning, Negotiation, Adequacy of Tech Support, and Instructor Effectiveness.

Costanza and Afifi (1979) recommended a probability to enter criterion more liberal than .05. They suggested a choice in the range of .15 to .20 to ensure entry of potentially important variables. Thus both the results for the conventional level (.05) and the liberal level (.15) are reported in the Table. While Chat and Video are not legitimate analyses because of the small cell size, they are retained in the Table for general information purposes. The summative representation of all the results can be seen in Table 10.

Table 10: Results of the Stepwise Discriminant Function Analysis (14 variables).

Online Component	Email	Disc	Audio	Graph	Web	H/text	Sim	Chat	Video
Number in Sample	208	178	96	94	79	45	46	38	32
Cell Size (Dislike/Like)	30/178	66/112	26/70	46/48	15/64	16/29	15/31	24/0	4/28
Demographic Model									
Age	•			• 1A					D
Employment		•							
Student St (FT/PT)		•		•					
Experiential Model									
Prior Experience (Online)	• D	•			• 1A			B	
Learning Styles Model									
Active (Reflective)	•	•	• B						E
Visual (Verbal)	• 3C	•		• 2B					
Sequential (Global)	• 1A	• 3C					C		C
Motivational Model									
Intrinsic		• D	D	•				A	
Task Value	•	• 1A		•		1A			
Self-Efficacy		•		•					
Instructional Design									
Relevance of Learning		•					• 1A		
Negotiation	•	• 2B	• 1A	•			2B		• 1A
Adequacy of Tech Sup	• 2B	•						C	B
Instructor Effectiveness	•	•	C	C	B				
Number of Steps (.05)	3 steps	3 steps	1 step	2steps	1 step	1 step	2steps		1 step
Number of Steps (.15)	4 steps	4 steps	4steps	3steps	2steps	1 step	3steps	3steps	5 steps
% of Cases Correctly Classified (.05)	77.6	71.0	63.1	75.2	67.0	58.5	69.4		79.4
% of Cases Correctly Classified (.15)	75.9	71.0	70.1	74.5	67.1	58.5	71.4	68.2	94.1

Note: • = significant (univariate $p < .01$); numbers (1-5) = steps in the Stepwise DFA with .05 entry; letters (A - E) = steps in the Stepwise DFA with .15 entry.
Note: The variables are clustered into the five quasi-models developed in the literature review.

Email

The means and standard deviations for the variables are reported in Table 11. The groups were reliably separated (Wilks' Lambda = 0.804, Chi-square = 44.56, df = 3, $p < .001$) with a successful classification rate of 77.6% (using a .05 entry criterion) and 75.9% (with a .15 entry criterion). As may be seen from the univariate analyses in Table 11, a few variables discriminate between the two groups. Specifically, students who like the email component took a greater number of prior online courses and are older. It appears that experience contributes to students' liking of this component. Higher ratings for Negotiation, Adequacy of Technical Support, and Instructor Effectiveness in an online course also have a positive correlation with students' satisfaction with the email component. With respect to the students' Learning Styles, students who like the email component appear to have Reflective, and Global learning style preferences, whereas Verbal learners dislike email. The nature of the component itself may explain this finding. The email component is frequently used for asynchronous type of communication allowing a sufficient amount of time to process new information and reflect which may be characteristic of Reflective and Global Styles. Finally, higher ratings for Task Value have a positive correlation with students' favorable attitude about the email component. Mature and self-motivated students appear to appreciate usefulness, importance, and relevance of the course content to their lives.

Table 11: Means and Standard Deviations for 14 Variables: Liking Email.

Email	Likes Email No Mean	SD	Likes Email Yes Mean	SD	Univ p	Stepwise Load .05	Step	.15	Step
Demographic Model									
Age	1.20	.41	1.47	.50	**	.37		.39	
Employment Status	1.87	.73	2.20	.72		.24		.33	
Student Status	1.27	.45	1.48	.50		.29		.38	
Experiential Model									
Prior Online Courses	1.07	1.39	2.21	1.53	***	.31		.53	4
Learning Style Model									
Active/Reflective LS	3.11/1.89	1.27	2.32/2.68	1.01	***	-.43/.45		-.46/.47	
Visual/Verbal LS	1.77/3.23	1.17	2.66/2.34	1.03	***	.61/-.61	3	.59/-.60	3
Sequential/Global LS	3.37/1.63	1.43	2.19/2.81	1.18	***	-.69/.69	1	-.67/.67	1
Motivational Model									
Intrinsic	2.87	.95	3.18	.97		.33		.37	
Task Value	3.44	.93	3.94	.88	**	.31		.36	
Self-Efficacy	3.63	.71	3.91	.69		.31		.34	
ID Model									
Relevance of Learning	3.30	.89	3.55	.94		.28		.34	
Negotiation	2.66	.94	3.22	1.03	**	.17		.17	
Adequacy of TechSup	3.61	.92	4.23	.62	***	.67	2	.65	2
Instructor Effectiveness	3.16	.99	3.67	.78	**	.29		.28	

Note: Higher scores indicate a higher degree of liking. Learning styles scores are bi-polar and calculated out of 5. ** p <.01, *** p <.001.

The Stepwise Discriminant Function Analysis of the data showed Global Learning style preference to be the most powerful predictor of students' liking the email component (.694). Student responses to the items that dealt with the Adequacy of Technical Support (.655) and Visual Learning style preference (.611) were also relatively accurate discriminants of the Liking email component, and added to the quasi-model analysis. With a more liberal probability, Prior Online Courses Taken (.529) also is a predictor of students' positive attitude towards the email component.

Online Threaded Discussions

The means and standard deviations for the variables in all five quasi-models are reported in Table 12. Using Discriminant Function Analysis the groups were reliably separated (Wilks' Lambda = 0.791, Chi-square = 40.89, df = 3, $p < .001$) with a successful classification rate of 71.0% (using a .05 entry criterion) and 71.0% (with a .15 entry criterion). Almost all the variables (except the Age variable) distinguish between groups (see Table 12). Students who were categorized as Discussion-Likers were characterized by the higher scores in the Experiential area, Motivational area, and the Instructional Design area. They all indicated a more positive attitude about the discussion component. This finding supports the notion that online students are highly motivated responsible adults. It also shows that a constructivist learning environment may affect student satisfaction in a positive way. On the Employment scale, Discussion-Likers were more likely to be employed part-time or full-time. Similarly, they were more likely to be part-time students. This effect might be related to the age of the participants: older students were willing to invest more effort and time in their studies. They may have feelings of responsibility, may be reluctant to leave the workforce, and may not have the same degree of dependence on parents. It is also possible that a personality variable is implicated here. For example, older online students may be more gregarious and sociable than younger online students. Further, those online students who liked Discussions showed preference for Reflective, Verbal, and Global learning. It appears logical since threaded discussions are structured in such as way that they allow maximum time for reflection and processing of material.

Table 12: Means and Standard Deviations for 14 Variables: Liking Discussions.

Discussions	Likes Disc No Mean	SD	Likes Disc Yes Mean	SD	Univ p	Stepwise Load .05	Step	.15	Step
Demographic Model									
Age	1.29	.46	1.47	.50		.47		.52	
Employment Status	1.88	.64	2.22	.77	**	.34		.37	
Student Status	1.26	.44	1.53	.50	***	.40		.46	
Experiential Model									
Prior Online Courses	1.61	1.52	2.25	1.58	**	.36		.39	
Learning Style Model									
Active/Reflective LS	2.79/2.21	1.27	2.24/2.76	.92	**	-.40/.41		-.38	
Visual/Verbal LS	2.17/2.83	1.08	2.71/2.29	1.03	**	.26/-.27		.30	
Sequential/Global LS	2.83/2.17	1.42	2.13/2.87	1.10	***	-.54/.54	3	-.52	3
Motivational Model									
Intrinsic	2.70	.96	3.39	.88	***	.45		.69	4
Task Value	3.39	.96	4.11	.72	***	.83	1	.79	1
Self-Efficacy	3.67	.64	3.96	.69	**	.43		.49	
ID Model									
Relevance of Learning	3.16	.90	3.63	.84	**	.49		.57	
Negotiation	3.03	.79	3.56	.81	***	.63	2	.60	2
Adequacy of TechSup	3.93	.75	4.21	.65	**	.42		.40	
Instructor Effectiveness	3.39	.92	3.83	.69	***	.52		.52	

Note: Higher scores indicate a higher degree of liking. Learning styles scores are bi-polar and calculated out of 5. ** $p < .01$, *** $p < .001$.

The Stepwise Discriminant Function Analysis of the data indicated that Task Value (.829), Negotiation (.628), and Global LS (.538) are the most powerful predictors of students' liking the discussion component. With a more liberal probability, Intrinsic motivation (.685) is also a predictor of students' positive attitude about the discussion component.

Audio

The means and standard deviations for the 14 variables are reported in Table 13. The groups were reliably separated (Wilks' Lambda = 0.925, Chi-square = 7.26, df = 1, $p < .01$) with

a successful classification rate of 63.1% (using a .05 entry criterion) and 70.1% (with a .15 entry criterion). In the univariate analyses, there are two variables that distinguish between the two groups of students: Reflective LS and Negotiation. Students who favor the audio component appear to be more Reflective learners and value Negotiation.

Negotiation is the best predictor of students' liking the audio component (1.000) in the Stepwise DFA. With a more liberal probability, Reflective Learning style preference (.651) and Intrinsic motivation (.441) are added as predictors of students' positive attitude about the audio component. Instructional Effectiveness (-.054) is the best predictor of students' negative attitude.

Table 13: Means and Standard Deviations for 14 Variables: Liking Audio.

Audio	Likes Audio No Mean	SD	Likes Audio Yes Mean	SD	Univ p	Stepwise Load .05	Step	.15	Step
Demographic Model									
Age	1.35	.49	1.44	.50		.26		.30	
Employment Status	1.89	.71	2.20	.75		.18		.32	
Student Status	1.35	.49	1.50	.50		.25		.28	
Experiential Model									
Prior Online Courses	1.85	1.62	1.96	1.57		.31		.40	
Learning Style Model									
Active/Reflective LS	3.04/1.96	1.18	2.33/2.67	1.10	**	-.31/.30		-.66/.65	2
Visual/Verbal LS	2.19/2.81	1.06	2.69/2.31	1.19		.20/-.20		.23/-.23	
Sequential/Global LS	2.89/2.11	1.45	2.41/2.59	1.31		.03/-.03		-.36/.37	
Motivational Model									
Intrinsic	2.96	1.02	3.37	.95		.16		.44	4
Task Value	3.77	1.00	3.90	.81		-.15		.20	
Self-Efficacy	3.79	.65	3.96	.72	*	-.11		.12	
ID Model									
Relevance of Learning	3.58	.85	3.63	.82		.01		.19	
Negotiation	2.94	1.00	3.51	.88	**	1.00	1	.65	1
Adequacy of TechSup	4.10	.64	4.20	.62		-.19		.05	
Instructor Effectiveness	3.92	.74	3.89	.59		-.16		-.05	3

Note: Higher scores indicate a higher degree of liking. Learning styles scores are bi-polar and calculated out of 5.
** $p < .01$, *** $p < .001$.

Graphics

The means and standard deviations for the variables in all five quasi-models are reported in Table 14. The groups were reliably separated (Wilks' Lambda = 0.771, Chi-square = 23.61, df = 2, $p < .001$) with a successful classification rate of 75.2% (using a .05 entry criterion) and 74.5% (with a .15 entry criterion). As may be seen from the univariate analyses in Table 14, seven variables have explanatory value: Age, Student Status, Visual LS, all three motivational variables, and Negotiation. It appears logical that students who like the graphic component display preference for Visual learning style. Those students who favor graphics are also older and more achievement motivated. Maturity might explain this tendency: older online students appear to be more motivated to learn.

Table 14: Means and Standard Deviations for 14 Variables: Liking Graphics.

Graphics	Likes Graphics No Mean	SD	Likes Graphics Yes Mean	SD	Univ p	Stepwise Load .05	Step	.15	Step
Demographic Model									
Age	1.24	.43	1.60	.49	***	.73	1	.67	1
Employment Status	1.98	.72	2.31	.78		.39		.38	
Student Status	1.35	.48	1.63	.49	**	.64		.61	
Experiential Model									
Prior Online Courses	1.80	1.61	2.33	1.58		.45		.43	
Learning Style Model									
Active/Reflective LS	2.46/2.54	1.09	2.17/2.83	.88		-.31/.31		-.30/.31	
Visual/Verbal LS	2.24/2.76	.97	2.96/2.04	1.05	**	.66/-.68	2	.62/-.64	2
Sequential/Global LS	2.46/2.54	1.26	2.02/2.98	1.18		-.18/.18		-.16/.16	
Motivational Model									
Intrinsic	2.77	1.10	3.38	.90	**	.48		.54	
Task Value	3.67	.87	4.15	.67	**	.38		.48	
Self-Efficacy	3.67	.74	4.07	.54	**	.36		.42	
ID Model									
Relevance of Learning	3.29	.91	3.71	.88		.26		.39	
Negotiation	3.17	.85	3.74	.80	**	.34		.43	
Adequacy of TechSup	4.07	.52	4.32	.73		.17		.30	
Instructor Effectiveness	3.60	.69	3.98	.77		.14		.46	3

Note: Higher scores indicate a higher degree of liking. Learning styles scores are bi-polar and calculated out of 5. ** $p < .01$, *** $p < .001$.

The Stepwise Discriminant Function Analysis of the data indicated that Age (.730) and Visual LS (.660) are the most powerful predictors of students' liking the graphics component. With a more liberal (.15) probability, Instructional Effectiveness (.461) is also a predictor of students' positive attitude about the graphics component.

Web Links

The means and standard deviations for the 14 variables in all the quasi-models are reported in Table 15. The groups were reliably separated (Wilks' Lambda = 0.822, Chi-square = 15.00, df = 1, $p < .001$) with a successful classification rate of 67.0% (using a .05 entry criterion)

and 67.1% (with a .15 entry criterion). There was only one variable that distinguished between the two groups of students: Prior Courses Taken. Students who have more positive attitude about the Web Links have more experience in an online environment. Prior Courses Taken is the best predictor of students' liking the Web Links (1.000) in the Stepwise DFA. With a more liberal probability, Instructor Effectiveness (.345) is also a predictor of students' positive attitude about the Web Links component. Prior Courses Taken and Instructor Effectiveness are the only two variables loading at .33 or higher (a criterion advocated by Tabachnick and Fidell, 1996) in the Structure matrix.

Table 15: Means and Standard Deviations for 14 Variables: Liking Web Links.

Web Links	Likes Web Link No		Likes Web Links Yes		Univ p	Stepwise Load			
	Mean	SD	Mean	SD		.05	Step	.15	Step
Demographic Model									
Age	1.27	.46	1.55	.50		21		.23	
Employment Status	1.93	.80	2.23	.77		.27		.23	
Student Status	1.33	.49	1.59	.50		.29		.30	
Experiential Model									
Prior Online Courses	.47	.64	2.16	1.57	***	1.00	1	.92	1
Learning Style Model									
Active/Reflective LS	2.20/2.80	.94	2.30/2.70	.97		-.13/.11		-.12/.12	
Visual/Verbal LS	2.53/2.47	1.64	2.80/2.20	1.07		-.04/.04		-.02/.02	
Sequential/Global LS	2.40/2.60	1.30	2.16/2.84	1.39		.04/-.04		.07/-.07	
Motivational Model									
Intrinsic	3.42	.85	3.48	.87		.09		.11	
Task Value	3.78	.90	4.05	.70		.18		.28	
Self-Efficacy	3.83	.67	3.95	.71		.15		.23	
ID Model									
Relevance of Learning	3.33	.79	3.50	.91		.17		.28	
Negotiation	3.33	.63	3.38	1.01		.07		.23	
Adequacy of TechSup	3.73	.73	4.16	.74		.17		.31	
Instructor Effectiveness	3.52	.83	3.86	.76		-.04		.35	2

Note: Higher scores indicate a higher degree of liking. Learning styles scores are bi-polar and calculated out of 5.
** $p < .01$, *** $p < .001$.

Hypertext

The means and SD for the variables are reported in Table 16. The groups were reliably separated (Wilks' Lambda = 0.905, Chi-square = 4.24, df = 1, $p < .05$) with a successful classification rate of 58.5% (using a .05 entry criterion) and 58.5% (with a .15 entry criterion). There were no variables found that distinguish between the two groups of students. Task Value (1.000) is the best predictor of students' liking the Hypertext in the Stepwise Discriminant Function Analyses (with both probabilities). Although the findings were considered significant

(p=.040), the difference is only slightly less than the significance level of .05, thus increasing the likelihood that the findings were due to chance and they must be viewed with discretion.

Table 16: Means and Standard Deviations for 14 Variables: Liking Hypertext.

Hypertext	Likes Hypertext No Mean	SD	Likes Hypertext Yes Mean	SD	Univ p	Stepwise Load .05	Step	.15	Step
Demographic Model									
Age	1.44	.51	1.45	.51		.27		.27	
Employment Status	2.19	.83	2.04	.91		.10		.10	
Student Status	1.50	.52	1.55	.51		.12		.12	
Experiential Model									
Prior Online Courses	1.38	1.36	1.62	1.66		.15		.15	
Learning Style Model									
Active/Reflective LS	2.19/2.81	.91	2.35/2.65	1.26		.15/-.15		.15/-.15	
Visual/Verbal LS	2.69/2.31	1.20	3.04/1.96	1.45		-.26/.26		-.26/.26	
Sequential/Global LS	2.00/3.00	1.32	2.59/2.41	1.30		.05/-.05		.05/-.05	
Motivational Model									
Intrinsic	3.56	.73	3.61	.78		-.02		-.02	
Task Value	4.38	.57	3.93	.72		1.00	1	1.00	1
Self-Efficacy	4.06	.63	3.98	.66		.08		.08	
ID Model									
Relevance of Learning	3.83	.62	3.60	1.00		.23		.23	
Negotiation	3.15	.94	3.38	1.13		.22		.22	
Adequacy of TechSup	4.10	.86	3.97	.84		.10		.10	
Instructor Effectiveness	4.04	.77	3.87	.81		.38		.38	

Note: Higher scores indicate a higher degree of liking. Learning styles scores are bi-polar and calculated out of 5.
** p <.01, *** p <.001.

Simulations

The means and standard deviations for the variables in all five quasi-models are reported in Table 17. The groups were reliably separated (Wilks' Lambda = 0.737, Chi-square = 13.15, df = 2, p < .01) with a successful classification rate of 69.4% (using a .05 entry criterion) and 71.4% (with a .15 entry criterion). Only one variable (Relevance of Learning) in the Instructional

Design Quasi-Model distinguishes between the groups. Students who favor the Simulations component scored higher for Relevance of Learning. Relevance of Learning (.705) is the best predictor of students' liking the Simulations in the Stepwise DFA, whereas Negotiation (-.654) is the best predictor of students' disliking this component. With a more liberal probability, Global LS (.335) is also a predictor of students' positive attitude about the Simulations component.

Table 17: Means and Standard Deviations for 14 Variables: Liking Simulations.

Simulation	Likes Simulat No Mean	Likes Simulat No SD	Likes Simulat Yes Mean	Likes Simulat Yes SD	Univ p	Stepwise Load .05	Step	.15	Step
Demographic Model									
Age	1.63	.52	1.55	.51		.02		-.11	
Employment Status	1.93	.80	2.29	.74		1.00		-.18	
Student Status	1.53	.52	1.58	.50		.02		-.08	
Experiential Model									
Prior Online Courses	1.73	1.71	2.36	1.38		.32		-.34	
Learning Style Model									
Active/Reflective LS	2.20/2.80	1.08	2.61/2.39	1.05		.03/-.03		.00/.00	
Visual/Verbal LS	2.53/2.47	1.36	2.81/2.19	1.22		-.21/.21		-.19/.19	
Sequential/Global LS	2.80/2.20	1.32	2.26/2.74	1.10		.09/-.09		-.34/.34	3
Motivational Model									
Intrinsic	3.24	1.16	3.31	.89		1.00		-.13	
Task Value	3.89	.87	4.15	.63		.26		-.26	
Self-Efficacy	4.00	.54	4.00	.87		.03		-.12	
ID Model									
Relevance of Learning	3.27	.74	4.10	1.03	**	.71	1	-.64	1
Negotiation	3.27	1.21	2.20	1.34		-.65	2	.59	2
Adequacy of TechSup	3.98	.95	4.40	.70		-.04		-.06	
Instructor Effectiveness	4.04	.71	3.38	.89		-.46		.04	

Note: Higher scores indicate a higher degree of liking. Learning styles scores are bi-polar and calculated out of 5.
** $p < .01$, *** $p < .001$.

Chat

It has been mentioned earlier that Chat is not a legitimate analysis because of the small cell size. It is provided only for general information. The means and standard deviations for the variables are reported in Table 18. The groups were reliably separated (Wilks' Lambda = 0.793, Chi-square = 8.02, df = 3, $p < .05$) with a successful classification rate of 68.2% (with .15 entry criterion). As may be seen from the univariate analyses in Table 18, there have been no variables found that distinguish between the students who like chat and those who do not. In the Stepwise DFA with a more liberal probability, Intrinsic motivation (.554) and Adequacy of Tech Support (.460) are the best predictors of students' liking the chat whereas Prior Online Courses Taken (-.458) is the best predictor of students' disliking this component. Due to a small cell size for the chat component (29/9), caution must be exercised when interpreting these results.

Table 18: Means and Standard Deviations for 14 Variables: Liking Chat.

Chat	Likes Chat No Mean	SD	Likes Chat Yes Mean	SD	Univ p	Stepwise Load .05 Step	.15 Step
Demographic Model							
Age	1.35	.48	1.33	.50			-.01
Employment Status	2.00	.76	2.00	.87			-.27
Student Status	1.48	.51	1.44	.53			.04
Experiential Model							
Prior Online Courses	2.00	.65	1.11	1.69			-.46 2
Learning Style Model							
Active/Reflective LS	2.35/2.65	1.01	2.78/2.22	1.09			02/-.02
Visual/Verbal LS	2.59/2.41	1.05	2.78/2.22	1.64			.31/-.31
Sequential/Global LS	2.17/2.83	1.44	2.22/2.78	1.20			-.25/.25
Motivational Model							
Intrinsic	3.20	.90	3.74	.60			.55 1
Task Value	3.86	.94	4.19	.65			.20
Self-Efficacy	3.67	.66	3.89	.89			.51
ID Model							
Relevance of Learning	3.45	.85	3.89	.80			.06
Negotiation	3.58	.68	3.52	1.02			.29
Adequacy of TechSup	4.09	.62	4.41	.47			.46 3
Instructor Effectiveness	3.93	.80	4.17	.61			.41

Note: Higher scores indicate a higher degree of liking. Learning styles scores are bi-polar and calculated out of 5. ** $p < .01$, *** $p < .001$.

Video

The statistical analysis of the Video component is provided only for the sake of interest since the small cell size affected the legitimacy of this test. The means and standard deviations for the variables are reported in Table 19. The groups were reliably separated (Wilks' Lambda = 0.724, Chi-square = 9.52, df = 1, $p < .01$) with a successful classification rate of 79.4% (using a .05 entry criterion) and 94.1% (with .15 entry criterion). As may be seen from the univariate analyses in Table 19, it is Negotiation that discriminates between the Likers and Non-Likers of

this component. Students who value the Video component scored higher for Negotiation. However, due to a small cell size for this online component (4/28), the results must be considered cautiously.

Table 19: Means and Standard Deviations for 14 Variables: Liking Video.

Video	Likes Video No Mean	SD	Likes Video Yes Mean	SD	Univ p	Stepwise Load .05	Step	.15	Step
Demographic Model									
Age	1.00	.00	1.50	.51		.28		.32	4
Employment Status	2.00	.82	2.14	.85		.29		.24	
Student Status	1.25	.50	1.61	.50		.39		.36	
Experiential Model									
Prior Online Courses	1.50	1.92	2.00	1.49		.14		.26	
Learning Style Model									
Active/Reflective LS	1.75/3.25	.96	2.25/2.75	.89		-.13/.13		.17/-.17	5
Visual/Verbal LS	2.50/2.50	1.29	2.79/2.21	1.07		.14/-.14		.16/-.16	
Sequential/Global LS	2.75/2.25	1.26	2.04/2.96	1.20		.23/-.23		-.18/.18	3
Motivational Model									
Intrinsic	2.75	.69	3.31	.99		.34		.35	
Task Value	3.83	.19	4.07	.77		.08		.09	
Self-Efficacy	3.25	.96	3.88	.56		.15		.05	
ID Model									
Relevance of Learning	3.17	.14	3.57	.95		.35		.13	
Negotiation	1.92	.14	3.52	.86	**	1.00	1	.55	1
Adequacy of TechSup	4.25	.32	4.17	.60		.48		-.04	2
Instructor Effectiveness	3.67	.45	3.81	.65		.44		.32	

Note: Higher scores indicate a higher degree of liking. Learning styles scores are bi-polar and calculated out of 5.
** $p < .01$, *** $p < .001$.

The Stepwise DFA of the data showed Negotiation (1.000) to be most powerful predictor of students' liking video component. The Stepwise DFA with a more liberal (.15) probability indicated that Adequacy of Technical Support (-.044) is the most powerful predictor of students'

disliking the video component, whereas Global LS (.181), Age (.317) and Active LS (.171) are the best predictors of students' liking this component..

Multiple Regression Analysis

One of the purposes of this study was to find out if one of the five quasi-models (Demographic, Experiential, Learning Styles, Motivational, and Instructional Design) could predict students' satisfaction with the online course components better than other quasi-models. In order to do that Multiple Regression Analyses (MRA) were conducted. The general purpose of a multiple regression is to learn more about the relationship between several independent or predictor variables and a dependent or criterion variable.

In this study, the MRA was used: (1) to predict the scores of a dependent variable (DV) from one or more independent variables (IV), (2) to assess the degree of relationship between dependent variables and independent variables, (3) to assess the relative importance of independent variables, and (4) to compare five sets of predictors. The MRA was applied only to two online components (email and online discussion) due to the low ratio of cases to independent variables for other online course components. According to Green (1991), the simplest rules of thumb are $N \geq 50+8m$ (m is the number of IVs) for testing the multiple correlation and $N \geq 104+m$ for testing individual predictors. These rules of thumb assume a medium-size relationship between independent variables and the dependent variable, $\alpha=.05$ and $\beta=.20$. With a sample size above 175, it appears safe to conduct this testing.

It was of interest to know whether one set of independent variables predicts a dependent variable better than other sets of predictors. Specifically, if student satisfaction with the online course components can be better predicted by demographic factors or by other factors such as prior online experience, students' learning style preferences, motivation, or online course design

components. The R^2 value for the 14 variables for the email component was R^2=.354, and for the discussion component R^2=.311 (see Appendix E for other statistics).

Email

A series of Multiple Regression tests was run for each of the five quasi-models (Table 20).

Table 20: Summary Results from the Multiple Regression Analyses for Each of the Five Sets (Quasi-Models) of Variables with "Liking Email" as the Dependent Measure.

Email	Model Summary		ANOVA				
	R	R^2	F	p	Beta	t	p
Demographic Quasi-Model	.43	.19	8.63	***			
Age					-.281	-2.34	*
Gender					-.105		
Children					.193		
Student Status					..353	3.74	**
Marital Status					-.004		
Employment Status					.188	2.18	*
Experiential Quasi-Model	.43	.18	12.97	***			
Prior Online Courses					.382	6.37	***
Word Processing					.085		
Use of Email					.049		
Use of Internet					.049		
Learning Style Quasi-Model	.38	.15	9.82	***			
Active/Reflective LS					-.054		
Sensing/Intuitive?					-.051		
Visual/Verbal LS					.210	3.25	**
Sequential/Global LS					-.189	2.41	*
Motivational Quasi-Model	.38	.15	6.14	***			
Intrinsic					.022		
Extrinsic					.090		
Task Value					.251	3.10	**
Learning					.029		
Success					-.064		
Self-Efficacy					.130		
Instructional Design Quasi-Model	.49	.24	9.103	***			
Relevance of Learning					.059		
Reflective Thinking					.083		
Negotiation					.135		
Empathy					-.052		
Support					-.008		
Adequacy of Tech Support					.304	4.13	***
Instructor Effectiveness					.108		

Note: In these analyses the dependent measure "Liking Email" is based on the continuous scale rating using a five-point Likert scale. * $p<.05$, ** $p<.01$, *** $p<.001$.

To test the difference, the correlation between the predicted scores from the set of Instructional Design variables (R=.485) (which was the highest) and those from the set of Learning Styles variables (R=.380) (which was the lowest) was calculated. Using the protocol suggested by Tabachnick and Fidell (1996) to test the difference between sets of predictor variables, the Z test was used. The results of the test between the two Multiple Regression analyses for the email component showed, Z^*=1.31. Because Z^* in the z test for the difference between r_{ya} and r_{yb} was within the critical values of $\pm$1.96 for a two-tailed test, there was no statistically significant difference in predicting students' satisfaction with the email component from the Instructional Design Quasi-Model versus the Learning Styles Quasi-Model. This will stay true for the rest of the quasi-models.

Online Threaded Discussions

A series of Multiple Regression tests was run for each of the five quasi-models (see Table 21).

Table 21: Summary Results from the Multiple Regression Analyses for Each of the Five Sets (Quasi-Models) of Variables with "Liking Discussion" as the Dependent Measure.

Discussion	Model Summary		ANOVA				
	R	R^2	F	p	Beta	t	p
Demographic Quasi-Model	.43	.19	7.33	***			
Age					-.299	-2.28	*
Gender					.140	2.05	*
Children					.188		
Student Status					.085		
Marital Status					.301	2.77	**
Employment Status					.257	2.75	**
Experiential Quasi-Model	.39	.15	8.91	***			
Prior Online Courses					.283	4.30	***
Word Processing					.283	3.68	***
Use of Email					-.017		
Use of Internet					-.211	-2.57	*
Learning Style Quasi-Model	.33	.11	6.05	***			
Active/Reflective LS					-.061		
Sensing/Intuitive?					.046		
Visual/Verbal LS					.170	2.33	*
Sequential/Global LS					-.210	2.31	*
Motivational Quasi-Model	.50	.25	10.33	***			
Intrinsic					.253	3.08	**
Extrinsic					.017		
Task Value					.280	3.40	**
Learning					.063		
Success					-.270	-2.78	**
Self-Efficacy					.182		
Instructional Design Quasi-Model	.504	.254	8.53	***			
Relevance of Learning					.252	2.06	*
Reflective Thinking					-.095		
Negotiation					.277	3.50	**
Empathy					-.016		
Support					.171		
Adequacy of Tech Support					.092		
Instructor Effectiveness					-.051		

Note: In these analyses the dependent measure "Liking Discussion" is based on the continuous scale rating using a five-point Likert scale. * $p<.05$, ** $p<.01$, *** $p<.001$.

As with the email component, the same statistical analysis was applied to test the predictive power of quasi-models for the Online Discussions component. To test the difference, the correlation between the predicted scores from the set of Instructional Design variables (R=.504) (which was the highest) and those from the set of Learning Styles variables (R=.329) (which was the lowest) was calculated. The results of the test between the two Multiple Regression analyses for the online discussions component showed, Z^*=2.1. Because Z^* in the z test for the difference between r_{ya} and r_{yb} was not within the critical values of $\pm$1.96 for a two-tailed test, there was a statistically significant difference in predicting students' satisfaction with the online discussion component from the Instructional Design Quasi-Model versus the Learning Styles Quasi-Model. Clearly, the Instructional Design Quasi-Model is a more important determinant of the students' satisfaction.

To further test the difference, the correlation between the predicted scores from the set of Instructional Design variables (R=.504) (which was the highest) and those from the set of Experiential variables (R=.329) (which was the second lowest) was calculated. The results of the test between the two Multiple Regression analyses for the online discussions component showed, Z^*=1.4. Because Z^* in the z test for the difference between r_{ya} and r_{yb} was within the critical values of $\pm$1.96 for a two-tailed test, there was no statistically significant difference in predicting students' satisfaction with the online discussion component from the Instructional Design Quasi-Model versus the Experiential Quasi-Model.

CHAPTER V

DISCUSSION

In this chapter, the results are considered and conclusions are drawn based on these results. Implications of the findings, recommendations for further studies, and limitations of the study also are explored.

This study was designed to explore relationships between students' satisfaction with nine online course components (email, online discussions, audio, graphics, simulations, web links, hypertext, chat, and video) on the one hand and demographic characteristics of online students, their prior online experiences, learning style preferences, motivations, and the elements of online course design on the other hand. The research questions led to the following hypotheses: (1) With respect to students' personal characteristics and their satisfaction with online course components, it was hypothesized that (a) older students would be more satisfied than younger, (b) males would be more satisfied than females, and (c) marital, employment, and student status would impact students' attitudes towards online course components; (2) With respect to students' prior online experiences and students' satisfaction, it was hypothesized that students who took more online courses would have a more positive attitude about the course components; (3) With respect to students' learning styles and students' satisfaction, it was hypothesized that global learners would be more satisfied with online components; (4) With respect to students' motivations and their satisfaction, it was hypothesized that students who are more motivated to learn would also have a more positive attitude about the course components; (5) With respect to the elements of the online course design and students' satisfaction, it was hypothesized that online courses that include various components typical of the constructivist learning environment would have a favorable effect on students overall satisfaction with the course components.

Hypothesis 1 (The Demographic Cluster):

There would be a relationship between online students' personal characteristics and their satisfaction with online course components, specifically (a) older students would be more satisfied than younger, (b) males would be more satisfied than females, (c) marital, employment, and student status would impact students' attitudes towards online course components.

This hypothesis was partially supported by the findings in that (1) older students were more satisfied than younger students with some of the online components, and (2) employment and student status had an impact on students' attitudes towards online course components. Participants who had more favorable attitudes about email, graphics, and video components were older students (>25 age group). This finding is consistent with the results of a number of research studies suggesting that older students might be better prepared for the demands of an online environment (Mourtos & McMullin, 2001; Shih & Gamon, 1999) and as a result, be more satisfied. The research has also shown that older students are the ones who have more prior online experience. It is also believed that older online students are more mature and more motivated to learn, hence, having more positive attitude about online learning in general and certain online components in particular. It is possible that age differences might have been found for some other components if the number of students enrolled in online courses with these components was greater.

Employment Status and Student Status were also identified as factors related to students' attitudes about some of the online components. Students who had more favorable attitude about the online discussions were full-time employed. Further, online students enrolled in the studies on a part-time basis were more satisfied than full-time students. Taking into account the

observation that a majority of part-time students are full- or part-time employed, and the fact that they are also more mature, more responsible, and obviously have more experience in an online environment, it seems logical that they reported the higher level of satisfaction with the above-mentioned components. It is also possible that being employed and having access to the online course materials at their work place might be a contributing factor affecting students attitude about the course component in a positive way. Online courses may allow such students to study "any place, any time." Flexibility of online courses might be what many students need to engage in college education and what is even more important to successfully complete it.

Although the findings of a number of earlier studies (Karma, 1994) suggested that there were gender differences in students' attitudes towards computers (Dambrot, 1995) as well as in the level of confidence in the use of technology (Culley, 1998), the data collected from the online questionnaire did not support the hypothesis that gender might be a factor affecting students' satisfaction with the online course components. In fact, after the preliminary analyses, the gender variable was completely eliminated as irrelevant. This finding was completely unexpected especially because historically the computer has been coupled more with males in the work and school environment than females (Kirk, 1992). Moreover, according to Kirk (1992) male dominance of computers was said to hover as high as 98 percent of the population of computer users in the 1980s.

Gender differences in knowledge and confidence were traditionally explained by differences in computer experiences of men and women (Morse & Daiute, 1992). There are some signs, however, signaling the fact that this might be changing. The HERI (2000) study on use of computers by freshman students in University of California at Los Angeles (UCLA) showed an increase in their computer use from 68 percent 1999 to 78 percent in the year 2000. The gender

gap has almost closed, with 78 percent of women students compared to 80 percent of men reporting frequent use of computers. Further, Rajagopal and Bojin (2003) found that more female students emphasize that learning and productivity improve from the use of IT, and fewer of them feel that universities or schools that use new technologies are likely to attract more students. The authors also pointed out that both female and male students find that IT enhances their research, expands their ability outside the class room in acquiring more skills, enhances their insight on class materials, makes learning easier and fun, and improves students' collaborative as well as leadership skills in learning and discussions. It is possible that the results of this study were illustrations of this current phenomenon. It is also possible that attitudes of female and male students became more similar as they both became accustomed to the online collaborative working environment.

Another sign that signals that gender gap might be closing is the constantly growing number of female students enrolled in online courses. In this study, female students dominated male participants 3 to 1. Based on this observation, we can conclude that if this trend continues, online education might be seen primarily as a female domain. In any event, more research needs to be done to investigate the male/female attitudinal differences. It would be interesting to investigate if the same results hold true with other populations (varying in age, professional status, and ethnicity) using computer-mediated communication.

Hypothesis 2 (The Experience Cluster):

There would be a relationship between students' prior online experiences and students' satisfaction with online course components: students who took more online courses would have more positive attitude about the course components.

This hypothesis was supported by the findings. None of the online courses chosen for this study required prerequisite knowledge or previous experience with the computer. Yet amongst the students there was a very wide range of prior online experiences (See Chart 1): participants ranged from those with absolutely no online experience right through to experts in various aspects of online learning.

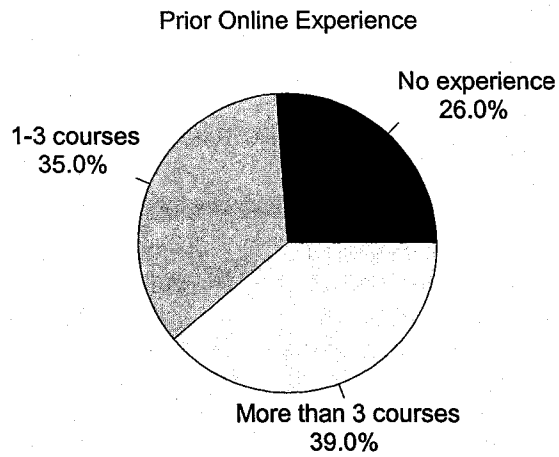

Chart 1: Students starting online experience

The previous online experience was greater for students who indicated satisfaction with a number of online components, including email, online discussions, web links, and chat. It seems reasonable that students who are more satisfied with certain online components possess a higher degree of proficiency and comfort with the Internet. These findings are also supported by a number of other researchers who reported that online experience was important and more so than experience with the computer (Qureshi, Morton, & Antosz, 2002) and that previous training with computer applications was one variable that influenced how students perceived their own degree of competence when completing online activities (Daugherty & Funke, 1998).

Hypothesis 3 (The Learning Styles Cluster):

There would be a relationship between students' learning styles and students' satisfaction with online course components: global learners and students who are generally well-balanced in their learning styles would be more satisfied with online components.

The hypothesis was supported by the findings. The variable "Sequential/Global LS" was found to be a rather powerful predictor when examining for students' likes and dislikes of email, online discussions, hypertext, and video components. This finding is consistent with the results of Mourtos and McMullin's (2001) study. They found that Global learners might be better suited for the online environment compared with the other types. It is possible that an explanation for this resides in the specificity of the online learning format which is more appropriate for independent, responsible, and motivated learners, as well as those who learn best whenever given a chance to see the big picture before they tackle the details. A sudden flash of understanding is characteristic of their approach to understanding (Felder & Soloman, 2000). Because of the nature of the online mode, it is likely that students are required to be highly self-regulated and responsible for organizing and reflecting on their learning. It is, therefore, important that they develop understanding and appropriate use of effective learning and metacognitive strategies such as planning, monitoring, adapting and evaluating learning when learning online.

The current study has also found that the participants who valued online threaded discussions, email, and audio components had the Reflective learning style preference. The nature of these components may explain this finding. Email and online discussion are frequently used for the asynchronous type of communication allowing sufficient amount of time to process new information and reflect. Some of the other findings fit very comfortably with our intuition: Visual learners remember best what they see (for instance, pictures, diagrams, flow charts, time

lines, films, and demonstrations); naturally they would favor the graphics component of online courses. Moreover, Carnevale (2001) also pointed out while the face-to-face students like sound better as the method of teaching, the online students like graphics better.

Because learners have different learning styles or a combination of styles, online educators should design activities that address their modes of learning in order to provide significant experiences for each learner. Verduin and Clark (1991) argued that an online instructor should be able to see a pattern of learning styles and plan or adjust the instructional design and strategies accordingly in order to increase the chances of student success. Visual learners, for instance, like a lot of graphics to help them process text-based information. These can be in the form of simple graphics (pictures) which *show* rather than tell (such as examples of facial expressions or gestures in a Communications course). They can also include more complex images such as animated gifs or rollovers. By adding graphics, the instructor can increase student recall by up to 50% (Summers, 2003). The addition of effective visuals in online environments may also appeal to the learner who tends more toward reflective observation (prefers generating a wide range of ideas and likes to gather information from many sources). Instructional strategies such as journaling and online chats that involve brainstorming may aid the reflective observer.

Kinesthetic learners like to click the mouse, move things around. Flash Technology with lots of drag and drop functions work well for kinesthetic learners – it is how the physical translates to the online. It helps some learners to write things down as part of the kinesthetic and visual aspects. If a notepad is offered in the course, or even if the instructor prompts the learner to write down their thoughts or responses, it helps them retain information. This is a non-technical approach that is still useful in an online course (Summers, 2003).

Incorporating observation in the online course design may be appropriate for the learner who is more prone to learn through concrete experience. Increasing the amount of lecture via videostreaming coupled with assignments to write reflective papers favors the abstract learners. In addition, the active learners should be encouraged to learn by completing simulations, case studies, and exercises that require carefully observing a situation before making judgments, viewing issues from different perspectives, and interpreting the meaning of events. Incorporation of conferencing into course designs supports such interaction and facilitates a sense of community among participants.

To fully engage students in an online course, alternative means for students to access information should be provided. It is a helpful tenet for professors to keep in mind, so that their content can reach students in as many ways as possible. Further, learning strategies should reflect a diversity of perspectives, approaches, and cultures. Designing course activities that include planning, creating models and theories, and inductive reasoning (Felder, 1996; Kolb, 2000) by the students, would allow for the students' optimal engagement rate and effective utilization of the online course.

Web-based courses are believed to be more difficult than their face-to-face counterparts. Online courses depend to a great degree on a large amount of reading, writing and independent analysis. It is important that an online student be willing to both know his/her learning preferences and also stretch into new learning modes.

Hypothesis 4 (The Motivational Cluster):

There would be a relationship between online students' motivations and their satisfaction with online course components: online students who are more motivated to learn would also have a more positive attitude about the course components.

Of the six motivational variables, only three (Intrinsic Motivation, Task Value, Self-Efficacy) discriminated between the groups of Likers and Non-Likers for email, discussions, audio, graphics, and hypertext components. Likers were clearly more motivated to learn. This is consistent with other research findings demonstrating that successful online learners are usually self-motivated and self-regulated learners (Liu and Ginther, 1999; Porter, 1997), thus they want to learn and fully participate in the course. It is also possible that some students were more motivated to learn simply because they enjoy learning something new or because they learn to achieve a specific goal (Conner, 2000).

It is interesting that the three variables found to discriminate between the satisfied and dissatisfied students are also essential components of the systematic motivational model of instructional design --ARCS model -- developed by Keller (1983). In this model, based on expectancy-value theory, "effort" is identified as the major measurable motivational outcome. For "effort" to occur, two necessary prerequisites are specified: (1) the person must value the task. High task value should lead to more involvement in one's learning; and (2) the person must believe he or she can succeed at the task. Therefore, in an instructional situation, the learning task needs to be presented in a way that is engaging and meaningful to the student, and in a way that promotes positive expectations for the successful achievement of learning objectives. Motivation can be very difficult for the learners in an online course if motivation techniques are not built into the course. The motivation of the learner can easily drop off without the face-to-face contact with either the teacher or the peers, therefore, course instructors need to identify the motive of the online learners and stimulate their motivation with course related activities. It is important to inspire students through activities that capture their imagination and stimulate a desire to do more than the minimum required to pass. One can concur with Pulist (2001) that the

motivational aspects must be consciously designed into the Web-based instruction as rigorous as any other pedagogical dimensions. For instance, in order to promote intrinsic motivation in an online course, the instructor can show the students how the course, assignments, and projects are relevant to their academic, professional, and/or personal needs by encouraging discussions that relate the learning material to the learners' personal experiences, and also discuss how it can be used in their own workplace. When the learners perceive the relevance of the information to their own personal situations, they will be more motivated to learn and become involved in the course. Also, an important characteristic of online learning is that it gives learners flexibility in accessing the learning materials and participating in discussions. By creating a relaxed atmosphere in the online environment, and permitting flexible deadlines to turn in assignments, the instructor is promoting motivation because the learners will not be stressed and can complete the work on their own schedules. This will also help motivate the learners to become involved in the course. Extrinsic motivation can be promoted if the instructor makes the assignments and participation worth a certain percentage of the course grade. In this way, the learners will be motivated to do the assignments and participate in class discussions, teamwork and pair work activities in order to get a good grade in the course.

This research has clearly shown that motivation plays an important role in students' satisfaction with online course components. This finding supports the notion that online students are mature responsible motivated adults who have concrete learning goals, and who are achievement-oriented (Cranton, 1989; Benshoff & Lewis, 1992).

Hypothesis 5 (The Instructional Design Cluster):

There would be a relationship between the elements of the online course design and students' satisfaction with online course components: those online courses that include

various components typical of the constructivist learning environment would have a favorable effect on student overall satisfaction with the online course components.

Of the seven instructional design variables, four (Relevance of Learning, Negotiation, Adequacy of Technical Support, Instructor Effectiveness) seem to have the strongest predictive power. Bearing in mind that almost one third of all the participants did not have any prior online experience, it seems logical that Adequacy of Technical Support was found to be an important predictor of the students' favorable attitude towards a number of online components (email, discussions, chat, and video). Using the computer as a learning mode requires new strategies and skills that cannot be taken for granted. Therefore, technical advice and support needs to be provided not only initially but as an ongoing measure.

Higher ratings for Instructor Effectiveness in an online course reflect a positive correlation with students' satisfaction with the email, discussions, audio, web links, and graphics online components. This is consistent with the findings of other researchers suggesting that the support and guidance of the tutor is a crucial component in students' satisfaction with their learning experience (Mason & Weller, 2000). It is particularly true in the situation where students have such an unequal range of prior online experiences as in the present study. It is not surprising, therefore, that online courses taught using such complicated components as simulations and video, without face-to-face tutorials, and expecting students to work collaboratively, are going to rely heavily on the quality of their tutors for the satisfaction and success of their students. Ruberg, Moore, and Taylor's (1996) research results support the current findings as well. They found that computer-mediated communication encouraged experimentation, sharing of ideas, increased and more distributed participation, and collaborative

thinking, but also found that for online discussion to be successful, it required a social environment that encouraged peer interaction facilitated by instructor structuring and support.

Every Web-based course always has a few students that need their instructor's constant reinforcement and encouragement throughout the duration of the course. Once students are engaged in the learning process, it ensures maximum retention and understanding. Immediate feedback, continuous assessment, and effective facilitation of course discussions are believed to be means of reducing dropout from online courses. Therefore, an effective online ID model would pay more attention to teacher characteristics and would emphasize the interaction between teachers and students. McIlrath and Huitt (1995) suggested including the following variables into the category of teacher characteristics: values and beliefs, knowledge of students and the teaching/learning process, thinking, communication and performance skills, and personality. While each of these is important, teacher efficacy is believed to be the best predictor of student success from this subcategory. The authors argued if a teacher believed that, in general, students could learn the knowledge or skills, and that, specifically, he/she could teach them, then that teacher was more likely to use the knowledge and skills he/she had and the students were more likely to learn. McIlrath and Huitt's argument could be directly related to Rosenthal's expectancy effects. The experimenter-efficacy effect, or Rosenthal Effect, refers to the phenomenon in which the researcher's tacit hypothesis or expectancy can become a self-fulfilling prophecy of the subject's responses (Harris & Rosenthal, 1985). Numerous experiments conducted by Rosenthal in laboratories and in the field showed that when teachers were led to expect better intellectual performance from their students they tend to get it.

The results of the current study have clearly indicated that Instructor's Effectiveness, including sufficient opportunity for interaction with instructors, is preferable to those with

limited interaction, and that interaction with instructors is an important factor in online learning. Future research should explore the relationship between students and teachers in online environments more deeply. Also, qualitative analyses of instructor-student interactions might provide more answers in this regard and is an area deserving of future research.

The Negotiation variable assessed the extent to which opportunities existed for students to explain and justify to other students their newly developing ideas, to listen attentively and reflect on the viability of other students' ideas and, subsequently, to reflect self-critically on the viability of their own ideas. It was found that negotiation was the strongest out of all the instructional design variables. It differentiated between the Likers and Non-Likers for email, online discussions, audio, graphics, simulations, and video components. This study has demonstrated that communication is a vital aspect of successful online learning. Interactions appear to be especially important in online discussions. This finding is consistent with the results of other studies that suggest that students perceive online discussions as more equitable and more democratic than traditional classroom discussions (Harasim, 1990). Moreover, Rourke, Anderson, Garrison, and Archer (2001) identified the development of social presence, the perceived interaction with others, as one of the cornerstones for the development of online learning communities. Development of social presence in online discourse should be explored in the future.

What makes the Instructional design findings exciting is their consistency with the findings of the research on computer-mediated communication and asynchronous online learning. Swan et al. (2003) asserted that the findings in the area of computer-mediated communication research point to three (and only three) course design factors that contribute significantly to the success of online courses. These are an instructor who interacts frequently

and constructively with students (Instructor Effectiveness variable in the current research study), a valued and dynamic discussion between students (Negotiation variable), and a transparent interface (consistency in course design). This combination of factors is not accidental, but rather it jointly supports the growth of what Scardamalia and Bereiter (1996) called "knowledge building communities." Many in the online education field believe that the development of such communities is critical to the success of online courses (Harasim, 1990; Wegerif, 1998). Further, the identification through empirical research of these three factors is both supported by social constructivist theory and supports social constructivist notions of the importance of the development of knowledge building communities (Swan, 2001). It also can guide the development of asynchronous online courses. It very well may be that other theoretical approaches can be successfully instantiated online. At present, however, the efficacy of social constructivist designs has been quite clearly demonstrated and surely deserves further, in depth, investigation.

Taken together, the findings of this study in the area of the Instructional design point to the importance of online interaction, and in particular to the value put on online discussion, in the success of online courses. The findings also suggest that shared dialogue among students and between students and instructors has a positive effect on student satisfaction with courses. They support previous findings linking the valuing of discussion to student satisfaction and learning (Hiltz, 1994; Poole, 2000; Swan, 2001). It can be concluded that support for students' interactions with content, instructors, and classmates and for the development of online communities of learning clearly deserves the attention of online developers and instructors alike, and further investigation by the educational research community.

One of the important discoveries of the present study is that the Instructional Design Quasi-Model might be a stronger determinant of the students' satisfaction with online components (threaded discussions) as compared to the rest of the quasi-models. However, considering that the predictability of the quasi-models was examined only for two components (email and online discussions) due to a small cell size of other components, a more fine-grained analysis is warranted to further investigate the predictive power of the Instructional Design Quasi-Model for student satisfaction.

Limitations

A major limitation of this study was that it only took into consideration the perceptions of the students who responded to the survey. There is currently no accountability for the perceptions of learning experiences and satisfaction with course components in the online learning environment from the viewpoint of the students who did not respond to the survey or officially withdrew from the course before the end of the semester.

Although the sample size of students who completed the questionnaires was relatively large and included students with various backgrounds, it is not possible to ensure that it is truly representative of the entire population of online undergraduate students in Ontario since the sample was comprised solely of the University of Windsor students. For this reason the findings of this study should not be generalized to all online undergraduate students in Ontario.

There are also limitations inherent in the chosen methods of data collection. For example, non-responses and the inability to ask follow-up questions are limitations commonly associated with questionnaires (Gray & Guppy, 1994).

While every attempt was made to control for extraneous variables, some insignificant limitations of this design might have had an effect on the results of the study. First, subject

fatigue was a possible weakness. Due to the length of the questionnaire, student participants may have grown tired during its completion. Such subject fatigue may have had an influence on student responses, particularly toward the end of the questionnaire. Second, willingness of the students to participate in an online survey might also have had an impact on the results of the data collection. Finally, technical problems that might have had occurred in process of completion of the questionnaire online could have affected the outcome as well.

Conclusions

The research findings suggest that a number of factors can affect students' satisfaction with the online components. They are students' demographic characteristics (Age, Employment, and Student Status), prior experience (Prior Online Courses Taken), learning styles (Active/Reflective, Visual/Verbal, Sequential/Global), motivational factors (Intrinsic motivation, Task Value, and Self-Efficacy), and instructional design components (Relevance of Learning, Negotiation, Adequacy of Technical Support, and Instructor Effectiveness). These findings continue to provide a rationale for the online format as well as a prognosis for the future of this format.

Many educators believe that the mere use of the WWW constitutes an engaging learning experience. As the present study has shown, it is not always true. The use of this medium in a specific course does not automatically imply effective instructional activities or quality instruction for the intended learners. Andrusyszyn and Davie (1995) argued that because each delivery medium has unique characteristics, not all would suit every learner or educator. As stated earlier, adult learners have different learning styles, multiple roles, and complex lives. Some may prefer experiential and/or experimental teaching-learning activities, whereas others need a more traditional visual or auditory method. Some may value interaction with others in

small and/or large groups, whereas others may prefer to learn on their own. Educators, on the other hand, may be skilled in the lecture-discussion method, whereas others may thrive on more facilitative approaches to knowledge development. Similarly, various delivery media have inherent features that may or may not appeal to all learners or educators. However, one could concur with Junk and Fox (1998) who pointed out, the advantages will outweigh the disadvantages if the end product is effective presentation of materials reflected by evidence of increased learning.

It is obvious that none of the course or delivery components alone guarantee good instruction and positive learning outcomes, since it is the instructional design methods that ultimately determine a specific site's effectiveness in producing effective learning. However, the impact of various online course components on students' learning and satisfaction cannot be ignored completely. An important conclusion is that the only way to maximize Web-based learning is to combine the concepts of instructional design and the knowledge about students' motivations and learning styles with the attributes of web technology.

Making meaning of the findings in this study is key to providing useful information for practitioners and researchers in the field of online education and instructional design. Based on the findings, some suggestions can be made for educators who intend to design and teach online courses: (1) A course design model cannot be blindly transferred from the traditional setting to fit Web-based environment. It has to be adjusted according to the specificity of the instructional medium. As the results of some research studies showed, lack of modifications might lead to students' negative experiences and unsatisfactory learning outcomes (Hara & Kling, 2000). Many ID theories and models, however, are learner-centered and take into account components vital for the successful delivery of online instruction -- student and teacher characteristics,

motivation, ongoing evaluation and revision as part of the process, focus on content analysis, as well as on support and service. Amongst these ID models are Reigeluth's Elaboration Theory, Merrill's Component Display Theory, Huitt's Model of the Teaching/Learning Process, Dick and Carey's Model of Instructional Design, ADDIE Design Model, and other. (2) Instructors should carefully consider individual characteristics of online students, their learning preferences, as well as their previous experience with technology and online learning. As the results of this and other studies (Markel, 2000) have indicated, discussion forums could be especially beneficial for those students who have a reflective style and need time to contribute to the discussion. Moreover, students whose first language is not English usually have trouble participating in synchronous (chat) communication (Murphy & Collins, 1997). Assessment of this nature should provide a base for consideration in a Web-based course design. (3) The results related to the students' preferred learning styles suggest that we will have to work harder to address the different types of learners when we offer courses at a distance. Moreover, the online environment may not be satisfactory for a large percentage of our undergraduate students, who need to interact with their instructor and their classmates on a more regular basis, to succeed in their courses. Accordingly, online course instructors need to think of effective ways to involve the student much more in the process. Instructors also need to have more active techniques that would allow them to get the student motivated. (4) It is important to balance instructional design components with the attributes of web technology. Research shows that educators may focus closely on the instructional elements and overlook the engaging and motivational characteristics such as sound and graphics of multimedia. On the other hand, developers with a profit motive may produce a flashy, fast moving program with minimal attention to the process of learning and minimal educational value (Hunter, 1998). (5) Every effort should be made to predict and get control over

technical problems and glitches that might occur during online instruction. As the results of this study indicated, adequate technical support can be a factor affecting student satisfaction with course components.

As teaching moves into distance learning, teachers recognize that the planning requires attention to concerns that are often ignored or not treated as important in conventional classroom teaching. These include: (1) Increase expectations of students before instruction starts and offer support to them before, during, and after instruction takes place; (2) Overcome the impersonal nature of distance learning and the lack of direct human support students encounter by ensuring that adequate communication takes place between individual students and the instructor, and among groups of students; (3) Help students self-discipline themselves to manage study time and fulfill responsibilities for participation, completing assignments, engaging in projects, making contacts with other students through interactive media, and so forth; (4) Integrate and control the use of diverse media by teachers and students; (5) Recognize the potential for technical problems at both the instructor's facility and at student site locations and how to be prepared to overcome them or substitute with other media or activities; (6) Know how to help students build relationships among each other, encourage participation, how to start and stop discussions, how to deal with the shy, the dominating, and the aggressive. To accomplish this, instructors should re-interpret their skills in terms of the new medium and to identify where online teaching can make a unique contribution. The instructor must have some readily well-thought-out and available implementation plans to deal with issues such as resistance, commitment, and culture. Finally, (7) recognize the fact that every student is different, for this reason, the best approach to online instruction is to give students a variety of options.

Implications for Future Research

In sum, this study represents an attempt to evaluate online course design and delivery at one university and reflects data for one semester. In order to better understand and track the progress of online courses, further studies are needed that will compare data from multiple semesters. The findings of this study should be viewed as (1) formative evaluation meant to inform the College community and facilitate improvement and (2) summative conclusions leading to decisions about the effectiveness of online course delivery.

The immediate implications of this research extend into the realms of both research and practice. To begin with, more research needs to be conducted in the area of student satisfaction, in both online educational environments and traditional educational environments. Research is needed to determine the extent students' perceptions of online learning influence student satisfaction, student motivation, and other attitudinal factors. From the instructors' perspective, research needs to be conducted to determine the extent of the influence of sound online instructional design on teacher effectiveness ratings and instructor satisfaction with courses taught.

It is apparent that research in the area of Web-based instructional design is still in its infancy; therefore, there is a great deal of work to be done. More descriptive and experimental studies are needed to examine different aspects of Web-based instruction and its design specifications. How the learner's preferred learning style may influence the course design needs and the choice of course delivery and course components to be explored in future studies. Furthermore, future projects should look at a broad range of Web-based courses and include development of one or more instruments to measure student perceptions and attitudes toward Web-based instruction.

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UNIVERSITY OF WINDSOR

CONSENT
TO PARTICIPATE IN A RESEARCH STUDY

TITLE OF STUDY: **INVESTIGATION OF FACTORS AFFECTING STUDENTS' SATISFACTION WITH ONLINE COURSE COMPONENTS**

INVESTIGATOR: Elena Qureshi, Ph.D. Candidate, (519) 253-3000 Ext. 3808.

PURPOSE
The benefits of Web-based instruction, such as access to education and opportunities for collaboration are well documented. The literature also emphasizes the drawbacks of Web-based instruction including reduced opportunity for interaction, varying degrees of self-motivation, and isolation. The focus of this research project will be factors affecting student satisfaction with various online course components.

SUBJECTS
You have been asked to participate because you are/were enrolled in a course offered online or supplemented with an online component.

PROCEDURES
If you choose to participate you will be asked to complete an evaluation that will take about twenty minutes to complete. This evaluation will ask questions about your experiences with various course components (email, text, web links, etc.). No sensitive questions will be asked.

RISKS
There are no known risks identified with this research. The students are/were already enrolled in courses which feature online components.

BENEFITS
There are no direct benefits to you as a participant in this study. Class participants and future students of courses offered online may benefit from this research due to the improved teaching methods that may be identified and utilized. Development of an evaluation tool and responses to the evaluation in this course, as well as future courses, may benefit teachers and students by improving the use of online education.

CONFIDENTIALITY
You will not be personally identified in any reports or publications that may result from this study. You will complete the evaluation of the online component of your class anonymously. The evaluation will be completed online and the results sent to the investigator's email with no identifiers attached. The data collected on the evaluations will be compiled into a computer spreadsheet and categorized by question. The instructor of the course will not see the evaluations until after grades are posted. No identifying information is included in the evaluation.

COSTS/COMPENSATION
There will be no cost to you nor will you be compensated for participating in this study.

RIGHT TO REFUSE OR WITHDRAW
You may refuse to participate or withdraw from the study without penalty or negative impact on your grades or education.

QUESTIONS
If you have any questions now or later, please contact me via email elenaqureshi@email.com or at (519) 253-3000 Ext. 3808.

CLOSING STATEMENT
CLICKING ON THE AGREE BOX BELOW INDICATES THAT I HAVE DECIDED TO PARTICIPATE IN RESEARCH OF ON-LINE INSTRUCTION AND THAT I HAVE READ, I UNDERSTAND, AND I AM ABLE TO PRINT A COPY OF THIS CONSENT FORM.

Agree

ONLINE QUESTIONNAIRE

Online teaching and learning takes place partially or entirely over the Internet. In the following questions, an "online course" is defined to be a course that is conducted partially or completely through the Internet. Online teaching/learning can include the use of tools such as email, Webpages to present information, conferencing software, courseware application such as WebCT, or other instructional tools. An online environment, therefore, is one that makes use of these types of tools.

The following terms will be used in this questionnaire:

Chat: Real-time communication between two users via computer. Once a chat has been initiated, either user can enter text by typing on the keyboard and the entered text will appear on the other user's monitor.

Electronic Mail (Email): Sending messages from one computer user to another.

Graphics: Pertains to any computer device or program that makes a computer capable of displaying and manipulating pictures.

Hypertext (HyperText Markup Language): A document that has been marked up to allow a user to select words or pictures within the document for connection to further information.

Online Threaded Discussions: These are index methods that allow a user to follow one particular strand/topic in a series of new group messages.

Simulation: The process of imitating a real phenomenon with a set of mathematical formulas. For example, advanced computer programs can simulate weather conditions, chemical reactions, atomic reactions, and biological processes.

Streaming (Audio or Video): A technique for buffering and transferring data such that it can be perceived as a steady and continuous stream.

Text: Words, sentences, paragraphs (any online text). Objects that are *not* text include graphics and numbers.

Web Links: A link is a connection from one Web resource to another. A link starts at the "source" anchor and points to the "destination" anchor, which may be any Web resource (e.g., an image, a video clip, a sound bite, a program, an HTML document, an element within an HTML document, etc.).

Web Pages: A document on the World Wide Web. Every page is identified by a unique URL (Uniform Resource Locator), e.g. your course Home Page.

At any time during this survey you can get back to this page by simply clicking on the "Terms" button.

Part I: Demographic/Background Information

Please record the following information. Any personal information will be used for survey analysis only.

1. Age: ☐ under 20 ☐ 20-24 ☐ 25-29 ☐30-34 ☐35-39 ☐40 or over
2. Gender: ☐ Male ☐ Female
3. Marital status: ☐ single ☐ married ☐ widowed ☐ divorced ☐ other
4. Number of children: ☐ 0 ☐1 ☐ 2 ☐ 3 ☐ 4 or more
5. Employment status: ☐ unemployed ☐ full-time employed ☐ part-time employed ☐ homemaker
6. Occupation: ☐ student ☐ professional ☐ skilled manufacturing/clerical ☐ unskilled/construction ☐ farming ☐ homemaker
7. Major field of study: ☐ Arts ☐ Social Science ☐ Business ☐ Science ☐ Education ☐ Other
8. Student status: ☐ Full-time ☐ Part-time
9. What discipline is your course in? ☐ Education ☐ Computer Science ☐ History ☐ Biology ☐ Business

Part II: Previous Online/ComputerExperience

1. How many courses have you taken prior to this one that used the Internet to enhance or deliver instruction? ☐ 0 ☐1 ☐ 2 ☐ 3 ☐ 4 or more
2. For each of the following statements, mark the response that best reflects your feelings according to the code listed below.

1 – strongly disagree	2 – disagree	3 – neither agree nor disagree	4 – agree	5 – strongly agree

1. I know how to use databases _____ 1 2 3 4 5
2. I have experience in using spreadsheets _____ 1 2 3 4 5
3. I'm quite competent with word-processing _____ 1 2 3 4 5
4. I exchange e-mail messages with others regularly-_____ 1 2 3 4 5
5. I know a lot about the Internet _____ 1 2 3 4 5

Part III: Learning Styles

For each of the 20 questions below select either "a" or "b" to indicate your answer. Please choose only one answer for each question. If both "a" and "b" seem to apply to you, choose the one that applies more frequently. When you are finished selecting answers to each question please select the submit button at the end of the form.

1. I understand something better after I
   - ○ **(a)** try it out.
   - ○ **(b)** think it through.
2. I would rather be considered
   - ○ **(a)** realistic.
   - ○ **(b)** innovative.
3. When I think about what I did yesterday, I am most likely to get
   - ○ **(a)** a picture.
   - ○ **(b)** words.
4. I tend to
   - ○ **(a)** understand details of a subject but may be fuzzy about its overall structure.
   - ○ **(b)** understand the overall structure but may be fuzzy about details.
5. When I am learning something new, it helps me to
   - ○ **(a)** talk about it.
   - ○ **(b)** think about it.
6. If I were a teacher, I would rather teach a course
   - ○ **(a)** that deals with facts and real life situations.
   - ○ **(b)** that deals with ideas and theories.
7. I prefer to get new information in
   - ○ **(a)** pictures, diagrams, graphs, or maps.
   - ○ **(b)** written directions or verbal information.
8. Once I understand
   - ○ **(a)** all the parts, I understand the whole thing.
   - ○ **(b)** the whole thing, I see how the parts fit.
9. In a study group working on difficult material, I am more likely to
   - ○ **(a)** jump in and contribute ideas.
   - ○ **(b)** sit back and listen.
10. I find it easier
    - ○ **(a)** to learn facts.
    - ○ **(b)** to learn concepts.

11. In a book with lots of pictures and charts, I am likely to
    - ○ **(a)** look over the pictures and charts carefully.
    - ○ **(b)** focus on the written text.
12. It is more important to me that an instructor
    - ○ **(a)** lay out the material in clear sequential steps.
    - ○ **(b)** give me an overall picture and relate the material to other subjects.
13. I prefer to study
    - ○ **(a)** in a study group.
    - ○ **(b)** alone.
14. I am more likely to be considered
    - ○ **(a)** careful about the details of my work.
    - ○ **(b)** creative about how to do my work.
15. When I get directions to a new place, I prefer
    - ○ **(a)** a map.
    - ○ **(b)** written instructions.
16. I learn
    - ○ **(a)** at a fairly regular pace. If I study hard, I'll "get it."
    - ○ **(b)** in fits and starts. I'll be totally confused and then suddenly it all "clicks."
17. I would rather first
    - ○ **(a)** try things out.
    - ○ **(b)** think about how I'm going to do it.
18. When I am reading for enjoyment, I like writers to
    - ○ **(a)** clearly say what they mean.
    - ○ **(b)** say things in creative, interesting ways.
19. I remember best
    - ○ **(a)** what I see.
    - ○ **(b)** what I hear.
20. Some teachers start their lectures with an outline of what they will cover. Such outlines are
    - ○ **(a)** somewhat helpful to me.
    - ○ **(b)** very helpful to me.

Part IV: Motivations to Learn

For each of the following statements, mark the response that best reflects your feelings according to the code listed below.

1 – strongly disagree	2 – disagree	3 – neither agree nor disagree	4 – agree	5 – strongly agree

1. In a class like this, I prefer course material that really challenges me so I can learn new things. 1 2 3 4 5
2. The most satisfying thing for me in this course is trying to understand the content as thoroughly as possible. 1 2 3 4 5
3. When I have the opportunity in this class, I choose course assignments that I can learn from even if they don't guarantee a good grade. 1 2 3 4 5
4. Getting a good grade in this class is the most satisfying thing for me right now. 1 2 3 4 5
5. If a can, I want to get better grades in this class than most of the other students. 1 2 3 4 5
6. I want to do well in this class because it is important to show my ability to my family, friends, employer, or other. 1 2 3 4 5
7. I think I will be able to use what I learn in this course in other courses. 1 2 3 4 5
8. It is important for me to learn the course material in this class. 1 2 3 4 5
9. I am very interested in the content area of this course. 1 2 3 4 5
10. If I study in appropriate ways, then I'll be able to learn the material in this course. 1 2 3 4 5
11. It is my own fault if I don't learn the material in this course. 1 2 3 4 5
12. If I try hard enough, then I will understand the course material. 1 2 3 4 5
13. I believe I will receive an excellent grade in this class. 1 2 3 4 5
14. I'm certain I can understand the most difficult material presented in the readings for this course. 1 2 3 4 5
15. I'm confident I can do an excellent job on the assignments and tests in this course. 1 2 3 4 5
16. Considering the difficulty of this course, the teacher, and my skills, I think I will do well in this class. 1 2 3 4 5

Part V: WB Course Components

Please answer the following questions related to the components used in your online course:

1. Have you used **email** in this course: ☐ Yes ☐ No

If the answer was "Yes," then please measure how you liked this component, how useful it was to you, and how confident you are with using it. Use the following scale:

1-strongly disagree 2-disagree 3-neither agree nor disagree 4-agree 5- strongly agree

	I really liked this component	I found email useful	I am confident with using email
Email	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5

If the answer was "No," then please mark how you think you would like email (find it useful/confident about using email) if it were included in your online course next time.

1-strongly disagree 2-disagree 3-neither agree nor disagree 4-agree 5- strongly agree

	I would really like this component	I would find email useful	I am confident with using email
Email	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5

2. Have you used **web links** in this course: ☐ Yes ☐ No

If the answer was "Yes," then please measure how you liked this component, how useful it was to you, and how confident you are with using it. Use the following scale:

1-strongly disagree 2-disagree 3-neither agree nor disagree 4-agree 5- strongly agree

	I really liked this component	I found web links useful	I am confident with using web links
Email	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5

If the answer was "No," then please mark how you think you would like web links (find them useful/confident about using web links) if they were included in your online course next time.

1-strongly disagree 2-disagree 3-neither agree nor disagree 4-agree 5- strongly agree

	I would really like this component	I would find web links useful	I am confident with using web links
Web links	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5

3. Have you used **online threaded discussions** in this course: ☐ Yes ☐ No

If the answer was "Yes," then please measure how you liked this component, how useful it was to you, and how confident you are with using it. Use the following scale:

1-strongly disagree 2-disagree 3-neither agree nor disagree 4-agree 5- strongly agree

	I really liked this component	I found online threaded discussions useful	I am confident with using online threaded discussions
Online threaded discussions	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5

If the answer was "No," then please mark how you think you would like online threaded discussions (find them useful/confident about using them) if it were included in your online course next time.

1-strongly disagree 2-disagree 3-neither agree nor disagree 4-agree 5- strongly agree

	I would really like this component	I would find online threaded discussions useful	I am confident with using online threaded discussions
Online threaded discussions	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5

4. Have you used **chat** in this course: ☐ Yes ☐ No

If the answer was "Yes," then please measure how you liked this component, how useful it was to you, and how confident you are with using it. Use the following scale:

1-strongly disagree 2-disagree 3-neither agree nor disagree 4-agree 5- strongly agree

	I really liked this component	I found chat useful	I am confident with using chat
Chat	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5

If the answer was "No," then please mark how you think you would like chat (find it useful/confident about using it) if it were included in your online course next time.

1-strongly disagree 2-disagree 3-neither agree nor disagree 4-agree 5- strongly agree

	I would really like this component	I would find chat useful	I am confident with using chat
Chat	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5

5. Have you used **graphics** in this course: ☐ Yes ☐ No

If the answer was "Yes," then please measure how you liked this component, how useful it was to you, and how confident you are with using it. Use the following scale:

1-strongly disagree 2-disagree 3-neither agree nor disagree 4-agree 5- strongly agree

	I really liked this component	I found graphics useful	I am confident with using graphics
Graphics	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5

If the answer was "No," then please mark how you think you would like graphics (find them useful/confident about using them) if they were included in your online course next time.

1-strongly disagree 2-disagree 3-neither agree nor disagree 4-agree 5- strongly agree

	I would really like this component	I would find graphics useful	I am confident with using graphics
Graphics	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5

6. Have you used **simulations** in this course: ☐ Yes ☐ No

If the answer was "Yes," then please measure how you liked this component, how useful it was to you, and how confident you are with using it. Use the following scale:

1-strongly disagree 2-disagree 3-neither agree nor disagree 4-agree 5- strongly agree

	I really liked this component	I found simulations useful	I am confident with using simulations
Simulations	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5

If the answer was "No," then please mark how you think you would like simulations (find them useful/confident about using them) if it were included in your online course next time.

1-strongly disagree 2-disagree 3-neither agree nor disagree 4-agree 5- strongly agree

	I would really like this component	I would find simulations useful	I am confident with using simulations
Simulations	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5

7. Have you used **audio** in this course: ☐ Yes ☐ No

If the answer was "Yes," then please measure how you liked this component, how useful it was to you, and how confident you are with using it. Use the following scale:

1-strongly disagree 2-disagree 3-neither agree nor disagree 4-agree 5- strongly agree

	I really liked this component	I found audio useful	I am confident with using audio
Audio	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5

If the answer was "No," then please mark how you think you would like audio (find it useful/confident about using it) if it were included in your online course next time.

1-strongly disagree 2-disagree 3-neither agree nor disagree 4-agree 5- strongly agree

	I would really like this component	I would find audio useful	I am confident with using audio
Audio	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5

8. Have you used **video** in this course: ☐ Yes ☐ No

If the answer was "Yes," then please measure how you liked this component, how useful it was to you, and how confident you are with using it. Use the following scale:

1-strongly disagree 2-disagree 3-neither agree nor disagree 4-agree 5- strongly agree

	I really liked this component	I found video useful	I am confident with using video
Video	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5

If the answer was "No," then please mark how you think you would like video (find it useful/confident about using it) if it were included in your online course next time.

1-strongly disagree 2-disagree 3-neither agree nor disagree 4-agree 5- strongly agree

	I would really like this component	I would find streaming video useful	I am confident with using streaming video
Video	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5

9. Have you used **text/hypertext** in this course: ☐ Yes ☐ No

If the answer was "Yes," then please measure how you liked this component, how useful it was to you, and how confident you are with using it. Use the following scale:

1-strongly disagree 2-disagree 3-neither agree nor disagree 4-agree 5- strongly agree

	I really liked this component	I found text/hypertext useful	I am confident with using text/hypertext
Text/hypertext	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5

If the answer was "No," then please mark how you think you would like text/hypertext (find it useful/confident about using it) if it were included in your online course next time.

1-strongly disagree 2-disagree 3-neither agree nor disagree 4-agree 5- strongly agree

	I would really like this component	I would find text/hypertext useful	I am confident with using text/hypertext
Text/hypertext	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5

Part VI: Course Design

For each of the following statements, mark the response that best reflects your feelings according to the code listed below.

1 – strongly disagree	2 – disagree	3 – neither agree nor disagree	4 – agree	5 – strongly agree

1. In this class I learn how to solve real-life problems.
   1 2 3 4 5
2. In this class what I learn connects well with what I know already.
   1 2 3 4 5
3. In this class what I learn is related to my future life.
   1 2 3 4 5
4. In this class I think carefully about how I learn.
   1 2 3 4 5
5. In this class I think critically about my understanding.
   1 2 3 4 5
6. In this class I learn how to become a better learner.
   1 2 3 4 5
7. In this class I get the chance to talk to other students.
   1 2 3 4 5
8. In this class I discuss my experiences with other students.

1 2 3 4 5

9. In this class I ask other students to explain their ideas.
   1 2 3 4 5
10. In this class the instructor realizes when students don't understand.
   1 2 3 4 5
11. In this class the instructor trusts the students.
   1 2 3 4 5
12. In this class if students don't agree with the lecturer they can talk about it.
   1 2 3 4 5
13. In this class the instructor takes a personal interest in us.
   1 2 3 4 5
14. In this class the instructor helps students with their work.
   1 2 3 4 5
15. In this class the instructor is someone students can depend on.
   1 2 3 4 5
16. The technology in this course worked well.
   1 2 3 4 5
17. I received adequate technical support in this course.
   1 2 3 4 5
18. There were few difficulties in accessing the technology used in this course.
   1 2 3 4 5
19. I was informed of my progress in this course in a timely manner.
   1 2 3 4 5
20. I received constructive feedback on assignments and tests.
   1 2 3 4 5
21. The instructor coordinated different activities of this course well.
   1 2 3 4 5
22. The instructor was conscientious about his/her instructional responsibilities.
   1 2 3 4 5
23. The instructor was sensitive to student needs.
   1 2 3 4 5
24. The instructor effectively used technology to facilitate course discussions.
   1 2 3 4 5

COMMENTS, SUGGESTIONS _____

THANK YOU FOR FILLING OUT THIS FORM

APPENDIX C

DEFINITIONS OF TERMS

Animation: A simulation of movement created by displaying a series of pictures or frames.

Asynchronous Communication: An exchange between two or more people whose contributions to the dialogue are separated by minutes or, more often, hours or days (Bi, 2000).

Chat: Real-time communication between two or more users via computer. Once a chat has been initiated, either user can enter text by typing on the keyboard and the entered text will appear on the other user's monitor.

Compressed Video: Video signals that downsized to allow travel along a smaller carrier.

Computer-Mediated Communication (CMC): It is the process by which people create, exchange, and perceive information using networked telecommunications systems (or non-networked computers) that facilitate encoding, transmitting, and decoding messages.

Course (Undergraduate): A unit of study that typically requires 100-200 hours of total student effort and that results in a grade or some other summative evaluation for permanent record of student achievement (Bi, 2000).

Delivery: With respect to distance learning delivery, this term refers to the arrangements by which instructional materials are made available to learners (Bi, 2000).

Desktop Videoconferencing: Videoconferencing on a personal computer.

Digital Video Interactive (DVI): A format for recording digital video onto compact disc allowing for full motion video through compression.

Distance Education (DE): A situation in which teacher and learner are in physically separate locations and contact between them is mediated by some form of technology, such as, hard copy,

audio teleconferencing, videoconferencing, and computer-mediated conferencing (Shale & Gomes, 1998).

Electronic Discussion: A means to provide a way for topical discussions to continue outside of the classroom. Students can post messages to one another and to the instructor electronically. A number of tools can make this easier, including newsgroups and listservs.

Electronic Mail (Email): Sending messages from one computer user to another.

Fully Interactive Video (Two-Way Interactive Video): Two sites interact with audio and video as if they were co-located.

Graphics: Pertains to any computer device or program that makes a computer capable of displaying and manipulating pictures.

Hypertext: A document that has been marked up to allow a user to select words or pictures within the document for connection to further information.

Instructional Design (ID): The science of creating detailed specifications for the development, evaluation, and maintenance of situations that facilitate the learning for both large and small units of subject matter (Richey, 1986).

Instructional Design Model: Prescribes how combinations of instructional strategy components should be integrated to produce a course of instruction (Braxton, Bronico, & Loom, 1995).

Multi-User Domain (MUD): The concept "MUD" refers to all primarily text-based Multi-User Dimensions. It has a spatial organization, for example, people interact with people or objects primarily within "rooms."

MUD, Object Oriented (MOO): It is Internet accessible, text-mediated virtual environment well suited for distance learning. For users, MOOs can be described as constellations of spaces, or "rooms", within which multiple individuals can congregate and interact. Movement is possible

room to room, by typing in cardinal directions, or via "teleporting", which allows immediate transport to rooms not adjacent to one's present location.

Simulation: The process of imitating a real phenomenon with a set of mathematical formulas. For example, advanced computer programs can simulate weather conditions, chemical reactions, atomic reactions, and biological processes.

Streaming (Audio or Video): A technique for buffering and transferring data such that it can be perceived as a steady and continuous stream.

Streaming Media: Any type of media (radio, television, virtual reality presentation, etc.) that can be viewed using a plug-in (e.g., RealNetworks's RealPlayer or Microsoft's NetCast).

Teleconferencing: Two-way electronic communication between two or more groups in separate locations via audio, video, and/or computer systems.

Threaded Discussions: Commonly used on usenet or listservs, these are index methods that allow a user to follow one particular strand/topic in a series of new group messages. Because email lists often receive a large number of messages on diverse topics, it can often be difficult to follow a single discussion. When messages are threaded, all messages are grouped together by topic making it easier to follow a single line of argument.

Usenet Newsgroups: One method to facilitate discussion outside of class. Students subscribe to a group and send messages to all other students in the group. The list is similar to an electronic bulletin board, so that students need to check it periodically to read the new messages.

Video Teleconferencing: A teleconference including two-way video.

Web-Based Instruction (WBI): An innovative approach for delivering instruction to a remote audience using the World Wide Web as the instructional delivery system (Khan, 1997).

APPENDIX D

MEANS AND SD

SIGNIFICANT MAIN AND INTERACTION EFFECTS: AGE/GENDER

Table 1.1. Means and Standard Deviations for Variables in the Experiential Model

Prior Experiences	Liking Email			
	Not so		Yes	
	Age Group		Age Group	
	18-25	>25	18-25	>25
Prior Online Courses Taken				
Mean	.87	1.43	1.49	3.03
SD	1.22	1.62	1.37	1.26
Word Processor				
Mean	3.63	3.43	3.73	3.81
SD	.89	.79	.81	.87
Email				
Mean	4.60	4.00	4.63	4.60
SD	.50	1.00	.48	.67
Internet				
Mean	4.23	3.43	4.42	4.33
SD	.68	.79	.53	.76

Table 1.2. Means and Standard Deviations for Variables in the Experiential Model

Prior Experiences	Liking Web Links			
	Not so		Yes	
	Age Group		Age Group	
	18-25	>25	18-25	>25
Prior Online Courses Taken				
Mean	.77	.50	1.81	2.51
SD	1.09	1.00	1.64	1.41
Word Processor				
Mean	4.31	4.25	4.03	4.14
SD	.75	.50	.93	.98
Email				
Mean	4.62	4.00	4.66	4.62
SD	.51	.82	.55	.79
Internet				
Mean	4.15	4.00	4.53	4.19
SD	.69	.00	.62	1.00

Table 1.3. Means and Standard Deviations for Variables in the Experiential Model

Prior Experiences	Liking Online Discussions			
	Not so Age Group		Yes Age Group	
	18-25	>25	18-25	>25
Prior Online Courses Taken				
Mean	1.11	2.65	1.58	3.10
SD	1.21	1.53	1.52	1.21
Word Processor				
Mean	3.47	3.75	3.93	3.74
SD	.68	.72	.89	.91
Email				
Mean	4.54	4.70	4.63	4.53
SD	.50	.47	.52	.71
Internet				
Mean	4.37	4.30	4.34	4.26
SD	.59	.66	.57	.81

Table 1.4. Means and Standard Deviations for Variables in the Experiential Model

Prior Experiences	Liking Chat			
	Not so Age Group		Yes Age Group	
	18-25	>25	18-25	>25
Prior Online Courses Taken				
Mean	1.52	2.91	.86	3.00
SD	1.57	1.22	1.46	2.00
Word Processor				
Mean	3.86	4.09	4.43	3.75
SD	.66	.54	.54	1.89
Email				
Mean	4.62	4.64	4.71	4.00
SD	.50	.51	.76	2.00
Internet				
Mean	4.29	4.55	4.29	4.00
SD	.56	.52	.76	2.00

Table 1.5. Means and Standard Deviations for Variables in the Experiential Model

Prior Experiences	Liking Graphics			
	Not so		Yes	
	Age Group		Age Group	
	18-25	>25	18-25	>25
Prior Online Courses Taken				
Mean	1.33	3.09	1.47	2.94
SD	1.44	1.38	1.54	1.32
Word Processor				
Mean	3.58	3.73	3.84	3.84
SD	.79	.79	.96	.92
Email				
Mean	4.47	4.82	4.63	4.53
SD	.51	.41	.60	.84
Internet				
Mean	4.28	4.18	4.42	4.12
SD	.51	.87	.69	.87

Table 1.6. Means and Standard Deviations for Variables in the Experiential Model

Prior Experiences	Liking Simulations			
	Not so		Yes	
	Age Group		Age Group	
	18-25	>25	18-25	>25
Prior Online Courses Taken				
Mean	.50	2.88	1.87	2.78
SD	.54	1.55	1.41	1.31
Word Processor				
Mean	4.25	4.25	4.06	4.28
SD	.87	.46	.93	.83
Email				
Mean	4.50	4.63	4.94	4.83
SD	.76	.52	.25	.38
Internet				
Mean	4.00	4.13	4.69	4.56
SD	.76	.84	.48	.62

Table 1.7. Means and Standard Deviations for Variables in the Experiential Model

Prior Experiences	Liking Audio			
	Not so		Yes	
	Age Group		Age Group	
	18-25	>25	18-25	>25
Prior Online Courses Taken				
Mean	.90	3.33	1.24	2.88
SD	1.18	1.12	1.34	1.34
Word Processor				
Mean	3.67	4.11	4.04	3.74
SD	.86	.60	.79	.99
Email				
Mean	4.71	4.78	4.65	4.41
SD	.46	.44	.48	.89
Internet				
Mean	4.52	4.22	4.41	4.12
SD	.60	.83	.54	.95

Table 2.1. Means and Standard Deviations for Variables in the Learning Styles Model

Learning Styles	Liking Email			
	Not so		Yes	
	Age Group		Age Group	
	18-25	>25	18-25	>25
Active LS				
Mean	3.10	2.86	2.61	2.07
SD	1.27	1.35	1.07	.91
Sensing LS				
Mean	3.50	3.14	2.93	2.30
SD	1.04	1.57	1.06	1.09
Visual LS				
Mean	1.80	2.43	2.44	2.93
SD	1.19	.79	1.11	.95
Sequential LS				
Mean	3.30	3.00	2.35	2.00
SD	1.44	1.16	1.29	1.02

Table 2.2. Means and Standard Deviations for Variables in the Learning Styles Model

Learning Styles	Liking Online Discussions			
	Not so Age Group		Yes Age Group	
	18-25	>25	18-25	>25
Active LS				
Mean	3.04	2.15	2.48	2.00
SD	1.21	.99	.96	.84
Sensing LS				
Mean	3.19	2.35	2.96	2.29
SD	1.13	1.14	1.05	1.12
Visual LS				
Mean	1.98	2.75	2.66	2.79
SD	1.06	1.12	1.18	.85
Sequential LS				
Mean	3.07	2.30	2.18	1.98
SD	1.44	1.03	1.22	.93

Table 2.3. Means and Standard Deviations for Variables in the Learning Styles Model

Learning Styles	Liking Graphics			
	Not so Age Group		Yes Age Group	
	18-25	>25	18-25	>25
Active LS				
Mean	2.60	2.18	2.37	2.03
SD	1.14	.75	.96	.90
Sensing LS				
Mean	2.88	2.36	3.11	2.31
SD	.98	1.21	1.20	1.18
Visual LS				
Mean	2.05	2.55	3.21	2.94
SD	1.02	.82	1.13	1.05
Sequential LS				
Mean	2.47	2.45	2.11	2.00
SD	1.30	1.04	1.45	.98

Table 2.4. Means and Standard Deviations for Variables in the Learning Styles Model

Learning Styles	Liking Audio			
	Not so Age Group		Yes Age Group	
	18-25	>25	18-25	>25
Active LS				
Mean	3.19	2.44	2.72	1.94
SD	1.21	.88	1.21	.87
Sensing LS				
Mean	3.14	2.22	3.20	2.50
SD	.85	1.09	1.19	1.24
Visual LS				
Mean	2.05	2.56	2.39	3.12
SD	1.20	.88	1.24	.98
Sequential LS				
Mean	3.05	2.22	2.54	2.26
SD	1.47	1.20	1.39	1.19

Table 3.1. Means and Standard Deviations for Variables in the Motivational Model

Motivational Goals	Liking Email			
	Not so Age Group		Yes Age Group	
	18-25	>25	18-25	>25
Intrinsic				
Mean	2.75	3.78	2.74	3.70
SD	.92	.50	.99	.64
Extrinsic				
Mean	3.19	3.72	3.11	3.79
SD	.80	.57	.91	.80
Task Value				
Mean	3.38	4.06	3.60	4.32
SD	.93	.65	.83	.65
Control of Learning Beliefs				
Mean	3.82	4.44	3.74	3.36
SD	.58	.54	.73	.52
Expectancy for Success				
Mean	3.52	4.00	3.47	4.10
SD	.55	.71	.64	.68
Expectancy for Self-Efficacy				
Mean	3.59	4.17	3.63	4.21
SD	.68	.68	.63	.62

Table 3.2. Means and Standard Deviations for Variables in the Motivational Model

Motivational Goals	Liking Online Discussions			
	Not so		Yes	
	Age Group		Age Group	
	18-25	>25	18-25	>25
Intrinsic				
Mean	2.40	3.52	3.07	3.76
SD	.91	.51	.90	.68
Extrinsic				
Mean	2.99	3.78	3.36	3.90
SD	.75	.52	.95	.82
Task Value				
Mean	3.14	3.90	3.83	4.45
SD	.91	.82	.71	.54
Control of Learning Beliefs				
Mean	3.63	4.18	3.90	4.43
SD	.77	.57	.65	.47
Expectancy for Success				
Mean	3.47	4.13	3.52	4.06
SD	.60	.67	.64	.67
Expectancy for Self-Efficacy				
Mean	3.50	4.05	3.73	4.25
SD	.58	.61	.68	.60

Table 3.3. Means and Standard Deviations for Variables in the Motivational Model

Motivational Goals	Liking Graphics			
	Not so		Yes	
	Age Group		Age Group	
	18-25	>25	18-25	>25
Intrinsic				
Mean	2.42	3.88	3.14	3.58
SD	.97	.45	1.00	.78
Extrinsic				
Mean	2.85	3.94	3.42	3.70
SD	.95	.55	.72	.87
Task Value				
Mean	3.52	4.24	3.80	4.39
SD	.86	.58	.62	.59
Control of Learning Beliefs				
Mean	3.67	4.42	3.72	4.41
SD	.65	.56	.73	.49
Expectancy for Success				
Mean	3.41	4.00	3.71	4.03
SD	.67	.59	.59	.77
Expectancy for Self-Efficacy				
Mean	3.49	4.23	3.97	4.16
SD	.66	.68	.54	.53

Table 3.4. Means and Standard Deviations for Variables in the Motivational Model

Motivational Goals	Liking Simulations			
	Not so		Yes	
	Age Group		Age Group	
	18-25	>25	18-25	>25
Intrinsic				
Mean	2.86	3.63	2.90	3.80
SD	1.35	.93	.96	.54
Extrinsic				
Mean	3.52	3.71	3.17	3.91
SD	1.36	.95	.86	.87
Task Value				
Mean	3.43	4.17	3.90	4.44
SD	.86	.64	.48	.62
Control of Learning Beliefs				
Mean	3.95	4.33	3.52	4.65
SD	.76	.62	.66	.49
Expectancy for Success				
Mean	3.64	4.13	3.38	4.39
SD	.69	.58	.56	.56
Expectancy for Self-Efficacy				
Mean	3.79	4.13	3.63	4.36
SD	.57	.35	.79	.72

Table 3.5. Means and Standard Deviations for Variables in the Motivational Model

Motivational Goals	Liking Audio			
	Not so		Yes	
	Age Group		Age Group	
	18-25	>25	18-25	>25
Intrinsic				
Mean	2.78	3.44	3.00	3.82
SD	1.17	.37	.98	.67
Extrinsic				
Mean	3.25	3.59	3.42	3.90
SD	1.00	.68	.91	.68
Task Value				
Mean	3.44	4.26	3.60	4.32
SD	1.02	.64	.79	.63
Control of Learning Beliefs				
Mean	3.71	4.19	3.89	4.44
SD	1.08	.58	.65	.52
Expectancy for Success				
Mean	3.41	3.94	3.52	4.10
SD	.80	.64	.63	.78
Expectancy for Self-Efficacy				
Mean	3.50	4.11	3.73	4.28
SD	.63	.42	.67	.68

Table 4.1. Means and Standard Deviations for Variables in the Instructional Design Model

ID Variables	Liking Email			
	Not so		Yes	
	Age Group		Age Group	
Relevance of Learning	18-25	>25	18-25	>25
Mean	3.11	3.38	3.26	3.85
SD	.98	.89	.94	.86
Reflective Thinking				
Mean	3.14	3.71	3.25	3.93
SD	.81	.95	.86	.79
Negotiation				
Mean	2.52	2.95	3.02	3.44
SD	.93	.89	.98	1.07
Empathy				
Mean	2.32	3.23	2.74	3.06
SD	.88	1.05	.99	.91
Support				
Mean	2.50	2.86	2.83	3.30
SD	1.02	1.07	1.01	.90
Adequacy of Tech Support				
Mean	3.50	3.43	4.06	4.41
SD	.89	1.49	.54	.64
Instructor Effectiveness				
Mean	3.02	3.19	3.56	3.86
SD	.98	1.10	.74	.76

Table 4.2. Means and Standard Deviations for Variables in the Instructional Design Model

ID Variables	Liking Online Discussions			
	Not so		Yes	
	Age Group		Age Group	
Relevance of Learning	18-25	>25	18-25	>25
Mean	2.85	3.69	3.41	3.87
SD	.89	.80	.82	.80
Reflective Thinking				
Mean	3.05	3.91	3.36	3.98
SD	.81	.86	.80	.73
Negotiation				
Mean	2.80	3.41	3.28	3.87
SD	.74	.81	.84	.66
Empathy				
Mean	2.51	3.07	2.92	3.30
SD	.77	.77	.90	.79
Support				
Mean	2.54	3.35	3.09	3.48
SD	.84	.84	.97	.79
Adequacy of Tech Support				
Mean	3.78	4.17	4.01	4.23
SD	.76	.79	.58	.65
Instructor Effectiveness				
Mean	3.25	3.72	3.66	4.03
SD	.89	.84	.65	.63

Table 4.3. Means and Standard Deviations for Variables in the Instructional Design Model

ID Variables	Liking Chat			
	Not so		Yes	
	Age Group		Age Group	
Relevance of Learning	18-25	>25	18-25	>25
Mean	3.35	3.50	3.83	4.00
SD	.84	1.01	.78	1.00
Reflective Thinking				
Mean	3.39	3.63	3.89	3.78
SD	.69	.95	.83	.51
Negotiation				
Mean	3.32	4.03	3.33	3.89
SD	.68	.37	1.23	.19
Empathy				
Mean	3.05	3.20	3.72	3.00
SD	1.01	.85	1.02	.67
Support				
Mean	3.26	3.60	3.83	3.89
SD	.87	.75	.96	.51
Adequacy of Tech Support				
Mean	3.84	4.57	4.33	4.57
SD	.53	.50	.47	.51
Instructor Effectiveness				
Mean	3.78	4.35	4.22	4.06
SD	.78	.43	.71	.42

Table 4.4. Means and Standard Deviations for Variables in the Instructional Design Model

ID Variables	Liking Graphics			
	Not so		Yes	
	Age Group		Age Group	
Relevance of Learning	18-25	>25	18-25	>25
Mean	3.00	3.97	3.53	3.80
SD	.87	.71	.86	.90
Reflective Thinking				
Mean	3.03	4.03	3.30	3.88
SD	.73	.67	.87	.74
Negotiation				
Mean	2.97	3.73	3.46	3.91
SD	.80	.95	.90	.67
Empathy				
Mean	2.56	3.39	3.09	3.39
SD	.71	.61	.98	.87
Support				
Mean	2.73	3.64	3.35	3.41
SD	.85	.71	1.10	.86
Adequacy of Tech Support				
Mean	3.95	4.49	4.21	4.41
SD	.43	.57	.61	.81
Instructor Effectiveness				
Mean	3.52	3.97	3.87	4.05
SD	.61	.60	.69	.83

Table 4.5. Means and Standard Deviations for Variables in the Instructional Design Model

ID Variables	Liking Simulations			
	Not so		Yes	
	Age Group		Age Group	
Relevance of Learning	18-25	>25	18-25	>25
Mean	3.48	3.08	3.78	4.33
SD	.69	.77	.99	.99
Reflective Thinking				
Mean	3.29	3.67	3.38	4.02
SD	.65	.86	.87	.87
Negotiation				
Mean	2.91	3.58	2.02	2.33
SD	1.37	1.04	1.38	1.37
Empathy				
Mean	3.10	3.17	2.47	2.77
SD	1.08	.69	1.43	1.23
Support				
Mean	3.14	3.58	2.64	2.94
SD	1.26	.43	1.30	1.12
Adequacy of Tech Support				
Mean	3.81	4.13	4.33	4.40
SD	.98	.96	.45	.87
Instructor Effectiveness				
Mean	3.88	4.19	3.39	3.43
SD	.90	.52	.86	.90

Table 4.6. Means and Standard Deviations for Variables in the Instructional Design Model

ID Variables	Liking Audio			
	Not so		Yes	
	Age Group		Age Group	
Relevance of Learning	18-25	>25	18-25	>25
Mean	3.12	4.07	3.54	3.70
SD	.98	.47	.80	.94
Reflective Thinking				
Mean	3.23	4.15	3.48	3.86
SD	1.00	.29	.85	1.03
Negotiation				
Mean	2.72	3.19	3.36	3.76
SD	.97	1.08	.87	.88
Empathy				
Mean	2.87	3.26	3.13	3.46
SD	.99	.60	.90	.93
Support				
Mean	2.97	3.59	3.28	3.70
SD	1.04	.55	.89	.78
Adequacy of Tech Support				
Mean	4.05	4.11	3.93	4.62
SD	.50	.87	.53	.50
Instructor Effectiveness				
Mean	3.72	4.19	3.72	4.13
SD	.82	.44	.63	.47

Table 5.1. Means and Standard Deviations for Variables in the Experiential Model

Prior Experiences		Liking Email			
		Not so		Yes	
		Gender		Gender	
		Male	Female	Male	Female
Prior Courses Taken					
	Mean	1.00	.97	2.72	1.94
	SD	.82	1.36	1.38	1.54
Word Processors					
	Mean	3.75	3.58	3.53	3.86
	SD	1.26	.83	.85	.84
Email					
	Mean	5.00	4.42	4.70	4.59
	SD	.00	.66	.67	.52
Internet					
	Mean	4.75	4.00	4.62	4.28
	SD	.50	.75	.72	.59

Table 5.2. Means and Standard Deviations for Variables in the Experiential Model

Prior Experiences		Liking Web Links			
		Not so		Yes	
		Gender		Gender	
		Male	Female	Male	Female
Prior Courses Taken					
	Mean	.50	.77	3.00	1.80
	SD	.58	1.17	1.34	1.51
Word Processors					
	Mean	4.25	4.31	3.95	4.12
	SD	.50	.75	1.15	.91
Email					
	Mean	4.50	4.46	4.65	4.65
	SD	1.00	.52	.93	.56
Internet					
	Mean	4.50	4.00	4.45	4.31
	SD	.58	.58	1.05	.76

Table 5.3. Means and Standard Deviations for Variables in the Experiential Model

Prior Experiences		Liking Online Discussions			
		Not so Gender		Yes Gender	
		Male	Female	Male	Female
Prior Courses Taken					
	Mean	2.30	1.17	3.06	1.99
	SD	1.46	1.34	1.27	1.59
Word Processors					
	Mean	3.43	3.57	3.56	3.93
	SD	.66	.69	.98	.88
Email					
	Mean	4.83	4.47	4.69	4.56
	SD	.39	.50	.78	.54
Internet					
	Mean	4.78	4.15	4.53	4.23
	SD	.42	.57	.88	.59

Table 5.4. Means and Standard Deviations for Variables in the Experiential Model

Prior Experiences		Liking Chat			
		Not so Gender		Yes Gender	
		Male	Female	Male	Female
Prior Courses Taken					
	Mean	1.75	2.04	4.00	1.00
	SD	1.71	1.60	.00	1.63
Word Processors					
	Mean	3.75	3.96	2.50	4.30
	SD	.50	.64	2.12	.95
Email					
	Mean	4.75	4.61	3.00	4.80
	SD	.50	.50	2.83	.63
Internet					
	Mean	4.50	4.36	3.00	4.40
	SD	.58	.56	2.83	.70

Table 5.5. Means and Standard Deviations for Variables in the Experiential Model

Prior Experiences		Liking Graphics			
		Not so Gender		Yes Gender	
		Male	Female	Male	Female
Prior Courses Taken					
	Mean	2.36	1.45	3.20	2.06
	SD	1.55	1.55	1.01	1.64
Word Processors					
	Mean	3.71	3.58	3.80	3.86
	SD	.61	.84	1.21	.80
Email					
	Mean	4.93	4.40	4.60	4.56
	SD	.27	.50	1.06	.61
Internet					
	Mean	4.71	4.10	4.58	4.11
	SD	.61	.50	1.06	.67

Table 5.6. Means and Standard Deviations for Variables in the Experiential Model

Prior Experiences		Liking Audio			
		Not so Gender		Yes Gender	
		Male	Female	Male	Female
Prior Courses Taken					
	Mean	2.00	1.69	2.38	2.35
	SD	2.83	1.65	.92	1.55
Word Processors					
	Mean	4.00	4.23	3.88	4.27
	SD	.00	.73	1.13	.78
Email					
	Mean	5.00	4.46	4.88	4.88
	SD	.00	.66	.35	.33
Internet					
	Mean	4.50	3.92	4.75	4.52
	SD	.71	.76	.46	.58

Table 5.7. Means and Standard Deviations for Variables in the Experiential Model

Prior Experiences		Liking Hypertext			
		Not so		Yes	
		Gender		Gender	
		Male	Female	Male	Female
Prior Courses Taken					
	Mean	2.00	1.33	2.80	1.24
	SD	1.63	1.35	1.62	1.45
Word Processors					
	Mean	4.50	4.33	3.80	4.64
	SD	.58	.82	1.40	.70
Email					
	Mean	4.50	4.67	4.50	4.88
	SD	1.00	.49	1.27	.44
Internet					
	Mean	4.75	4.20	4.40	4.36
	SD	.50	.68	1.27	.76

Table 6.1. Means and Standard Deviations for Variables in the Learning Styles Model

Learning Styles		Liking Email			
		Not so		Yes	
		Gender		Gender	
		Male	Female	Male	Female
Active LS					
	Mean	2.50	3.12	2.23	2.45
	SD	.58	1.32	1.03	1.05
Sensing LS					
	Mean	3.75	3.39	2.57	2.69
	SD	1.50	1.12	1.17	1.09
Visual LS					
	Mean	1.25	2.00	2.60	2.67
	SD	1.50	1.09	.96	1.13
Sequential LS					
	Mean	2.75	3.30	2.10	2.24
	SD	1.71	1.36	1.20	1.19

Table 6.2. Means and Standard Deviations for Variables in the Learning Styles Model

Learning Styles		Liking Online Discussions			
		Not so		Yes	
		Gender		Gender	
		Male	Female	Male	Female
Active LS					
	Mean	2.74	2.87	1.97	2.39
	SD	1.14	1.32	.82	.98
Sensing LS					
	Mean	2.96	2.96	2.53	2.72
	SD	1.26	1.16	1.19	1.12
Visual LS					
	Mean	2.17	2.19	2.59	2.73
	SD	1.15	1.13	.84	1.13
Sequential LS					
	Mean	2.70	2.92	1.87	2.20
	SD	1.46	1.36	1.01	1.14

Table 6.3. Means and Standard Deviations for Variables in the Learning Styles Model

Learning Styles		Liking Graphics			
		Not so		Yes	
		Gender		Gender	
		Male	Female	Male	Female
Active LS					
	Mean	2.29	2.60	2.00	2.22
	SD	.91	1.13	.93	.93
Sensing LS					
	Mean	2.71	2.80	2.87	2.50
	SD	1.14	1.02	1.36	1.18
Visual LS					
	Mean	2.00	2.20	2.87	3.11
	SD	.88	1.04	1.13	1.06
Sequential LS					
	Mean	2.29	2.52	1.80	2.14
	SD	.99	1.32	1.32	1.10

Table 6.4. Means and Standard Deviations for Variables in the Learning Styles Model

Learning Styles		Liking Hypertext			
		Not so Gender		Yes Gender	
		Male	Female	Male	Female
Active LS					
	Mean	2.00	2.27	1.80	2.76
	SD	.00	1.10	1.23	1.27
Sensing LS					
	Mean	2.25	2.80	3.50	3.64
	SD	1.89	1.27	1.35	.95
Visual LS					
	Mean	2.50	2.73	3.00	2.88
	SD	1.00	1.22	1.56	1.54
Sequential LS					
	Mean	1.00	2.33	2.10	2.84
	SD	.82	1.23	1.52	1.18

Table 7.1. Means and Standard Deviations for Variables in the Motivational Model

Motivational Goals	Liking Online Discussions			
	Not so Gender		Yes Gender	
	Male	Female	Male	Female
Intrinsic				
Mean	2.71	2.76	3.45	3.37
SD	1.05	.91	1.04	.81
Extrinsic				
Mean	3.14	3.22	3.45	3.69
SD	.76	.75	1.10	.86
Task Value				
Mean	3.29	3.38	4.16	4.11
SD	1.11	.87	.73	.70
Control of Learning Beliefs				
Mean	3.71	3.79	4.09	4.17
SD	.81	.72	.52	.67
Expectancy for Success				
Mean	3.71	3.63	3.66	3.82
SD	.80	.64	.85	.67
Expectancy for Self-Effic				
Mean	3.76	3.61	4.00	3.97
SD	.72	.60	.71	.69

Table 7.2. Means and Standard Deviations for Variables in the Motivational Model

Motivational Goals	Liking Hypertext: Not so Gender		Liking Hypertext: Yes Gender	
	Male	Female	Male	Female
Intrinsic				
Mean	3.58	3.52	3.73	3.51
SD	1.14	.62	.95	.64
Extrinsic				
Mean	2.83	4.07	3.37	4.24
SD	1.00	.59	1.06	.70
Task Value				
Mean	4.33	4.33	4.23	3.93
SD	.47	.59	.55	.75
Control of Learning Beliefs				
Mean	4.08	4.21	4.03	4.12
SD	.50	.52	.37	.74
Expectancy for Success				
Mean	3.50	3.86	3.50	3.74
SD	.58	.75	1.16	.58
Expectancy for Self-Effic				
Mean	4.13	4.07	3.90	4.04
SD	.25	.68	.70	.61

Table 8.1. Means and Standard Deviations for Variables in the Instructional Design Model

ID Variables	Liking Email: Not so Gender		Liking Email: Yes Gender	
	Male	Female	Male	Female
Relevance of Learning				
Mean	3.42	3.13	3.52	3.54
SD	1.17	.94	.94	.95
Reflective Thinking				
Mean	3.17	3.27	3.55	3.57
SD	1.17	.83	.88	.90
Negotiation				
Mean	2.00	2.69	3.17	3.23
SD	1.19	.88	.96	1.07
Empathy				
Mean	2.33	2.53	2.75	2.95
SD	.47	1.03	.91	.97
Support				
Mean	2.58	2.57	2.91	3.11
SD	1.14	1.03	1.01	.97
Adequacy of Tech Support				
Mean	3.67	3.46	4.24	4.20
SD	.72	1.05	.66	.59
Instructor Effectiveness				
Mean	2.88	3.08	3.54	3.76
SD	1.70	.90	.84	.72

Table 8.2. Means and Standard Deviations for Variables in the Instructional Design Model

ID Variables	Liking Online Discussions: Not so Gender		Liking Online Discussions: Yes Gender	
	Male	Female	Male	Female
Relevance of Learning				
Mean	3.33	2.93	3.75	3.58
SD	.94	.92	.77	.85
Reflective Thinking				
Mean	3.49	3.16	3.77	3.61
SD	.81	.94	.81	.83
Negotiation				
Mean	3.07	2.88	3.62	3.55
SD	.79	.80	.60	.86
Empathy				
Mean	2.58	2.66	3.04	3.12
SD	.73	.82	.74	.90
Support				
Mean	2.62	2.79	3.33	3.26
SD	.96	.89	.75	.95
Adequacy of Tech Support				
Mean	4.17	3.71	4.22	4.20
SD	.60	.81	.76	.61
Instructor Effectiveness				
Mean	3.23	3.41	3.87	3.82
SD	.98	.84	.67	.68

Table 9.1. Significant Main and Interaction Effects for Age and Gender

MODELS/ COMPONENTS	AGE Significant Main Effects	GENDER Significant Main Effects
Experiential Model		
Email	F (4, 229)= 7.76, p< .001	F (4, 230)= 3.76, p<.01
Web Links		
Discussions	F (4, 195)= 14.46, p< .001	F (4, 196)= 15.48, p<.001
Chat	F (4, 36)= 2.94, p<.05	F (4, 37)= 3.24, p<.05 Interaction effect: F (4, 37), p<.05
Graphics	F (4, 98)= 10.26, p< .001	F (4, 98)= 5.96, p<.001
Simulations	F (4, 43)=4.40, p< .01	
Audio	F (4, 103)= 15.02, p< .001	F (4, 103)= 4.79, p<.01
Video		
Hypertext		F (4, 47)= 3.11, p<.05
Learning Styles Model		
Email		
Web Links		
Discussions	F (4, 195)= 7.27, p< .001	
Chat		
Graphics	F (4, 98)= 2.84, p< .05	
Simulations		
Audio	F (4, 103)= 4.78, p< .01	
Video		
Hypertext		F (4, 47)= 2.75, p<.05
Motivational Model		
Email	F (6, 213)= 5.74, p< .001	
Web Links		
Discussions	F (6, 182)= 12.02, p< .001	
Chat		
Graphics	F (6, 91)= 6.76, p< .001	
Simulations	F (6, 40)= 4.81, p< .01	
Audio	F (6, 94)= 4.25, p< .01	
Video		
Hypertext		F (6, 44)= 3.73, p<.01
Instructional Design Model		
Email	F (7, 203)=2.33, p< .05	
Web Links		
Discussions	F (7, 171)=7.05, p< .001	
Chat	F (7, 28)=2.40, p< .05	
Graphics	F (7, 88)=4.32, p< .001	
Simulations		
Audio	F (7, 89)=2.74, p< .05 Interaction Effect: F (7, 89), p<.05	
Video		
Hypertext		

APPENDIX E

MULTIPLE REGRESSION ANALYSIS (SUMMARY RESULTS)

Table 10.1. Summary Results from the Multiple Regression Analysis for the Fourteen Variables Used for Model Building with "Likes Discussion" as the Dependent Measure.

Discussion	Model Summary		ANOVA				
	R	R^2	F	p	Beta	t	p
Model	.558	.311	5.26	.000			
Age					.000		
Employment Status					-.057		
Student Status					.045		
Prior Online Courses					-.022		
Active/Reflective LS					-.010		
Visual/Verbal LS					.104		
Sequential/Global LS					-.079		
Intrinsic					.203	2.13	<.05
Task Value					.159		
Self-Efficacy					-.037		
Relevance of Learning					.061		
Negotiation					.240	2.91	< .01
Adequacy of Tech Support					.054		
Instructor Effectiveness					-.041		

Table 10.2. Summary Results from the Multiple Regression Analysis for the Fourteen Variables Used for Model Building with "Likes Email" as the Dependent Measure.

Email	Model Summary		ANOVA				
	R	R^2	F	p	Beta	t	p
Model	.595	.354	7.55	.000			
Age					-.113		
Employment Status					.048		
Student Status					.163		
Prior Online Courses					.177	2.43	<.025
Active/Reflective LS					-.072		
Visual/Verbal LS					.167	2.59	<.01
Sequential/Global LS					-.163	-2.30	<.025
Intrinsic					-.095		
Task Value					.118		
Self-Efficacy					.050		
Relevance of Learning					-.006		
Negotiation					.071		
Adequacy of Tech Support					.190	2.74	<.01
Instructor Effectiveness					.073		

VITA AUCTORIS

NAME:	Elena Qureshi
PLACE OF BIRTH	Volgograd, Russia
YEAR OF BIRTH	1971
EDUCATION	Volgograd State Pedagogical University, Russia 1989-1994 B.A./M.A.
	University of Windsor, Ontario 1999-2001 M.Ed. in Educational Administration
	University of Windsor, Ontario 2001-2004 Ph.D. in Educational Studies