IDENTIFYING AT-RISK STUDENTS: AN ASSESSMENT INSTRUMENT FOR DISTRIBUTED LEARNING COURSES IN HIGHER EDUCATION

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The current period of rapid technological change, particularly in the area of mediated communication, has combined with new philosophies of education and market forces to bring upheaval to the realm of higher education. Technical capabilities exceed our knowledge of whether expenditures on hardware and software lead to corresponding gains in student learning. Educators do not yet possess sophisticated assessments of what we may be gaining or losing as we widen the scope of distributed learning.

The purpose of this study was not to draw sweeping conclusions with respect to the costs or benefits of technology in education. The researcher focused on a single issue involved in educational quality: assessing the ability of a student to complete a course. Previous research in this area indicates that attrition rates are often higher in distributed learning environments. Educators and students may benefit from a reliable instrument to identify those students who may encounter difficulty in these learning situations. This study is aligned with research focused on the individual engaged in seeking information, assisted or hindered by the capabilities of the computer information systems that create and provide access to information.

Specifically, the study focused on the indicators of completion for students enrolled in video conferencing and Web-based courses. In the final version, the Distributed Learning Survey encompassed thirteen indicators of completion. The results of this study of 396 students indicated that the Distributed Learning Survey represented a

reliable and valid instrument for identifying at-risk students in video conferencing and Web-based courses where the student population is similar to the study participants. Educational level, GPA, credit hours taken in the semester, study environment, motivation, computer confidence, and the number of previous distributed learning courses accounted for most of the predictive power in the discriminant function based on student scores from the survey.

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I dedicate this dissertation to my parents, Dorothy Jo Osborn and Garland Hurchel Osborn; to my sister, Roxie Irl Turner; and to my brother, Thomas Lloyd Osborn.

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CHAPTER 1

PROBLEM STATEMENT

Introduction

This study investigated the barriers to information acquisition for students who receive instruction through the use of technical media and who also communicate with the instructor and with other students primarily through some form of telecommunications. Specifically, the research investigated the reliability and validity of an assessment instrument for students taking distributed learning courses. The researcher constructed the instrument and analyzed it for predictive validity with a sample drawn from students enrolled in distributed learning courses at a university located in the southwestern United States.

The research questions for the study fall within the academic disciplines of instructional technology and information science. In the past, key areas of information science research involved a focus on bibliometric analysis and on information retrieval systems. Though these research areas continue to be important, current work by information scientists includes investigations that seek to understand and improve the diverse, digital, networked, and increasingly personal systems for accessing and acquiring information (Levy, 1995; Lynch, 1995; Saracevic, 1990).

The perspective on information science represented by these recent areas of research reflects a statement by the NATO Advanced Study Institutes in Information Science concerning the foundations of the discipline. Information science is "centered around the nature of information, the nature of information systems, technology and its impact on society and resources (personnel and education)" (Debons, 1991, p. 338). Such a conception of information science is compatible with an expanded range of interdisciplinary studies.

The current study is aligned with research focused on the individual engaged in seeking information, assisted or hindered by the capabilities of the computer information systems that create and provide access to information. As computer-mediated communication becomes ubiquitous, the environment for acquiring this information is not defined by systems in one physical location. The distributed information system, and the arena for information science research, may span the library, classroom, conference room, office, and home.

Problem Statement

At the present time, universities offer distributed learning courses that include the use of multimedia, telecommunications, and collaborative methods. A survey instrument that identifies the key variables that contribute to students' ability to complete a distributed learning course would assist students, faculty, instructional designers, and university administrative personnel.

This study addressed the following research questions:

1. What are the critical factors, in terms of abilities, attitudes, and situational variables, that contribute to a student's ability to complete a distributed learning course?

2. Using a brief survey instrument, does a weighted combination of the critical factors indicate which students are at-risk in terms of the probability that the students will complete the distributed learning course?
3. Do the critical factors correlate with the student's level of satisfaction in the course?

To avoid confusion with the term factor in statistical analysis, the researcher used the term indicator when discussing student characteristics related to the completion of the course.

Background

Many questions arise in the discussion of distributed learning, such as the nature of learning, the components of the learning environment that facilitate a student's ability to acquire knowledge, and the effect of mediated communication on messages, the instructor, and the student. These questions are not new. Philosophers, psychologists, communication specialists, computer scientists, information scientists, and educators have studied cognition and developed theories to describe and explain the variables that influence information acquisition and learning. In the last 20 years, however, our methods of education have come under intense scrutiny. Current economic, technological, and social forces are contributing to a restructuring and re-evaluation of the educational services (Green & Hayward, 1997; Harasim, 1996; Saba, 1997).

Universities and community colleges are revising their course offerings to include technology-based instructional delivery and communication (Institute for Higher Education Policy, 1999). Two major issues provided the context for the current study. The first issue centered on the causes or forces that are driving these changes in instructional delivery in higher

education. The second issue concerned the effect of the multiple course formats on the quality of learning for the students.

Forces of Change

Increasingly, individuals find that they need a college degree and specialized training in order to secure and maintain employment. These new students, in turn, have changed the composition of higher education classes. The learning styles and other characteristics of these students tend to reflect the population as a whole, rather than the subset of the population traditionally attracted to academic life. In addition, a higher percentage of students are pursuing a degree while working off-campus in full or part-time jobs. The faculty may find that the tried and true methods of instruction may not be as effective as in the past (Schroeder, 1993; Somervill, 1997).

The proliferation of computer networks, on campus and in the workplace, and the growth of the Internet present additional challenges to the status quo (Anderson & Garrison, 1998; Duderstadt, 1998; Sengstack, 1996). Employers want workers who are familiar with collaborative methods, computer-mediated communication, and productivity software (Gibson, 1998c; Novek, 1996). In response to these pressures, institutions of higher education are attempting to prepare students adequately for participation in an Information Age economy.

Universities and community colleges may adopt the use of computers and telecommunications technology to meet student needs, maintain a competitive edge in attracting students, and establish their image as leaders in integrating technology into the educational

experience (Besser & Donahue, 1996; Green & Hayward, 1997; Novek, 1996). In addition, financial pressures contribute to institutions' reevaluation of traditional methods (Anderson & Garrison, 1998; Besser & Bonn, 1996; Novek, 1996). University administrators may view technology as an opportunity to achieve their goals while downsizing faculty and attracting corporate funding (Guskin, 1997).

Format and Quality of the Learning Environment

A learning environment provides the context for teaching and for learning. Moore and Kearsley (1996) advocate a systems approach for understanding distributed learning environments, in particular. From a systems perspective, the learning environment is an integrated unit made up of components that influence one another in complex interrelationships. To examine each component separately is not enough. "The whole system is more than the sum of the contributions of each individual part" (Infante, Racer, & Womack, 1997).

Ever-increasing numbers of courses feature telecommunications technology and new models of learning. Whether described by the term distance education (Moore & Kearsley, 1996), distance independent learning (Besser & Bonn, 1996) or distributed learning (Oblinger & Maruyama, 1996), these instructional situations allow students and instructors to enter and participate at different times, from different locations, or both. Often, these environments involve an increased focus on meeting learner needs. As the aspect of physical distance is introduced into the educational experience, media and the resulting mediated communication

between participants contribute to the instructional situation in significant ways (Moore & Kearsley, 1996).

Each course format presents a specific set of demands on the student and on the instructor in terms of both skills and responsibilities. In discussing the variety of learning environments, a time-space matrix provides a useful taxonomy (Ellis, Gibbs, & Rein, 1991). The matrix includes four categories or quadrants:

1. same place and same time;
2. same place and different time;
3. different place and same time; and
4. different place and different time.

Same place and same time environments correspond to the traditional classroom. An instructional lab situation represents one version of the different time and same place category (Besser, 1996). Distributed learning environments include the categories of different place and same time (synchronous communication) and different place and different time (asynchronous communication).

Of course, neither synchronous nor asynchronous communication is a novel development in education. What is new in the application of technology to the educational experience is the spectrum of capabilities for instructional delivery and for facilitating interaction among students and between the instructor and students. Donahue (1996) pointed out that instructional technology may be used for two distinct functions: to deliver the content and to

facilitate communication. Turner (1996), an early investigator of computer-mediated communication in educational settings, noted both the advantages and drawbacks associated with the use of technology. From a systems perspective, modification of the instructional model or philosophy, as well as the method of delivery and the means of communication and interaction, influence every other element in the learning environment. This signifies an impact on students, instructors, facilitators, and administrators.

In the discussion of the future of higher education in the United States, there are voices sounding the alarm, claiming that in the rush to embrace educational technology we are making an expensive mistake (Noble, 1997). When educators introduce technical media, such as television, e-mail, Web-based presentations, video conferencing, and computer conferencing, into the system, the learning environment changes. Researchers point out that computer-mediated communication, and the distributed learning environments based on such technology, may be different in fundamental ways from traditional methods of communication and delivery of information (McHenry & Bozik, 1995). Westera (1999) outlined some of the changes inherent in networked learning environments, including the distortion of emotional content in computer-mediated communication, the change in authority patterns from hierarchical to egalitarian, and a decrease in the importance of speaking skills and assertiveness.

Faculty question whether the revamping of higher education will proceed with due consideration of appropriateness and educational benefit. Some fear that this path will lead to the devaluation of the teaching profession and to a less human view of education and of the

students involved in it (Novek, 1996). A major concern is the level of attrition for students in this new wave of non-traditional courses. Dropout rates are generally higher when the student is separated from the instructor and from the other students (Holmberg, 1994; Ridley, Miller, & Williams, 1995; Towles, Ellis, & Spencer, 1993).

On the other hand, our Western culture has given us a predisposition to see progress in the introduction of new technology. The voices of optimism promise that if we are farsighted and courageous, new vistas of educational opportunity will open for our citizens (Blick, 1995; Novek 1996). While the use of telecommunications in educational settings does not automatically equate with increased student learning, the development of these distributed learning environments does offer opportunities for students and for institutions of higher education (Mortensen, 1997; Turner, 1996). Leaders in the fields of human-computer-interaction, information science, and telecommunications acknowledge the transformations possible through the use of computer networks: the capacity to empower, to decentralize and to globalize modern life, in virtual classrooms and virtual communities (Harasim, 1996; Negroponte, 1995; Pelton, 1998). Through multimedia and hypermedia we may be able to individualize instruction, accommodate learners' cognitive styles, and implement the visions of information scientists to increase access to the body of recorded knowledge (Bush, 1945; Goldberg, 1992; Henderson, 1996).

A key issue is how and to what extent distributed learning environments enhance or detract from a student's ability to learn. Determining why some students succeed and others do

not becomes increasingly important, “as distance education moves from a marginal to an integral role in overall educational provision” (Powell, Conway, & Ross, 1990, p. 6). In this time of transition and change, those concerned with educational quality must seek to preserve "what is worth keeping" from the university that has been based on traditional classroom instruction, while adopting methods that may enhance the learning experience (Brown & Duguid, 1996; Gibson, 1998c; Novek, 1996; Saba, 1997).

Purpose of the Study

This study focused on a central aspect of educational quality: the student’s ability to acquire information in a given learning environment by successfully completing a course. The purpose of the study was twofold: to identify a set of indicators related to a student’s ability to complete a distributed learning course and to design an assessment instrument based on key variables identified in existing theory and tested in previous research. Wherever feasible, the instrument included items previously tested for reliability and validity.

Significance of the Study

The number of distributed learners and the number of institutions of higher education that offer distributed learning courses and programs are increasing. The quality of educational offerings depends on whether these changes maximize the opportunities for student learning and minimize any negative effects. Evaluation plays a key role in this effort. As Gibson (1998d) pointed out, distance learners represent a heterogeneous group. Educators involved in distributed learning programs need access to an accurate profile of their students. This study

addressed that need through the creation and testing of an assessment instrument for distributed learning students. As such, the research contributes to the on-going conversation regarding the appropriate use of information technology in higher education.

We know that student attrition rates often increase substantially when institutions offer courses in non-traditional, technology-based formats (Institute for Higher Education Policy, 1999). This study applied the knowledge of the distance learner gained through current research in the field, in order to understand the individual learner who enrolls in a distributed learning course (Gibson, 1998c). By specifying key variables that indicate at-risk students for a given distributed learning environment, the instrument developed in this study provided assessment information that may assist students, faculty, instructional designers, and administrators.

The instrument developed in this study may provide guidance for students with respect to the appropriateness of a given course of instruction. It may indicate whether a student can expect to encounter difficulties in completing a specific distributed learning course, given the student's current situation, attitudes, and abilities. The Distributed Learning Survey provides a means of assessment at the beginning of a course, when the student has not yet invested a significant amount of time, money, and emotional involvement in the course (Turner, 1993).

A student's score on the instrument will allow faculty to adjust the course structure, in terms of course activities and the level of interaction, to meet the identified student needs (Biner & Dean, 1997a; Gibson, 1998a). For the current semester, some aspects of the course remain

flexible. These modifiable components may include orientation sessions at the beginning of the semester, expansion of on-campus office hours, degree of interaction via e-mail and telephone, and types of projects included in the course requirements.

Taking a long-range view, the results of this study have implications for those who design instructional materials and instructional system interfaces. Based on an aggregate of student scores, the designers may revise course components to increase compatibility with identified aptitudes, attitudes, and needs (Kember, 1995). Such modifications could affect the design of collaborative projects, the development of multimedia courseware, or the provision of reminders to students regarding assignment requirements and due dates. In addition, by providing information to the institution regarding student needs, a predictive instrument such as the one developed in this study will support quality education, in terms of the type and format of the courses offered and support services provided, such as tutoring, advising, and counseling (Biner & Dean, 1997a).

Limitations, Delimitations, and Assumptions

Limitations

The following aspects of research were not subject to the researcher's control and pose limitations to the study:

1. The researcher tested the instrument at a single institution: a medium-sized, state-supported university in the southwestern United States. The results of the study may not be generalizable to the entire population of higher education students.

2. The measurement of the key variables was based on self-reported information.
3. Students and faculty were not required to participate in the study. Since participants in the study were not randomly selected from the student or faculty populations, the results may not be generalizable to all of higher education.

Delimitations

The researcher controlled the following aspects of the research that represent restrictions on the proposed study:

1. The courses included in the study represented a subset of the formats for distributed learning. These courses used video conferencing and instructional delivery available through the Internet. The factor weighting based on discriminant analysis of the instrument may be limited to these course formats. The results of this study may not be generalizable to other types of distributed learning courses.
2. Participants in the reliability and validity tests of the instrument were enrolled in classes during 1999.

Assumptions

1. A student's score on the instrument described in this study indicated a stable representation of that person's characteristics for the time period of the course, approximately three months.
2. Student responses to three or four items in a survey format gave a valid indication of each indicator of the student's ability to complete a distributed learning course.

Definition of Terms

distributed learning course - a course of instruction provided by an institution of higher education that exhibits the following characteristics:

1. an instructor who designs the environment and acts as a guide, rather than as a gatekeeper of information;
2. use of information technology and networked delivery of instruction;
3. provision for two-way communication between students and between instructor and students, using asynchronous forms of communication or a combination of asynchronous and synchronous communication; and
4. a learning environment where students and faculty may enter at different times, from different locations, or both (Keegan, 1991; Moore & Kearsley, 1996; Oblinger & Maruyama, 1996).

enrollment in a distributed learning course – for this study a student is enrolled in the course when the student registers and maintains that enrollment:

1. until the orientation class in a Web-based course;
2. through the initial class meeting for a video conferencing course; or
3. until that student begins or completes initial activity or assignment for the course.

non-completion of a distributed learning course by a student - for the purposes of this study non-completion occurs when a student enrolls in a distributed learning course and then subsequently:

1. formally withdraws from the course; or
2. does not complete one or more units of the course, including the final project or examination.

CHAPTER 2

REVIEW OF RELATED LITERATURE

> What gets measured is usually what gets improved (Westerheijden, 1997, p. 58).

Introduction

This chapter reviews the literature that forms the foundation for the study. The first section gives an overview of the theories related to student completion of distributed learning courses. The major constructs discussed by Billings, Tinto, Kennedy, Powell, Conway, Ross, and Kember formed the theoretical basis for the distributed learning instrument developed in this study.

Next, the chapter addresses relevant research in the areas of instructional technology and student outcomes. This section examines issues such as learning assessment, learning philosophy and goals, media characteristics, and instructional design. Also, it includes a discussion of student satisfaction, student success and profiles of the distance learner, as given in current studies of distributed learning. The final section presents aspects of human information processing, as they relate to the distance learner. The topics addressed include the human factors of motivation, autonomy, self-confidence, anxiety, and learning style.

The researcher designed the current study to develop an instrument to assess critical characteristics of the distance learner. The purpose of the instrument was to allow students and

faculty to measure these characteristics at the beginning of a semester, or at the initiation of a student's program, so that they may make more informed decisions. In addition, the instrument could provide faculty and administrators with an assessment of student needs so that they may more effectively guide and assist students in distributed learning courses.

Theoretical Framework

Though the research related to distributed learning is extensive, attention to theory building has been noticeably lacking (Kember, 1995). A well-defined theoretical base would make explicit the underlying assumptions in this area of scientific investigation and would focus potential research questions (Buckland, 1991). Given the crucial role that theory plays in framing research, it is not surprising that the study of distributed learning and the application of instructional technology has seemed to lack direction (Kennedy & Powell, 1990; Moore & Kearsley, 1996). Early research into student success and course completion focused on a single variable to explain attrition and these studies were noticeably unsuccessful in explaining and predicting students' completion or non-completion. Studies that investigated entry characteristics alone, even when regression analysis was used to consider a large number of variables, produced insignificant results.

The models described in this section take a systems view of the issue, accounting for the interdependencies of factors and for the complexity inherent in analyzing the student's participation in multiple spheres of activity (Garrison, 1985; Kember, 1995; Powell, Conway, & Ross, 1990; Tinto, 1997). These theories affirm the ecological system theory of human

framed by Bronfenbrenner in the 1970's (Gibson, 1998b). Bronfenbrenner (1977) advocated the evaluation of a person's behavior and development in the context of relationships with other individuals and groups. In his model, he viewed the active individual engaged in and responding to forces from immediate settings and the larger social environment. Within this framework, a researcher studies the dynamic relations of the learner in multiple, interacting settings, considering the "the factors of place, time, physical features, activity, participant, and role" found in each setting (Bronfenbrenner, 1977, p. 514).

Billing's Model of Correspondence Course Completion

Based on studies of nurses enrolled in correspondence courses, Billings (1989) developed a model for student completion of such correspondence courses. In her discussion, Billings noted that the issue of attrition in correspondence instruction bears similarity to the dropout problem in part-time, on-campus instruction. In selecting variables and developing the causal structure, she followed guidelines developed by Bean (1980). Billings identified four sets of variables: background variables, organization variables, attitudinal variables, and outcome variables. Billings used "intention to complete the course" as an intervening variable. Studies based on the model indicated that the most significant predictors were entrance examination scores, GPA, completion of other correspondence courses, perceived family support, and high goals for completing the program.

Tinto's Model of Persistence

Tinto (1997) is one of the leading researchers in the study of student persistence, with a focus on student completion of higher education courses in the traditional classroom format. Recently he has investigated the applicability of his theory to courses and classroom communities that involve computer-mediated communication and collaboration. Interaction within various communities that involve the student and the relationship to attrition constitute a major focus of Tinto's theoretical framework (Fjortoft, 1995).

At the center of Tinto's model is the idea of integration, a construct borrowed from Durkheim's investigation of suicide (Kember, 1995). Durkheim documented that one form of suicide is prevalent in individuals who experience isolation from the social community. He noted that these individuals lack integration into society, both socially and intellectually. They do not establish close personal ties with others nor do they experience sufficient "commonality in values and beliefs with those of the relevant community" (Kember, 1995, p. 29). Tinto found this description illuminating in terms of student behavior with respect to dropout from college courses. He hypothesized that students are at-risk for dropout, in a manner similar to Durkheim's suicide victims, when they are unable to embrace the values or to find a place in college social life (Tinto, 1975).

In his recent elaboration on the theory, Tinto (1997) highlighted the interaction of these types of integration with elements of instruction such as collaboration, computer-mediated communication, and interdisciplinary subject matter. Course completion is the primary outcome

variable in his model (Tinto, 1975). He identified five major factors that lead to course completion and continued enrollment. The first factor is pre-entry attributes that encompass skills and abilities, prior schooling, and family background. The second and third factors, student goals and student commitments, also play a significant role in course completion. The student's contact with the institution, both academically and socially, contribute to the final two factors designated in the model: level of academic integration and level of social integration that each student attains.

Kennedy and Powell Descriptive Model

Kennedy and Powell (1976) studied withdrawal behavior for students enrolled in the British Open University system. They employed a qualitative, case-study approach in developing their descriptive model that takes account of two categories of variables related to course completion: student characteristics that are subject to little or no change over the academic period and circumstances subject to rapid variation. The researchers considered motivation, educational background, educational self-concept, personality, aptitude, and stage of adult development in the category of student characteristics. Circumstantial variables included occupation, health, finances, family relationship, peer relationships and institutional support. Kennedy and Powell (1976) projected these categories onto a two-dimensional grid, with student characteristics on the vertical axis and circumstances on the horizontal axis. This representation localized the at-risk student on the left side of the graph, where problems with circumstances coincide with weaknesses in student characteristics.

These researchers concluded their overview with the observation that in addition to the "external, circumstantial reasons for withdrawal," non-completing students often feel insecure and inferior (Kennedy & Powell, 1976, p. 25).

Powell, Conway, and Ross' Empirical Model

An empirical model established by Powell, Conway, and Ross (1990) presented a three-faceted framework that builds on the Kennedy and Powell model, highlighting students' predisposing characteristics, life changes, and institutional factors. The authors based their model on prior research, rather than on any one theoretical perspective. This model parallels the one developed by Billings in two major areas, in the categories of predisposing characteristics/ entry characteristics and institutional factors/ organizational variables. In their original study, these researchers conducted a discriminant analysis of students beginning study in an open university environment. The model developed by these researchers classified 69% of the respondents correctly in terms of completion. Subsequent research based on the model indicated that the category of predisposing characteristics was strongest determinant of student completion.

Kember's Open Learning Model

In his Open Learning Model Kember (1995) drew substantially from Tinto's model of persistence. He described the major factors, such as student entry characteristics, social integration and academic integration, that contribute to student completion of distributed learning programs. Kember based his model on the work of "several researchers in four countries,

which were radically different in nature" and then tested the model extensively at two institutions (Kember, 1995, p. 217). He designed a sophisticated framework that encompassed "the situational, dispositional, and institutional deterrents to adult participation in education" (Fjortoft, 1995, p. 2).

As in Tinto's model, two dimensions of integration, academic and social, formed the nexus of the Open Learning Model. Kember presented both types of integration as a continuum. For the quantitative analysis of the model, he developed the Distance Education Student Progress (DESP) questionnaire. Along the social dimension, a student may tend toward social integration or external attribution. In the DESP the social integration component consisted of three subscales: enrollment encouragement, study encouragement, and family support. To uncover elements of external attribution, Kember asked students questions regarding distractions, amount of study time, hindrances to study, and doubts about the value of the study. This construct reflected how well adult, part-time distance learning students accommodate academic demands in the context of employment, family, and other social obligations.

In the academic dimension, Kember assessed students on a continuum from academic integration to academic incompatibility. This component included subscales to assess "approach to study, motivation, impression of the course" and language ability (Kember, 1995, p. 137). The academic dimension involves all aspects of the course and of student interaction with the institution. In assessing academic integration, Kember considered both positive and

negative facets. A positive approach to studying is manifest in the enjoyment of reading; a deep approach that emphasizes the underlying meaning of instructional activities; and intrinsic motivations. On the negative side, academic incompatibility encompasses a surface approach to the subject; extrinsic motivations; negative evaluation of assignment feedback and course materials; and an assessment of language ability.

Kember (1995) described in some detail the process of including entry characteristics in the model. He noted the correlation of some entry variables, such as educational background, employment, and family status, with persistence in open learning programs, but his overall message was one of caution. These characteristics, while statistically significant in some studies, generally account for a very small percentage of the variance in attrition rate. In the final version of the DESP the researcher asked questions regarding the student's age, gender, marital status, salary, years of work experience, and highest academic level achieved. He included these entry variables because of their influence on students' integration behavior, not because they constitute good predictors, alone or in combination with one another.

Conclusion

In keeping with Bronfenbrenner's perspective that emphasizes the person in an "ecological environment," each model presented in this section accounted for a set of factors that impact the student's behavior and decisions in the immediate setting and in the larger environment. Background characteristics, such as age, were integrated into the theoretical framework as contributing elements, rather than as isolated predictors. The Billings' model

presented three sets of variables as the primary influences on course completion: organizational, environmental, and attitudinal variables. Tinto and Kember viewed these factors primarily as aspects of academic and social integration. Powell and his colleagues highlighted the temporal side of the variables that contribute to student completion of distributed courses. Specifically, Kennedy and Powell identified characteristics that tend to be stable over time, such as educational background and personality. In addition, they described circumstances that are subject to rapid change, including health and finances.

Each of these models focused on students in higher education courses. The learning environments considered by the researchers span a continuum from traditional classroom situations to the open university approach to instruction. A systems perspective unites the five models of student completion. In addition, the theories exhibit a degree of consensus on the key variables, for example, motivation and family support, that contribute to student completion of higher education courses.

Instructional Technology

> Radio will become one of the most powerful constructive forces for education of our people if we devote adequate attention to the development of truly educational programs (Marsh, 1937, in Moore, 1997, p. 2).

The focus of this study was the student in a distributed learning environment. Technology to deliver instruction to these students and to facilitate communication "across the distance" was a dominant factor in how students acquire the information they are seeking. In this context, distance is measured in terms of physical and psychic separation of students from

their classmates and from their instructors (Besser & Bonn, 1996). Over the last 50 years, there has been no shortage of research or speculation regarding the relationship of technology and learning. Visionaries have welcomed each new wave of innovation with the expectation that the means to revolutionize education had arrived (Dede, 1995; Moore, 1997).

Extensive research efforts have focused on whether the technology used to deliver instruction substantially affects learning outcomes for the student (Hiltz, 1997; Moonen, 1996, Thomerson & Smith, 1996). Rather than centering on the learning process, "the dynamics of students' acquisition of new knowledge, skills, or sensitivity," most research has focused on outcomes that were easy to measure (Cookson, 1989, p. 23). Russell (1996) addressed this long-standing debate in his analysis of 218 media comparison studies. He found a general consensus that the media employed in educational settings does not determine educational effectiveness when effectiveness is assessed in terms of course grades and short-term retention of course content. Russell titled this finding, "The 'No Significant Difference' Phenomenon."

Several crucial issues are involved in an evaluation of this body of research with respect to the current study of distance learners. An initial question centers on whether learning can be equated with a student's score on an objective posttest or with the student's grade in a course. Typically, researchers have operationalized achievement in such ways (Biner, Welsh, Barone, Summers, & Dean, 1997; Hiltz, 1997). This question points to the need to distinguish information dissemination from information acquisition and a deep approach to learning from a surface one.

Additional considerations include the underlying philosophy of learning embodied in the instructional goals and in the instruction itself; media characteristics; and, finally, the quality of instructional design and implementation. Often researchers overlook or minimize the complexities inherent in the application of technology as they move on to assess instructional outcome variables. As background to this study, the following sections address four issues and their relationship to research on instructional technology and distance learners: the assessment of learning, learning philosophy and goals, media characteristics, and instructional design.

Assessment of Learning

Educators should be aware that providing access to information is distinct from providing successful learning experiences (Gibson, 1998c). Teaching is distinct from learning and the dissemination of information does not equate with acquisition of that information. The case can be made that both classroom instruction and the more traditional forms of distance education have emphasized information transmission, rather than information acquisition (Olgren, 1998; Salomon, 1998).

The perspective taken by Russell (1996) reflects an information transfer model of learning. When the learning objective is content delivery, then a distributed learning course may employ any medium to accomplish that purpose. Clark's famous statement that "media are mere vehicles that deliver instruction but do not influence student achievement any more than the truck that delivers our groceries causes changes in our nutrition" relates specifically to the content delivery objective (Clark, 1983, p. 445).

Determining whether a person has acquired the needed information, in the sense that it is transformed into knowledge that will be retained and will be useful in the future is, of course, more problematic. In any classroom situation it is difficult to assess the acquisition of deep knowledge and such a task in a distributed learning setting is just as difficult (Sandberg & Barnard, 1997). Deep learning is exemplified by learners "who seek the underlying meaning of what they read and actively relate it to their own experience and needs" (Kember, 1995, p. 257). At the levels of learning that can be easily assessed, the impact of technology is apparently insignificant, as noted by Russell and Clark. For intellectual behaviors beyond comprehension and application of factual material, the same conclusion is questionable (Novek, 1996; Salomon, 1998).

Learning Philosophy and Goals

As institutions implement distributed learning courses, they also activate alternative models of instruction. Hannafin and Land (1997) made the observation that "all learning environments, explicitly or tacitly, reflect underlying beliefs about how knowledge is acquired and used" (p. 172). The choices that are justified, in terms of the theoretical framework and subsequent design of the learning environment, ultimately depend on the underlying purpose of the instruction.

Historically, many leaders involved in providing educational opportunities to a geographically dispersed population embraced a Fordist or neo-Fordist strategy, based on the model of industrialization (Hanson, et al., 1997). This point of view emphasizes central authority

and the mass production of course curricula. Such a philosophy was prevalent when print materials and television broadcasts dominated in the area of instructional delivery for distance education. This strategy still appeals to some educators, particularly in developing countries, who see distributed learning as a cost-effective method for reaching a geographically dispersed population in order to increase literacy and provide training.

An alternate perspective, the Post-Fordist strategy, focuses on the importance of human interaction and individualization of instruction (Hanson, et al., 1997). Hannafin and Land (1997) point out that developments in computer technology and telecommunications provide feasible alternatives to the more traditional methods. These alternatives involve a more student-centered learning environment. When theorists and researchers compare distributed learning to a more traditional approach, such evaluation requires acknowledgement of the goals and assumptions that support the learning method, not simply a discussion of the media or a comparison of the results of outcome measures (Hannafin & Land, 1997). Essentially, the investigators are testing alternative models of instruction that emphasize factors such as individual exploration, team learning, variety, the teacher as manager and guide, and dynamic content (Anderson & Garrison, 1998; McHenry & Bozik, 1995; Oblinger & Maruyama, 1996).

As noted above, Hannafin and Land (1997) suggest the goals and objectives for learning should guide the construction and evaluation of the learning environment. If the learning goal is primarily to deliver content to learners motivated and ready to receive it, then the educator may not need to find ways of implementing a high degree of interaction. On the other

hand, "if we aim to address sophisticated learning goals involving in-depth study, problem solving, and reasoning, alternative assumptions, foundations and methods must be developed" (Hannafin & Land, 1997, p. 197-198).

When educators seek to encourage a deep approach to learning, they must focus on learners and their needs. Here, a situated learning philosophy and constructivist model, articulated by theorists such as Piaget, Bruner, and Lave, may be appropriate with a corresponding emphasis on integrating information, skills, and appropriate application in both the social and physical world. Oliver and Reeves (1996) suggested the following four dimensions of effective, interactive learning: collaboration, generative learning, contextual engagement, personal autonomy, and motivation. This perspective reflects a holistic view rather than a mechanistic one, where learning is a natural process in which context and awareness of socially determined patterns of behavior are critical ingredients as a person acquires knowledge and skills (Laurillard, 1993).

According to this view of learning, the student is involved in a "sense-making" process that involves the whole person, emotions, intellect, and will (Laurillard, 1993). The shift away from a teacher-centered, broadcast mode of instruction to an information processing one transforms the learner's role and requires an increased emphasis and support for the learning process (Linn, 1996; Rothenberg, 1994). Without this emphasis on needs assessment and student-centered learning, we may create a situation where "not only will these

[communications] technologies be underexploited, but they may well reinforce the current limitations of our higher educational system" (Brown & Duguid, 1996, p.19).

Media Characteristics

It is clear that the various technologies available to deliver instruction and facilitate communication possess distinct capabilities (Hanson, et al., 1997). It is the introduction of physical and psychic distance, through the use of technical media, that makes distance education "fundamentally different from traditional, face-to-face instruction" (Schlosser & Anderson, 1994, p. 14). In his theory of symbol systems, Salomon suggested that the media employed in the knowledge acquisition process influence messages and participants. Each medium varies in the aspects of content that tend to be reinforced and in the processing demands on the learner (Kearsley, 1997). Although the effect of media characteristics is still a matter for debate in the research community, an understanding of the potential benefits and inherent limitations of each technology is a basic prerequisite for instructional design (Clark, 1994a; Kozma, 1994; Salomon, 1998).

A number of researchers have proposed a classification scheme for the technologies employed in distributed learning. They specify features such as modality, level of interaction supported, opportunity for feedback and collaboration, level of learner control, flexibility, one-way or two-way communication, and synchronous or asynchronous access (Chen, 1997; McIsaac & Gunawardena, 1996). In addition to these features, Salomon (1984) found evidence that learners' expectations of the technology may contribute to the overall effectiveness

of that technology for instruction. When there is a mismatch of task difficulty and the level of effort associated with a media type, such as the use of television for instruction of language skills, an instructional environment based on that media may be ineffective for a significant portion of the population.

Instructional Design and Implementation

Technological innovation, in the form of hypermedia and high-speed, digital networks, offer new possibilities for delivering instruction and sharing resources. Will technological developments alone bring a revolution in the field of education? According to Moore (1997), the answer to that question is probably, "No." The potential educational benefits of networking, collaborative systems, and hypermedia instructional software seem obvious. Moore's cautionary statements indicate that effective instruction depends on collective will, in terms of priorities and financial resources, and intelligent instructional design, not on technological potential in itself (Clark, 1994a; Clark, 1994b; Moore & Kearsley, 1996).

Current technology allows educators to change the learning environment in a variety of ways and to deliver course content effectively. In distance education the question remains whether designers, instructors and students can attain all educational objectives regardless of the media that is selected. A major challenge in distance education research and practice involves assessing "deep learning;" and predicting the interaction of the media and media attributes in the learning process. Consideration should not be focused on the technology in isolation, but on the

synergistic effect of "the whole 'cloud of correlated variables' -- technology, activity, goal, setting, teacher's role, culture" (Salomon, Perkins, & Globerson, 1991, p.8).

What factors should be considered by researchers, administrators, and other leaders in higher education when they design learning environments? An answer to this question involves careful consideration of appropriate learning theory and goals (Clark 1994a). The aim is to allow the student to receive maximum benefit from easily accessible, technology-enhanced instruction (Oblinger & Maruyama, 1996). Guided by clear education goals, rather than a narrow focus on technology, educators may avoid making uninformed, "long-range sociological, epistemological, and psychological changes in the form a gradual loss of educators' expert authority, shallow processing, and the construction of flimsy associationistic cognitive networks" (Salomon, 1998, p. 7).

If educators adopt a systems approach to analyzing and designing the learning environment, including distributed learning environments, then they can plan those environments in a comprehensive manner. The objectives of the course that specify the level of intellectual behavior desired, from knowledge and comprehension to synthesis and evaluation, will be intertwined with the technical media used to establish communication among participants. "It is how technology is used, not what technology is used, that is the critical issue" (Burge & Roberts, in press, cited in Roberts, 1996, p. 814). Together the goals, philosophy, instructors, students, and media interact and give character to the learning environment.

Student Outcomes

In his review of the research on the distance learner, Cookson (1989) summarized the major outcome variables: completion and withdrawal, academic achievement, satisfaction with the course learning experience, and intention to enroll in additional distributed learning courses. Student completion or non-completion of a distributed learning course was the primary independent variable for this study and the research literature pertaining to this outcome is addressed first in this section. In addition, this section includes a discussion of two of the variables that Cookson identified, student success and student satisfaction with the course, and concludes with an overview of research describing profiles of the successful distance learner.

Student Attrition

Student attrition in distributed learning courses has been a major concern and student completion is the outcome that is studied the most often (Cookson, 1989; Gibson, 1998a). Cookson (1989) described three components of this variable. First, non-completions may include initial registrations that are not followed by final registrations. Second, it may involve students who withdraw after registration and before the final examination. And, finally, non-completion may also include the "failure to obtain credit in either course assignments or the final examination" (Cookson, 1989, p. 23). High attrition rates represent an expensive problem for both students and institutions (Kennedy & Powell, 1976). As Powell, Conway, and Ross (1990) noted, the issue of "why some students succeed and others fail (however "success" and

"failure" are defined) are of both theoretical and practical importance, as distance education moves from a marginal to an integral role in overall educational provision" (p. 6).

Studies of student completion of courses and programs encompassed both traditional classroom settings and distributed learning environments. Though some students do not persist in their studies, regardless of the course format, higher dropout rates tend to occur when the learning environment includes separation of the student from the instructor and from the other students (Powell, Conway, & Ross, 1990). Moore and Kearsley (1996) reviewed the research on student completion and concluded that three factors predict success: intention to complete the course (confidence in ability), early submission of first assignment, and prior completion of other distributed learning courses.

Garrison (1985) studied data on completers and non-completers in an adult education class, using discriminant analysis, with a view toward predicting and explaining dropout behavior. The researcher adopted a holistic approach that emphasized the dynamic interactions of the learner with the socioeconomic demands present in both external and internal environments. He acknowledged the theoretical basis for the study in Tinto's model of persistence and noted that "with the adult learner a better explanation of dropout can be achieved by viewing dropout as a function of the lack of integration of school within the life space of the adult learner" (Garrison, 1985, p. 27).

Garrison analyzed the variables of goal clarity and content relevance, as well as last grade completed, hours worked, and what he called psychosocial variables, such as scholastic

ability, self-confidence, interpersonal effectiveness, and external and internal motivation. He found seven variables that contributed to the prediction of completion. After consideration of the time since the student's last grade was completed and the number of hours worked, a combined variable measuring self-confidence and interpersonal effectiveness was the most significant factor. Financial concern, involvement in the course in terms of interest and participation, scholastic ability, alone and in combination with relevancy of the course, and recent, stressful life changes, all contributed to dropout behavior in this study.

Cookson (1989) suggested that attrition in distance education programs is a systematic problem that needs creative solutions and well-considered interventions. As with other multi-causal problems, this issue requires "multiple partial solutions which operate progressively and cumulatively" (Cookson, 1989, p. 24). Cookson (1989) noted that the reasons given by students in a study conducted by Rekkedal for withdrawal from a course reflect the depth of questions they were asked. The view of student completion that emerges from Cookson's analysis of the research supports Bronfenbrenner's ecological perspective of competing and interlocking personal and environmental influences on the individual. Foremost in the array of factors leading to completion or withdrawal are the factors of academic preparation, experience with distance learning courses, relationship of the course to the student's goals, provision of time for study, and the integration of the student's interests and background with the course requirements.

Dille and Mezack (1991) conducted research to identify at-risk community college students who enrolled in telecourses. For the purpose of the study, the researchers defined a telecourse as a series of videotaped lessons accompanied by printed study materials. The students could view the lessons at the time of broadcast, on cable, or on videotape. In their studies, Dille and Mezack (1991) used three instruments to gather data, a demographic questionnaire, Rotter's Internal-External Locus of Control Scale, and Kolb's Learning Style Inventory. The study specifically addressed the issue of attrition in telecourses, asking, "what type of telecourse student... is likely to be academically unsuccessful?" (Dille & Mezack, 1991, p. 25).

Dille and Mezack (1991) found six factors that correlated with student success in the telecourses. Specifically, high-risk students were divorced and 25 years of age or older, in a sample where the average age was 27.5 years. They possessed an external locus of control, as indicated by a high score on the Rotter scale (above 7.5). These high-risk students had completed fewer than thirty credit hours for college courses and had attained a GPA lower than 2.9 on a 4.0 scale. Two aspects of the Kolb Learning Style proved to be indicators of high-risk: a high rating for concrete experience score and a low rating for abstract conceptualization.

In their investigation of adult learners, Mikulecky, Lloyd, and Huang (1996) constructed a Self-Efficacy for Academic Achievement Scale, based on items they created and on eighty-three items included in instruments from previous studies of self-efficacy. The researchers tested

their instrument in a study of seventy-three adult learners and found that the persistence subscale of the instrument had a Cronbach internal consistency reliability coefficient of 0.728.

Fjortoft (1995) studied distance learning students using an eight-factor model. The researcher analyzed eight independent variables in the model, including age, gender, previous college grade point average, satisfaction with previous college experience, ease of learning on own, intrinsic job satisfaction, intrinsic benefits of the course, and extrinsic benefits. The model explained 23% of the variance in persistence for the sample and three of the variables, age, ease of learning on one's own, and intrinsic benefits, correlated significantly with completion.

In this study the age of the graduate students ranged from the twenties to over sixty. The older students were less likely to complete the program. Students who rated themselves highest in terms of learning on their own were less likely to complete the course. This result seems counter-intuitive and it may arise from the fact that the sample was limited to the type of student who would choose to enroll in a self-paced, individualized course. Fjortoft's model reflected three indicators of motivation: extrinsic benefits, intrinsic benefits, and intrinsic job satisfaction. Of these, only intrinsic benefits correlated positively with completion.

Student Success

A significant portion of research pertaining to distributed learning has focused on easy to measure variables that could be associated with student achievement, such as the student's final grade in the course or the percentage of course assignments completed successfully (Biner & Dean, 1997a; Cookson, 1989). A recent study conducted by Pultorak (1992) identified

successful telecourses as those courses that received good student evaluations. In contrast with this practice, many researchers have employed qualitative methods in studying distributed learning environments, indicating that meaningful measures of participants' transformation, or lack of transformation, through the educational process may not be captured by an objective post-test of cognitive achievement (Westerheijden, 1997).

Noting the importance of long-term effects, Moonen (1996) advocated that institutions establish longitudinal studies to capture this information. He identified the "direct outputs" of the educational process, such as "cognitive achievement, manual skill development, attitudinal changes, and behavior changes." These elements could be relatively quickly and easily measured. According to Moonen, less immediate outcomes included "employment, earnings, status, job- and life-satisfaction."

Rowntree (1997) also specified both immediate and long-term measures of student achievement and course success. Immediate indicators included number of dropouts from the course, comments from students and instructors, performance in previous and concurrent courses, end-of-course exam grades, and results of assignments and projects. Long range indicators would encompass student progress in the program, performance on subsequent courses, performance on professional examinations, and job performance.

Profiles of the Successful Distance Learner

The relationship of the learner profile to the knowledge acquisition process is a common theme in adult education research (Hemby, 1998). In addition, experts in the field of

instructional design have long advocated needs assessment, in terms of both student attitudes and intellectual skills, to determine the appropriate content (Turner, 1993). Establishing an accurate perspective on the student's current status, a learner profile, is an integral part of the needs assessment process.

In their attempts to describe distant learners, researchers have found a "dynamic and heterogeneous group" of people (Gibson, 1998d, p. 140). In order to serve this diverse population, those who design and implement distributed learning programs need a profile of each learner. Such an assessment would assist the students themselves, helping them to identify their objectives, to develop plans for management of time, stress, and sources of support, and to involve them immediately and directly in the academic process.

In their review of the research, Hanson, et al. (1997) pointed out that the typical distance learner was an adult who voluntarily enrolled in an alternative educational setting. The research examined learner attributes in terms of demographic variables, communication apprehension, social and academic integration, motivation and learning style. Research findings suggested that environmental and social factors influence academic persistence, as well as personal factors. The evidence indicated that autonomy, high self-expectations, self-confidence, academic accomplishment, and locus of control are contributing factors.

The research conducted by Powell, Conway and Ross (1990) focused on an assessment of success and completion for students in their first distance education course at the open university. Using discriminant analysis, the researchers found evidence that nine variables

in the category "predisposing characteristics" were significant. Two demographic characteristics, marital status and gender, contributed to student success. In this study, those students who were female and married were more likely to succeed.

According to Powell, Conway, and Ross (1990), students fared better when they perceived that they had a good chance of succeeding in their studies and identified a strong need to succeed in the course in order to avoid the negative consequences of not passing. Those who stated a minimal need for support from others and who lacked the need to discuss course work with other students were more successful. The students who tended to succeed identified themselves as possessing organizational skills. They had established study habits that included a place to study and an adequate, designated time for study. Financial stability contributed to success. This variable included not only stated income level, but also the student's perceived level of financial security. The three additional factors included persistence in new projects; literacy level; and subjective perception of the adequacy of educational preparation.

To predict student achievement, Biner and Dean (1997b) focused on a set of personality traits, measured by the Sixteen Personality Factors Questionnaire (16PF). This instrument consists of 105 items that cluster around 16 factors. Using final course grade as the measure of success, these researchers found that the most successful students were self-sufficient. These students viewed themselves as more independent and resourceful than other students participating in the study.

The second characteristic that predicted performance was a tendency to be less compulsive than their peers. Biner and Dean (1997b) hypothesized that given the students' need to juggle the demands of work, family, and study, the more compulsive students might experience a greater degree of stress that would, in turn, negatively affect performance. For the students in this study, the third predictor of success was tendency to handle tasks in an expedient manner. Those students who rated themselves high in completing assignments quickly and efficiently achieved a higher grade in the course. The researchers found that demographic variables, such as age, gender, and socioeconomic status, were not significant indicators of performance.

McIsaac and Gunawardena (1996) presented a profile for adult distance learners based on a review of the current research. The successful distance learner is a part-time student who is married, female, between the ages of 25 and 44 years, and employed full-time. Anxiety may have a negative impact on the ability of these students to perform cognitive tasks. On the other hand, a high level of motivation characterizes this group and the authors found evidence that the students were motivated primarily by the "desire to move from their current level of proficiency to a new, higher level" (McIsaac & Gunawardena, 1996, p. 423).

Satisfaction with the Course

Student satisfaction in distributed learning courses is an important outcome variable to consider in conjunction with other measures of effectiveness and success (Westerheijden, 1997). The first study in this section focused on summative evaluation in traditional higher

education courses. The next two studies compared distance learners with on-campus students. The fourth study investigated aspects of course evaluation in light of student perception of the instructional delivery system. The final study in this section, conducted by Biner and Dean, analyzed the correlation of satisfaction in distance classes with personality characteristics.

Cashin and Downey (1992) conducted a study of 17,183 classes using the IDEA Survey Form (Center for Faculty Evaluation and Development, Kansas State University, 1988), that included four control items and two global items for measuring student perception of teaching effectiveness. Cashin and Downey (1992) noted that the reliability of the items in the IDEA Survey FORM ranged from .77 to over .80. The following two global items, in separate regression analyses of the data, accounted for over 50% of the variance in the evaluation scores:

- Overall, I rate this instructor an excellent teacher.
- Overall, I rate this an excellent course.

The authors concluded that, in addition to the global items, the following two items that related to teaching method contributed significantly to the "explanation of additional, useful variance" (Cashin & Downey, 1992, p. 568):

- Stimulated students to intellectual effort beyond that required by most courses.
- Degree to which the course hung together (various topics and class activities were related to each other).

Thomerson and Smith (1996) investigated the use of compressed video for instructional delivery and focused on expanding the criteria for distributed learning evaluation beyond tests of

cognitive achievement. They considered four dependent variables to gauge affective perception: level of interaction, course structure, physical environment, and student enjoyment of the course. The researchers developed a 21-item scale to measure the four outcome variables of interest.

During pilot testing of the instrument, Thomerson and Smith report reported a Cronbach Coefficient Alpha of .89. Five of the survey items corresponded to overall course enjoyment and satisfaction. The results of the study indicated that students in the remote sites were more satisfied with the course than those who attended classes on-campus. The evidence suggested that students who choose a distributed learning course are more willing to tolerate some of the inconveniences associated with communications technology than students who choose a traditional classroom educational experience (Thomerson & Smith, 1996).

Westbrook (1997) investigated the change in attitudes between the beginning and the end of the term for both on-campus and off-campus students. The students participated in classes that used a 2-way audio and 2-way video delivery system for graduate business courses. The researcher assessed student attitudes in terms of the perception of interaction, student satisfaction with the course, and perceived interference of the technology. The results of the study supported the hypothesis that distance learners find a comparable degree of course satisfaction with on-campus students. The anticipated level of satisfaction remained constant over the semester time-period.

Silvernail and Johnson (1992) studied a distributed learning environment that involved instruction delivered synchronously to multiple sites via broadcast video with a two-way audio

system. The authors developed an eleven-item end-of-course evaluation to assess student satisfaction with the course. In the study, 93 students participated, a 78% participation rate (N=118). A two-factor model of the instrument "accounted for approximately 55% of the variance in student responses" (Silvernail & Johnson, 1992, p. 48). Factor 1 consisted of four items and corresponded to the students' perceptions of the course presentations. Factor II consisted of three items and corresponded to student involvement. The Cronbach alpha coefficients for the two factors were 0.78 and 0.83.

In the study, 49 of the 93 participants "strongly agreed" that the interactive video system was an effective way to teach the course. The authors conducted an item-by-item comparison of the two groups, those students who judged the system effective versus those who did not. Both groups "ranked the course and instructors positively" (Silvernail & Johnson, 1992, p. 49). The results showed no significant difference between the two groups in the ratings on the instructor variables. The group who considered the instructional television system as effective gave the course a higher overall rating than the group who viewed the instructional delivery system as ineffective.

Biner, Welsh, Barone, Summers, and Dean (1997) used the Telecourse Evaluation Questionnaire (TEQ) to measure student satisfaction in the distributed learning environment. This inventory encompassed seven factors: (1) instructor and instruction, (2) technological aspects of the course, (3) course management, (4) at-site personnel, (5) promptness of material delivery, (6) support services, and (7) out-of-class communication with the instructor. The

researchers focused on "the determinants and consequences of student satisfaction" (Biner & Dean, 1997b, p. 17). They found that degree of satisfaction in higher education telecourses correlates with personality traits, such as introversion or extroversion, and with the student's level of anxiety.

These studies illustrated the use of student satisfaction with the course as a dependent variable in distributed learning research. Typically, those who had a choice and chose a distributed learning course tended to be satisfied with the instruction they received. As the Thomerson and Smith (1996) study indicated, students who did not have a choice, such as host-site students in a video conferencing course, tended to be sensitive to problems related to technology and were more dissatisfied with the instruction they received.

Human Information Processing

The preceding sections highlighted the theory and research related to student learning and persistence in distributed learning environments. A major premise underlying this area of research is that the learner's profile bears an important relationship to the acquisition of knowledge (Hemby, 1998). In other words, the characteristics of the situation and specific attitudes and attributes of a person have an impact of that person's behavior, and, subsequently, on the person's ability to acquire and process information. Through their investigations, researchers have identified a set of factors in the form of situational and affective characteristics that significantly influence persistence, achievement, and learning. These factors, such as motivation, autonomy, self-confidence, anxiety, and learning style, have particular relevance for

this study of at-risk students in distributed learning courses. This section discusses the factors individually.

Motivation

Few question the importance of motivation as a contributing factor for success in academic work (Baker & Siryk, 1984). A high degree of motivation characterizes adult learners, in general, and adult distance learners, in particular (McIsaac & Gunawardena, 1996). Biddle and Brooke (1992) pointed out that as a psychometric construct, motivation has been viewed from various perspectives, ranging from "drive theories through to social cognitive interpretations" (p. 247). Generally, researchers distinguish two components of motivation: extrinsic motivation, related to tangible reward or gain, and intrinsic motivation, related to interest, positive feelings, and benefits inherent in the activity itself (Kember, 1995).

The prevailing view of motivation in an educational context focuses on intrinsic aspects of "exploration, competence-seeking and mastery attempts" (Biddle & Brooke, 1992, p. 247). This perspective emphasizes the multidimensionality of intrinsic motivation, as developed in the models by White in the 1950s and Harter in the 1970s. In operationalizing the motivation construct, researchers have not reached agreement on the number or identity of the dimensions.

Harter developed a theory of competence motivation that centers on the fundamental aspects of mastery, curiosity, challenge, and play. In a framework distinct from Harter's theory, Keller (1987) specified four dimensions of intrinsic motivation in his ARCS Motivation Model: attention, relevance, confidence, and satisfaction. He viewed these elements of motivation as

requirements for learning. Attention involves stimulating the student's curiosity to learn. By making clear the reason for studying the subject, the instruction becomes relevant for the student, linked with his or her needs and desires. Confidence corresponds to the student's expectation of success and a sense of personal control over the outcome of the learning activity. Students derive satisfaction from using new skills or knowledge in meaningful contexts.

Building on the Harter model, Weiss developed the Motivation Orientation in Sport Scale (MOSS) that included preference for challenging tasks, the desire to satisfy one's own curiosity and interest, and mastery (Biddle & Brooke, 1992). Baker and Siryk (1984) continued the development of this instrument through their longitudinal study of academic performance of college freshmen. Entwistle and Kozeki (1985) also made a significant contribution to the study of motivation and its measurement. The investigated the relationship of intrinsic and extrinsic motivation with academic achievement of adolescent students in two European countries and developed a 10-factor representation of motivation. For their study of effective use of educational technology in higher education, Perrin and Rueter (1997) constructed an instrument based on the work of Biddle and Brooke (1992) and Baker and Siryk (1984). In a study of 258 students enrolled in three university biology, geology, and psychology courses, the course-specific motivation scale had a reliability of 0.897.

Motivation was an important consideration for this study, in terms of the reasons students engage in a learning activity and the results they expect. As Oliver and Reeves (1996) noted, "motivation has special importance in instructional settings where students are required to

assume some responsibility for their own learning" (p. 53). A distributed learning environment, by definition, allows students more flexibility in defining learning goals, given the context of their needs and interests (Oblinger & Mayurama, 1996; Oliver & Reeves, 1996). According to Kember (1995) and Garrison (1985), the student's goals are linked in a complex way to completion of distributed courses. While clear goals may be positively related to completion of distributed learning courses, researchers have found that when goals are unrealistic in terms of the student's abilities, they contribute to non-completion of those courses.

Autonomy

Learning theorists support the contention that effective learners possess a set of skills, encompassed under the labels autonomy, self-direction, or self-regulation (Butler & Winne, 1995). According to Butler and Winne (1995), self-regulation involves the ability to set goals for developing knowledge, to evaluate the costs and benefits of various paths toward these goals, and to monitor the on-going effects of engaging in learning activities. Self-regulated learners are "aware of qualities of their own knowledge, beliefs, [and] motivation" (Butler & Winne, 1995, p. 245).

Linn (1996) characterized autonomous learners as those who take the initiative in the learning situation and who are active in responding to guidance. They "critique their own understanding, recognize when they need help, and seek opportunities to access their comprehension by applying what they have learned in novel situations" (Linn, 1996, p. 826). In

their study of successful distance learners, Biner and Dean (1997a) found evidence that such autonomy or self-sufficiency was a significant predictor of achievement.

A connection exists between self-regulation and motivation. Goals embody the learner's expectations and they play a central role in autonomous learning.. Together with achievement and other forms of external feedback, they exert a strong influence over behavior in the learning situation. Based on both internal and external feedback, the learner monitors progress toward goals, and then modifies goals, strategies and the information stored in memory (Linn, 1996).

Feedback, level of confidence, and active participation are key elements in this regulation process. Though the research to establish a clear link between autonomy and persistence in distributed learning courses has had mixed results (Thompson, 1998), from a theoretical perspective it seems clear that autonomy, and the skills associated with it, assists students in distributed learning courses because these learning situations typically involve a decrease in interaction among the participants (Linn, 1996, p. 826).

Self-confidence

Major research studies of adult learners, and distance learners in particular, have investigated the link between self-esteem and student achievement (Gibson, 1998b; Sterbin & Rakow, 1996). In terms of academic self-concept, self-confidence is a critical component. Self-acceptance and personal efficacy are two aspects of self-confidence or self-esteem that may impact a student’s decision to study and attempt to succeed in an academic situation

(Conrad & Hedin, 1981; Sterbin & Rakow, 1996). According to Gibson (1998b), academic self-concept is a dynamic and multi-dimensional construct. She noted that a common theme in research on student attrition is that the perception of ability held by an adult learner contributes to the learner's chances for success. Various enhancers and detractors "affect the student's perception of self as learner at a distance" (Gibson, 1998b, p. 68). Enhancers include support from professors, personal success, progress toward educational goals, and familiarity with distributed learning courses. On the other hand, separation of the instructor and learner, lack of necessary skills, increased learner responsibility, lack of familiarity with distributed learning, and the requirement to juggle multiple roles, detract from the learner's self-concept (Gibson, 1998b).

In their study of students enrolled in a Canadian open university, Kennedy and Powell (1976) identified a sense of insecurity, and intellectual inadequacy as characteristics in their at-risk student profile (Kennedy & Powell, 1976). Garrison (1985), in his investigation of attrition among adults in basic education classes, found that the discrepancy between self-confidence and perception of personal effectiveness contributed to prediction of student completion. Powell, Conway and Ross (1990) identified this factor as the student's perception of his or her chances for success.

Not surprisingly, the development of instruments to measure self-confidence in academic settings has paralleled this stream of research. In a study of 21,000 randomly selected high school seniors, Sterbin and Rakow (1996) developed a brief survey designed to

measure self-esteem. The researchers estimated the reliability for the four items to be 0.8259. In the traditional classroom situation studied by Sterbin and Rakow, self-esteem did not correlate significantly with achievement. The Rosenberg Self Esteem Scale is a 10-item scale designed to measure a particular facet of self-esteem, the facet of self-acceptance. In tests of reliability and concurrent validity, researchers have found this scale to be in the acceptable range for both reliability (0.85) and validity (0.65 to 0.83) (Conrad & Hedin, 1981).

Anxiety and Computer Confidence

In their review of distance education research, McIsaac and Gunawardena (1996) noted that about twenty-five percent of the studies mentioned the need to decrease student anxiety and increase motivation. Students may experience high levels of anxiety in distributed learning situations due to the use of technology and the separation of the student from the instructor (Hanson, et. al, 1997). Research into anxiety, or arousal in Eysenck's (1982) terminology, suggests that while low levels of anxiety may actually enhance performance, higher levels, particularly in the performance of difficult tasks, can "reduce attentional, conscious capacity available for thought processes required" (Mandler, 1979, p. 195). Given these findings, it seems particularly relevant to investigate student anxiety with respect to the design of learning environments and the study of student attrition.

Closely related to both the general construct of anxiety and to self-confidence is level of confidence or anxiety that a person experiences in using computers. Researchers in the areas of human-computer interaction and distance education have not only studied participants' level of

anxiety or stress in computer-mediated environments, they have also focused on computer anxiety as a specific form of anxiety (Anderson, 1995; Hemby, 1998; Knezek & Christensen, 1998; Toro, 1995). Computer anxiety involves a fear of interacting with a computer when such fear is out of proportion with any real threat (Anderson, 1995). According to Toro (1995), computer anxiety encompasses "an array of emotional reactions including fear, apprehension, hope and personal threat. In some individuals, it also includes a distrust of technology in general" (p. 634).

Computer confidence, on the other hand, denotes "a positive, anxiety-free attitude toward computers" (Levine & Donitsa-Schmidt, 1997). Knowledge and experience with computers promote confidence and lead to a decrease in anxiety and fear (Christensen, 1997). Generally, computer anxiety and confidence are measured by responses on self-report instruments (Toro, 1995). For example, in a study of the relationship of computer anxiety, experience, and knowledge, Anderson (1995) used the Computer Anxiety Rating Scale (CARS) as a measure of computer anxiety. This instrument, adapted from the original survey developed by Raub (1981), has been used extensively in research and consists of is a self-report inventory that includes 10 items with a Likert response format.

Levine and Donitsa-Schmidt (1997) studied the causal relationship of computer experience, confidence, attitudes, and knowledge. In their research they merged several existing questionnaires that had been used in previous research in order to construct a reliable and valid instrument that encompassed seven dimensions. They identified 10 reliable items to

measure computer confidence that exhibited construct validity and an internal- consistency reliability of 0.90.

Learning Style

Individual differences among students in terms of learning style and cognitive style may lead to variation in interaction patterns and thus influence the effectiveness of the learning experience. Researchers have employed a variety of definitions and a diverse array of implementations for both learning style and cognitive style. Dunn (1984) gave a representative definition of learning style, stating that it "represents each person's biologically and experientially induced characteristics that either foster or inhibit achievement" (p. 17). Learning style is the way a person "absorbs and retains information and skills" (Dunn, 1994, p. 12). On the other hand, cognitive style relates on a person's "information processing habits representing certain typical modes of perceiving, thinking, remembering, and problem solving" (Messick, 1969, p. 359, cited in Burton, Moore, & Holmes, 1995).

Grasha (1984), an early researcher in the investigation of learning styles, traces the beginning of investigations into individual differences to 1796, when the astronomer Maskelyne fired his assistant at the Greenwich Observatory for incorrectly calibrating the clock. This event led Bessel, a Dutch astronomer, to develop a personal equation to assist astronomers in such calibrations by accounting for individual variation in the approach to the task. Since that time, researchers and theorists have developed scores of learning style and cognitive style instruments. This area of scientific inquiry attempts to study objectively individual differences

with the goal of improving quality of life in some way, including the current area of interest, the design of instructional environments.

The theories and instruments that have been developed to measure learning style, specify variables that cluster around five dimensions: cognitive, sensory, interpersonal, intrapersonal, and environmental (Grasha, 1984). Given this myriad of learning style characteristics, which are most relevant to the design of instructional environments and the accommodation of individual learners within those environments? According to Grasha (1984), a useful learning style framework, and the instrument based on such a framework, must meet the following criteria: internal consistency and test-retest reliability; construct and predictive validity; the production of data that directly relates to instructional practice; promotion of learner satisfaction; and assistance for the learner in acquiring content.

At the present time, the reliability and validity of many of these instruments remain in question. In response to this problem, Grasha (1984) has suggested that in addition to self-reported assessments of what the learner does, researchers could use observational methods while the learner describes or actually engages in an attempt to learn something new. Such a methodology may provide more accurate results, given that some learners hold mistaken views about their own behavior.

In distance education research, both the Myers-Briggs Type Indicator (Myers, 1980) and the Canfield Learning Style Inventory (Canfield, 1976) have been used extensively to measure individual differences with a view to adjusting course presentation based on such

differences (Bargar & Hoover, 1984; Crosby & Stelovsky, 1995; Gee, 1990; McIsaac & Gunawardena, 1996; WestEd, 1997). Based on Jung's theory of psychological types, the Myers Briggs Type Indicator was designed to separate individuals into four dimensions based on individual preferences: introversion or extroversion, sensing or intuitive, thinking or feeling, and perceiving or judging (Crosby & Stelovsky, 1995). Using the information of gained from this instrument, Bargar and Hoover (1984) presented implications for educational practice: a student's psychological type may affect preference for instructional activities, influence interest in subject matter, and indicate the most helpful approach for dealing with learning problems.

The Canfield instrument conceptualizes learning style in terms of preferences for certain conditions, content, and modes. In a study investigating the relationship of perceived academic achievement, attitudes toward the learning environment, and course completion, Gee (1990) used the Canfield Learning Style Inventory to classify the participants along two dimensions: social or independent and applied or conceptual. Turner (1993) recommended this instrument, among others, to instructors for conducting needs assessment of the students in their classes.

Locus of control, as an aspect of learning style, has been widely studied as a determinant of achievement and behavior, particularly in the area of student interaction with technology (Dille & Mezack, 1994; Hanson, et. al, 1997; McIsaac & Gunawardena, 1996; Sterbin & Rakow, 1996). This construct refers to the conviction that the results of a person's s behavior depend on that behavior, rather than being dependent primarily on unpredictable, chance events (Folkman, Schaefer, & Lazarus, 1979). A person with a strong internal locus of

control believes that he or she bears responsibility for experiences and results, whereas a person with an external locus of control tends to believe that life's events are determined by chance or by powerful people. In 1966 Rotter published the Internal-External (I-E) Scale "to measure individual differences in a generalized expectancy or belief in external control" (Rotter, 1972, p. 270). On this scale, scores range from zero to a maximum of 23, with a high score indicating an external locus of control.

The locus of control construct is related to, but distinct from self-efficacy. According to Bandura (1997), perceived self-efficacy encompasses a person's beliefs about whether that person "can produce certain actions" (p. 20). In Bandura's view, a person's self-efficacy beliefs reflect that person's perception of the quality of their behavior. Locus of control, on the other hand, concerns a person's beliefs about the degree of influence that he or she has over events, the results of behavior (Kolb & Aiello, 1996).

One interpretation of locus of control is that it forms "a person's perspective on the world" (Anderson, 1995, p. 61) and many researchers, in their studies of learning situations, have differentiated participants according to this aspect of learning style. In their study of telecourse students, Dille and Mezack (1991) found evidence that students with an internal locus of control were more likely to be successful. The chances of success for students with an external locus of control increased when the learning situation included regular contact with the instructor.

In their study of 21,000 high school seniors, Sterbin and Rakow (1996) developed a three-item measure of locus of control, based on the original Rotter's original scale. The researchers estimated the reliability for the four items to be 0.6763. This is a marginal level of reliability, though comparable with the test-retest reliability (0.49 to 0.83) and the internal-consistency (0.65 to 0.79) results obtained from the Rotter scale (Rotter, 1972).

Applying Rotter's work to higher education, Pascarella and Terenzini (1994) developed the Internal Locus of Attribution for Academic Success. Their instrument consisted of four items. The researchers conducted a longitudinal study of higher education students and found that the instrument had an internal consistency reliability of 0.62 in the initial measure and 0.64 in post-test measure.

Another aspect of learning style often included in studies of computer-mediated and other distributed learning environments is the dimension of field dependence or independence (Leader & Klein, 1996; Toro, 1996; Yoon, 1994). Beginning in the 1970s, Witkin and his fellow researchers investigated the way a person gains a sense of orientation in space (Witkin, Oltman, Raskin, & Karp, 1971). Specifically, they analyzed whether the individual relies primarily on internal cues or external cues, the self versus the context or field. Through his studies, Witkin identified field dependency as a description of "the way people perceive and have knowledge of their environment" (Burton, Moore, & Holmes, 1995, p. 360).

A field-independent learner has a defined self-concept, such that "attributes, needs, and feelings are recognized as being one's own and distinct from others" (Burton, Moore, &

Holmes, 1995, p. 360). They have the ability to discern the relevant aspects in problem-solving situations. Field-independent learners tend to be internally motivated and possess an internal frame of reference, two characteristics that allow "them to structure situations on their own" (Sanchez & Gunawardena, 1998, p.51). On the other hand, field-dependent learners take a global view and rely on external and interpersonal aspects of a situation. In a learning situation, field-dependent students "prefer instructor guidance and involvement, are externally motivated, and prefer group work and extrinsic rewards" (Sanchez & Gunawardena, 1998, p. 51).

Summary

This chapter presented an overview of the theory and research related to the student in a particular context: learning environments that employ technology to mediate communication and to deliver instruction. The theoretical framework for understanding the decisions and behavior associated with student completion of a distributed course reflects a systems perspective. No single variable explanation is sufficient. The models articulated by Tinto, Billings, Kember, Kennedy, Powell, Conway, and Ross present a comprehensive overview, identifying the spectrum of influences on the student that support or hinder course completion.

Two themes emerged from the literature in instructional technology: (1) the media employed to deliver instruction do not significantly impact learning; and (2) the quality of instruction is strongly affected by instructional design, including careful consideration of media characteristics and implementation of the technology. An explanation for the apparent contradiction in these two viewpoints begins with an acknowledgment that the importance of the

technology is diminished when the goal of information dissemination is emphasized and when characteristics of the student population compensate for deficiencies in the instruction. On the other hand, the research supports the contention that the effective use of technology, where the media characteristics are understood and integrated into the design so that beneficial aspects are highlighted and detracting aspects are minimized, directly affects the quality of instruction and the depth of learning possible for the students.

The current study was based on both of these two conclusions from the research. First, when technology is integrated into the course design, aspects of the student's abilities, attitudes, and situation enable some students to overcome difficulties and complete the course, while other students dropout. This study was designed to identify those student characteristics. Second, a goal of the study was to provide an instrument to assist faculty in improving the quality of distributed courses. The Distributed Learning Survey was designed to identify at-risk students as they begin a particular course, in time for faculty and administrators to modify the course characteristics and availability of support services in order to meet student needs.

CHAPTER 3

METHODOLOGY

Introduction

This study investigated the reliability and validity of an assessment instrument for students enrolled in higher education distributed learning courses. The instrument encompassed a set of items selected to correspond to indicators of student completion of such courses. Theory and research in the area of distributed learning guided the selection of these indicators and of the individual items. Specifically, the researcher analyzed:

- the internal-consistency reliability of each subscale in the instrument;
- the content validity of the instrument;
- the construct validity of the instrument; and
- the predictive validity of the instrument.

This chapter describes the research questions, research design, student sample, instrumentation, data collection procedures, and data analysis procedures for the study.

Research Questions and Research Design

This section addresses the set of research questions that pertain to the construction and the utility of a predictive instrument for distributed learning courses. The study involved two

phases for data collection and data analysis. Table 1 depicts the research design used in the study.

Table 1. Research Design

Phase I		
Data Collection	Expert Panel	Evaluate Distributed Learning Survey
Data Analysis	Content Validity Analysis	
Phase II		
Data Collection	Student Sample	Beginning of semester:
		Complete Background Survey
		Complete Distributed Learning Survey
		End of semester:
		Complete student satisfaction instrument
		Obtain student completion data
Data Analysis	Reliability Analysis	
	Construct Validity Analysis	
	Predictive Validity Analysis	

During the initial phase of the study, the researcher analyzed the evidence regarding the aspects of a student's background, attitudes, situation, and cognitive skills that hinder or assist that person in completing a distributed learning course. This initial phase of the study focused on the first research question:

1. What are the critical factors, in terms of abilities, attitudes, and situational variables, that contribute to a student's ability to complete a distributed learning course?

Investigation of this question involved analysis of theory and research in student completion, specifically in learning environments where distance is introduced between instructor

and students. The researcher looked for evidence of a consensus among prominent theorists and researchers regarding the variables that indicate whether a student will complete a distributed course. In the areas where the research and theory exhibited consensus, the researcher identified the variables that are significant for discriminating between the population of students likely to complete or not complete distributed courses.

Each variable for identifying at-risk students corresponds to a construct described in psychometric theory (Nunnally & Bernstein, 1994). According to this theory, the process of developing and validating measurements of constructs begins with a definition of the constructs in terms of observable variables. In this study, each indicator of completion, identified from the literature, corresponded to a set of items that were included in the instrument. These constructs are abstract by definition. The researcher hypothesized that the items on the Distributed Learning Survey measure observable behaviors related to the constructs.

The first phase of the study included analysis of the instrument for content validity. Content validity relates to whether the instrument adequately samples the domain it claims to represent (Nunnally & Bernstein, 1994). The domain for the study encompassed the student's background, attitudes, situation, and cognitive skills that hinder or assist that person in completing a distributed learning course.

The second phase of the study addressed the utility of the instrument based on the indicators of completion identified in the initial phase. This phase centered on the second research question:

2. Using a brief survey instrument, does a weighted combination of the critical factors indicate which students are at-risk in terms of the probability that the students will complete the distributed learning course?

During this second phase of the study, each indicator included in the Distributed Learning Survey was analyzed for internal-consistency reliability. This analysis focused on the individual items in the instrument in order to indicate "the extent to which there is cohesiveness or interrelatedness among the items" (Isaac & Michael, 1995, p. 132). According to Nunnally and Bernstein (1995), "the goal of studying constructs is to employ one or more measures whose results generalize to a broader class of measures that legitimately employ the same name, e.g., 'anxiety.'" (p. 85). Establishing the link between the indicators and the test items was the goal of the procedure to determine construct validity in this phase of the study.

In the investigation of construct validity and predictive validity, the researcher determined the extent to which the variables associated with each indicator or construct correlated with each other and with measures of other variables of interest. Completion or non-completion of the distributed learning course was the primary criterion variable. Student satisfaction with the course represented an additional criterion variable of interest. With respect to this variable, the study addressed one final question:

3. Do the critical factors correlate with the student's level of satisfaction in the course?

Sample

Participants in this study were students enrolled in distributed courses at the University of North Texas during the summer and fall semesters of 1999. Table 2 presents a list of the courses included in the study.

Table 2. Courses in Sample

Dept	Course Number	Title	Course Format	Course Level	Semester
AGER	5600	Elderly Housing	VC	G	Fall
CECS	1100	Computer Applications	WW	U	Fall
CECS	5210	Instructional Design	WW	G	Fall
CECS	5300	Cognitive Processing	WW	G	Summer
EDAD	5540	Principles and Techniques of Supervision	VC	G	Summer
EDAD	6580	Administration & Supervision of Programs	VC	G	Summer
EDCI	6460	Policy Analysis in Curriculum & Instruction	VC	G	Summer
KINE	3090	Motor Behavior	WW	U	Fall
PHED	1000	Scientific Principles & Practices of Fitness	WW	U	Summer
SLIS	5000	Introduction to the Information Profession	WW	G	Fall
SLIS	5000	Introduction to the Information Profession	WW	G	Summer
SLIS	5200	Introduction to Information Organization	VC	G	Summer
SLIS	5300	Management of Information Agencies	VC	G	Summer
SLIS	5340	Learning Resources and Services	WW	G	Summer
SLIS	5600	Information & Access Services	VC	G	Fall
SLIS	5600	Information & Access Services	VC	G	Summer
SLIS	5710	Information Technology	WW	G	Summer
SLIS	5720	Instructional Materials Production & Use	WW	G	Summer
SLIS	5960	Learning Resources and Organizational Media	WW	G	Summer

Instruction in these courses was delivered primarily in one of the following two formats: Web-based delivery or video conferencing. Student and instructor participation was voluntary. The total sample size for the study was based on the number of items in the Distributed Learning Survey. A total of 423 students participated in the study by completing the Consent Form and

the Distributed Learning Survey. The Distributed Learning Survey consisted of 28 items; therefore, subsequent statistical procedures required that a minimum of 280 students participate in the study. The study was open to both graduate courses and undergraduate courses from a variety of departments. The diversity of courses in the study was contingent on course offerings and on the willingness of both instructors and students to participate.

Instrumentation

The researcher used three instruments to collect data for this study: a Background Survey, the Distributed Learning Survey, and a student satisfaction instrument. Each instrument was available in two formats: a print version and an on-line version. Course structure and instructor preference determined which format was used for a specific course. A copy of the Consent Form and of each survey instrument is included in the Appendix A.

The student satisfaction instrument consisted of 20 items with a Likert-scale response format. The researcher selected the items for the instrument from published research regarding summative evaluation of higher education courses. The student satisfaction instrument included four items analyzed by Cashin and Downey (1992) in their research of summative evaluation in higher education courses. Based on feedback from the expert evaluators and from students during pilot testing, the researcher made slight modifications to the wording of two of the four items.

In addition, the researcher adopted four items from an instrument developed by Silvernail and Johnson (1992) that were considered relevant for both synchronous and

asynchronous instructional delivery formats. Finally, the student satisfaction instrument included 12 items developed by Thomerson & Smith (1996) that related to course enjoyment and satisfaction. Appendix B lists the items in the student satisfaction instrument and indicates the source of each item. For this study, a student's total score on the satisfaction instrument corresponded to a measure of satisfaction in the course.

The researcher conducted a pilot study of the print version of the Background Survey and the Distributed Learning Survey during the spring semester of 1999. Table 3 shows the courses included in the pilot study and the number of students who participated. The two courses in the pilot study were graduate level courses in the School of Library and Information Sciences. The primary goal of the pilot study was to identify sources of error in the wording of the items or in the overall presentation of the instruments. In addition, this test provided an estimate of the time required to complete each instrument. The researcher did not use the pilot study data in the student sample.

Table 3. Courses in the Pilot Study

Course	Title	Course Level	N
SLIS 5080	Research Methods and Analysis	G	12
SLIS 5713	Telecommunications for Information Professionals	G	40

The researcher found that twenty minutes of class time was needed to briefly describe the study and to allow the students to complete the Consent Form, Background Survey and Distributed Learning Survey. This time was sufficient for classes varying in size from 20 to 110. Fifteen minutes of class time was needed for the students to complete the student satisfaction

instrument. When a class used the online version of the surveys, the instructor provided a Web link to the surveys as part of the course materials. Approximately thirty minutes of instructor time was required for this task.

Data Collection Procedures

In the first phase of the data collection process, the researcher identified a set of indicators that contribute to a student's ability to complete a distributed learning course and then she constructed the assessment instrument. Selection of these indicators was based on the variables specified in models of distributed learning and persistence and tested by prominent researchers. As far as possible, the instrument included items previously tested for reliability and validity in research settings.

Before the Distributed Learning Survey was given to student participants, the researcher applied for approval of the study from the Institutional Review Board (IRB) at the University of North Texas. The initial IRB approval letter for the study and a subsequent letter that described the procedure for disclosure of student grades are included in Appendix C.

Next, four experts with experience in distributed learning research and in the validation of survey instruments evaluated the instrument. The data collected during this phase consisted of an evaluation of the indicators of completion and of each item included in the instrument. Appendix D gives a sample of Evaluation Form that the researcher sent to each expert on the panel. Three of the experts completed the Evaluation Form. One of the experts responded with general comments about the items and the indicators included in the instrument.

During the next phase of the data collection, the researcher met with instructors of Web-based and video conferencing courses in order to present the goals and procedures for the study. When an instructor agreed to participate in the study, the researcher invited the students in the class to participate by completing the Consent Form, the Background Survey, and the Distributed Learning Survey near the beginning of the semester. In addition, participating students completed the student satisfaction instrument near the end of the semester.

The researcher informed the participants about a Web site where students could request a copy of their own survey answers and obtain copies of the Consent Form, Background Survey, Distributed Learning Survey, and student satisfaction instrument. Appendix E shows the initial page of the Web site for this study. When requested, the researcher sent a report of the student's survey answers to them after the end of the semester. Appendix F includes a sample of the report sent to students.

After the close of the semester, the instructors provided information to the researcher regarding completion of the course by the participants. The instructors who participated were not provided with individual results from any of the measures used in the study. Several weeks after the end of the semester, instructors received a report on the aggregate data. Appendix G includes a sample of the report sent to participating instructors.

Data Analysis Procedures

Data analysis in this study involved primarily quantitative methods. The data gathered in the study was presented in aggregate form to protect anonymity. The researcher used the

programs included in the Statistical Package for the Social Sciences (SPSS), Version 9.0 (SPSS, Inc., 1998), to analyze the data.

During the first phase of data analysis, the researcher analyzed the published survey items used in previous research in order to construct the Distributed Learning Survey. A central requirement of the Distributed Learning Survey was its brevity. In selecting a given item, the researcher determined whether a three to five set of items could represent the indicator of completion.

In selecting specific items, the researcher contacted the person who developed the published instruments (see Appendix H). Each item included in the Distributed Learning Survey met the following criteria:

- The item related to one of the key variables or indicators, as supported by theory and research regarding student completion of distributed learning courses;
- The researcher had access to both the item's content and statistical analysis of its use in a research setting;
- The developer of the item could be contacted during a six-week time period during March and April, 1999; and
- The developer granted permission to use the item in the current study.

Next, the researcher analyzed the data collected from the panel of experts in the field of instrument validation and distributed learning. This procedure indicated the content validity of the instrument: whether the variables selected for inclusion in the instrument matched expert

judgment regarding the indicators of at-risk students in distributed courses. In addition, this procedure determined whether the experts agreed that the items chosen for each indicator measured the associated construct. Based on this evaluation, the researcher modified the Distributed Learning Survey.

During the second phase of the data analysis, the researcher conducted a factor analysis of the items included in the instrument to establish construct validity. Factor analysis specifies the patterns of intercorrelation among the items and isolates "the dimensions to account for these patterns of correlation" (Isaac & Michael, 1995, p. 164). Evidence of the construct validity of the Distributed Learning Survey consisted of a close match between (a) the grouping of items and indicators of completion specified by the researcher and (b) the correlation patterns in the factor analysis.

To test the internal-consistency reliability of the instrument, the researcher calculated the Coefficient Alpha for each subscale. The Coefficient Alpha, developed by Cronbach, indicates the cohesiveness of the items on a scale that uses a non-dichotomous format for responses, such as the Likert-like response format (Isaac & Michael, 1995). This statistic takes account of the homogeneity of the items in the subscale and the consistency of measurement in determining the percentage of the score variance that is non-error variance.

To determine the predictive validity of the Distributed Learning Survey with respect to the nominal criterion variable of course completion, the researcher analyzed the data using discriminant analysis. This statistical technique has been used frequently in studies of student

completion (Garrison, 1985; Powell, Conway, & Ross, 1990; Pugliese, 1994; Terenzini & Pascarella, 1977). The predictor variables in the discriminant analysis corresponded to variables in the Background Survey and to the indicators of student completion, as identified in the first phase of the study and confirmed in the content and construct validity analysis. The criterion variable was dichotomous, completion or non-completion of the course, so the researcher tested predictive validity using a two-group discriminant analysis procedure.

The following assumptions underlie discriminant analysis:

- There are two or more groups.
- There are at least two cases per group. In the student sample, it was necessary that a minimum of two participants fell within each group, completers and non-completers, in order for the statistical analysis to be valid;
- The number of predictor variables cannot exceed the number of cases or participants, minus two;
- No predictor variable may be a linear combination of other predictor variables;
- The covariance matrices for the completer and non-completer groups must be approximately equal; and
- The groups, completers and non-completers, must be drawn from a population with a multivariate normal distribution on the predictor variables (Klecka, 1980).

The discriminant analysis determined the ability of each key variable in the instrument to discriminate between students who completed and did not complete the distributed course. The

SPSS discriminant analysis program produced a discriminant function equation that combined the variables in order to predict membership in the completer or non-completer groups. The output from the analysis presented a set of canonical coefficients for the variables in the function and information regarding the accuracy of the function (Klecka, 1980). Based on this analysis, the researcher designed the method for scoring responses on the Distributed Learning Survey.

The discriminant analysis procedure indicated the amount of variance in the sample that was accounted for by the discriminant function (1 – Wilks' Lambda). The results of a Chi-Square test indicated whether the function discriminated between completers and non-completers with an degree of accuracy significantly "above the 50 percent level that would be expected by chance" (Huck, Cormier, & Bounds, 1974, p. 163). For this study, the level of significance was established at the 0.1 level. In addition, a classification table showed the number of cases for each group (completers and non-completers) that were classified correctly by the discriminant function.

The researcher conducted a double cross-validation of the data, using the SPSS program to divide the sample data into two randomly assigned groups. Two discriminant function prediction equations resulted from this analysis, one from each of the two assigned groups, Group A and Group B. To test for predictive validity, the discriminant function prediction equation calculated for Group A was applied to Group B and vice versa.

CHAPTER 4

DATA ANALYSIS AND RESULTS

Introduction

This chapter presents the data analysis procedure and results for the three research questions in the study. Related to the first research question, the chapter begins with a discussion of the variables that the researcher identified as indicators of student completion of distributed learning courses and concludes with the results of the content validity analysis. The next section addresses the second research question. It describes the student sample and discusses the analysis of the Distributed Learning Survey for construct validity, internal consistency reliability, and predictive validity. In conclusion, the chapter presents the results related to the third research question, noting the correlation between the indicators of completion and student satisfaction in the course. A brief summary completes the chapter.

Analysis for Research Question One

Research Question One: What are the critical factors, in terms of abilities, attitudes, and situational variables, that contribute to a student's ability to complete a distributed learning course?

Identification of Indicators of Completion and Item Selection

The researcher reviewed the theory and research in distributed learning, with a focus on student completion of courses. This review, described in Chapter 2, showed three general areas of consensus central to understanding student decisions and behavior in completing a course: background characteristics, social integration, and academic integration. Appendix I presents the three instruments given to the students in the study, displaying the variable name and number for each of the items.

In the Background Survey the researcher presented items that could not be represented in a Likert-scale response format. Some of the background and situational variables were descriptive and categorical, such as the questions regarding gender, marital status, access to computer equipment, and whether the course was required for the student's major program. Interval and ratio-level items in the Background Survey included age, GPA, experience with distributed learning courses (number of previous courses), hours worked per week, educational level, current course load, and time since completion of a college course. Because of their open-ended response format, the researcher excluded these variables from the reliability analysis and factor analysis, but included them as predictor variables in the discriminant function analysis.

Kember (1995) defined social integration as "the degree to which the student is able to integrate the demands of part-time study with the continuing commitments of work, family, and social life" (p. 259). Support from family, friends, and employers strongly influence the

student's decision to enroll in a distributed learning course and the on-going decision to study and complete the course (Billings, 1989; Gibson, 1998b). Financial concerns also play a role in this social context for learning (Garrison, 1985). The researcher used the three questions developed by Kember (1995) to represent an enrollment encouragement subscale. In Kember's study these items had a reliability of 0.69. In addition, the researcher included one item developed by Powell, Conway, and Ross (1990) that pertained to financial stability.

Academic integration encompasses the qualities of intrinsic motivation and tenacity, two central characteristics of a successful distance learner (Fjortoft, 1995; Powell, Conway, & Ross, 1990; McIsaac & Gunawardena, 1996). For the motivation subscale the researcher used one item related to the need for success, from the Powell, Conway, and Ross (1990) study. In addition, four items were drawn from a twelve-item course specific motivation scale developed by Perrin and Reuter (1997). For the tenacity subscale, the researcher selected one item from Powell, Conway, and Ross (1990) and five items from a nine-item persistence sub-scale developed by Mikulecky, Lloyd, and Huang (1996), an instrument described in Chapter 2. Also, included under the broad construct of academic integration, the researcher included six items from the study conducted by Powell, Conway, and Ross (1990) that corresponded to the category of study habits, need for support, and rating of previous education.

In the research on completion in distributed learning environments and the effect of mediated communication, learning style preference is often identified as an independent variable. Specifically, researchers frequently focus on locus of control and field dependence as indicators

of learning style (Dille & Mezack, 1994; Hanson, et. al, 1997; Leader & Klein, 1996; McIsaac & Gunawardena, 1996; Sterbin & Rakow, 1996; Toro, 1996; Yoon, 1994). In the current study, the researcher selected four items for the Distributed Learning Survey from the Internal Locus of Attribution for Academic Success developed by Pascarella and Terenzini (1994). Finally, the Distributed Learning Survey included four items from the computer confidence scale developed by Levine and Donitsa-Schmidt (1997). Appendix J gives a list of items selected for the Distributed Learning Survey and indicates the source of each item, its original wording, and final wording used in the survey.

Content Validity Analysis

To establish the content validity of the Distributed Learning Survey, the researcher contacted four experts with experience in distributed learning research and in the validation of survey instruments. Three of the experts completed an Evaluation Form (Appendix D) to indicate whether the set of indicators or categories selected for inclusion in the instrument matched their judgment regarding the key variables for determining at-risk students in distributed courses. A fourth expert provided comments regarding the investigation of persistence and the use of predictor variables. In addition, the experts judged whether the items chosen for each indicator would measure the associated construct.

Table 4 shows the responses of the expert panel in their evaluation of the indicators of student completion included in the Distributed Learning Survey. A "+" in a column indicates that the expert agreed with the selection as an indicator of student completion. An "x" in a

column indicates that the evaluator found the indicator unacceptable. A "?" in a column indicates that the evaluator questioned the use of that variable in this study. The researcher structured the Evaluation Form to capture a quantitative assessment of the indicators and the associated items. In addition to this structured appraisal, the experts contributed qualitative information in the form of written comments.

Table 4. Results of Expert Evaluation of the Indicators of Completion

Expert / **Indicator of Completion**	**1**	**2**	**3**
Computer Confidence	+	+	x
Enrollment Encouragement	+	+	?
Financial Stability	x	+	?
Locus of Control	+	+	+
Motivation	+	+	+
Need for Support	?	+	+
Preparation	+	+	?
Study Habits	+	+	+
Tenacity	+	+	+

In light of the feedback provided by the evaluators, the researcher dropped financial stability as one of the indicators of completion in the Distributed Learning Survey. For each of the other indicators, at least two of the three experts agreed that the variable was significant and appropriate for identifying at-risk students in distributed learning courses. The researcher retained these eight indicators.

Based on comments from one of the experts, one item in the computer confidence category was deleted. The researcher made minor changes in the wording of three items based on the suggestions of the expert evaluators (see Appendix J). Table 5 shows the composition

of the Distributed Learning Survey, as revised according to the evaluation of the experts. The researcher presented the updated version to the students in the sample.

Table 5. Composition of the Distributed Learning Survey

Indicator of Completion	Number of Items
Computer Confidence	4
Enrollment Encouragement	3
Locus of Control	4
Motivation	5
Need for Support	2
Preparation	2
Study Habits	2
Tenacity	6

Summary of Findings for Research Question One

From the review of the research in the area of distributed learning, the researcher identified nine indicators of student completion that could be represented in Likert-scale format. Next, the researcher selected survey items that corresponded to these indicators and that had been previously tested in research settings. These items were included in the Distributed Learning Survey. After evaluation of the instrument by four experts, the Distributed Learning Survey encompassed eight indicators of student completion: computer confidence, enrollment encouragement, locus of control, motivation, need for support, preparation for the course, study habits and tenacity.

Analysis for Research Question Two

Research Question Two: Using a brief survey instrument, does a weighted combination of the critical factors indicate which students are at risk in terms of the

probability that the students will complete the distributed learning course?

Student Sample

The students in the sample participated as part of distributed learning courses offered at the University of North Texas during the summer and fall semesters of 1999. For this sample, the overall participation rate was 78.79% and the course completion rate was 86.69%. Appendix K presents a list of courses in the sample with the corresponding class size, participation rate, and completion rate for each course.

Because the statistical procedures used in the data analysis required independent observations, the researcher deleted duplicate records for students who completed the survey more than once. After this deletion of duplicate records, the sample contained 423 records. Of these 423 records, 396 records contained complete information with respect to the thirteen predictor variables, including interval and ratio-level variables and Likert-scale factors, used in the predictive validity analysis. In order to contain the discussion, the descriptive statistics presented here reflect these complete 396 records.

At the time of the sample, the majority of the distributed learning courses at the university were graduate level courses. The sample for this study reflects this fact, with graduate students composing 83.84% of the sample. The majority of the participants took classes in the fall (59.60%). In terms of instructional format, 68.94% of the sample involved students taking Web-based courses and 31.06% taking video conferencing courses. Table 6 lists the

departments represented in the sample, indicating the number of participants by course level (undergraduate or graduate), semester (summer or fall), and instructional format (video conferencing or Web-based instruction).

Table 6. Participants in the Sample by Department

Department	U	G	Summer	Fall	VC	WWW
Aging and Gerontology	1	9	0	10	10	0
Computer Education	22	66	18	70	0	88
Curriculum and Instruction	0	9	9	0	9	0
Educational Administration	0	19	19	0	19	0
Kinesiology	26	0	0	26	0	26
Library and Information Sciences	12	229	111	130	85	156
Physical Health Education	3	0	3	0	0	3
Total	64	332	160	236	123	273
Percentage	16.16	83.84	40.40	59.60	31.06	68.94

A profile of the average participant in the sample indicated that the student was 34.49 years old with a GPA of 3.46, who worked an average of 34.34 hours a week and who was taking 6.64 credit hours in the current semester. The typical student had been away from college 2.49 years and had taken 1.09 distributed learning courses prior to participating in the study. Appendix L gives the means and standard deviations for the variables in the Background Survey, such as age, GPA, and hours worked for the entire sample, and then presents similar information for two groups of students, those who completed and those who did not complete the course.

Construct Validity Analysis

The researcher used a 5-point Likert scale response format for each of the 28 items on the Distributed Learning Survey (see Appendix A). The response scale ranged from strongly disagree to strongly agree.

As described in the content validity section above, the researcher retained eight indicators of completion included in the Distributed Learning Survey after completion of the expert evaluation: computer confidence, enrollment encouragement, locus of control, motivation, need for support, preparation, study habits, and tenacity (see Table 4). The researcher conducted an exploratory factor analysis of the participants' responses to items on the Distributed Learning Survey, using a principal component analysis method of extraction. Factors or components with eigenvalues greater than 1.0 were extracted and subjected to varimax rotation.

This analysis yielded eight factors that accounted for 56.94 percent of the variance. According to the scree plot, six of the factors accounted for the majority of the variance. The researcher eliminated one survey item, ("I feel I will do well in this class."), because the item loaded on two of the factors simultaneously. The subsequent six-factor solution accounted for 49.42 of the variance. Appendix M shows the factor loading for these initial eight-factor and six-factor solutions.

To determine the stability of the factors, the researcher split the sample data into two randomly assigned groups and conducted a six-factor analysis separately on each group. Items

that did not load consistently on factors in the two groups were eliminated. Next, the researcher conducted a final six-factor analysis of the data, using only the items that consistently loaded on the factors, and then labeled each factor according to the underlying construct represented by the items loading on that factor. This solution accounted for 56.81 of the variance in the sample. Table 7 shows the factor loadings and alpha coefficients for the six-factor solution. An asterisk (*) beside an item indicates that the item was coded in reverse for factor analysis. Appendix N gives the means and standard deviations for these six factors for the following groups: the entire sample,

students who completed the course, and the students who did not complete the course.

Factor 1 accounted for 12.86% of the variance and consisted of the four items from the computer confidence category, with structure coefficients between .453 and .871. The researcher designated Factor 1 with the label "computer confidence." The four original locus of control items loaded together on Factor 2, accounting for 10.17% of the variance. The structure coefficients ranged from .641 to .703. Because a high score on these items corresponded to an external locus of control preference, the researcher labeled the factor "external locus of control."

Factor 3 corresponded to the three items that described the student's study environment, in terms of a designated time and place for study, as well as the student's assessment of time management ability. This factor accounted for 10.55% of the variance.

Table 7. Factor Loading and Internal Consistency Reliability

Variable Name	Indicator of Completion and Item	Factor Loading	Cronbach Alpha
	Computer Confidence		**.789**
computr1	I find using the computer easy.	.871	
computr2	I feel comfortable working with computers.	.858	
computr4	I learn new computer programs easily.	.855	
cmptutr5r	I hope I never have a job which requires me to use a	.453	
	computer.*		
	External Locus of Control		**.626**
control3	Getting a good grade in a college course depends more	.703	
	on being "naturally smart" than on how hard I work.		
control2	Good luck is more important for college academic	.676	
	success than hard work.		
control1	The grade I get in a course depends more on how hard	.642	
	the instructor grades than on how carefully I study.		
control4	When I have trouble learning the material in a course it is	.641	
	because the professor isn't doing a very good job.		
	Study Environment		**.682**
studytm	I am able to set aside regular times to study and do	.777	
	course assignments.		
studypl	I have a designated place for studying that is relatively fre	.757	
	from interruptions.		
timemg	I am a good time manager.	.716	
	Enrollment Encouragement		**.573**
enrlfrn	My friends encouraged me to enroll in this course.	.777	
enrlemp	My employer encouraged me to enroll in this course.	.729	
enrlfam	My decision to enroll in this course was influenced by	.653	
	family concerns.		
	Tenacity		**.472**
persist5	I can study well when there are other interesting things	.735	
	to do.		
persist4	If I can't understand a reading the first time, I keep	.688	
	trying until I can.		
prsist3r	It is difficult for me to concentrate on my learning task.*	.525	
	Motivation		**.392**
goals	Not passing this course would be a serious setback in	.720	
	relation to my educational goals.		
movtive3	I plan to work hard at my homework for this class.	.647	
support2	I need to discuss course work with other students.	.604	

Structure coefficients for the items in this factor ranged from .716 to .777. The researcher assigned the label "study environment" to Factor 3.

The three original enrollment encouragement items loaded together on Factor 4, accounting for 8.50% of the variance in the sample. The researcher designated this factor as "enrollment encouragement." The structure coefficients for the items ranged from .653 to .777.

Factor 5 included three items from the tenacity category, accounting for 7.77% of the variance. The structure coefficients ranged from .525 to .735. The researcher labeled Factor 5 "tenacity."

Factor 6 corresponded with two items from the motivation category and one item from the need for support category ("I need to discuss coursework with other students"). This factor accounted for 6.95% of the variance with structure coefficients ranging from .604 to .720. The researcher labeled the factor "motivation."

Of the original nine indicators of completion that the researcher identified from previous research, eight were included in the Distributed Learning Survey, as presented to the students in this study. The previous section on content validity analysis mentioned that the researcher dropped one of the initial indicators (financial stability) based on the comments of the expert evaluators.

The six-factor solution described here encompassed seven of the eight indicators of completion included in the Distributed Learning Survey and presented to the students in the sample. Six of the original indicators, computer confidence, enrollment encouragement, locus of

control, motivation, tenacity, and study environment, mapped to distinct factors. One of the items from the "need for support" category loaded on Factor 6 with the motivation items. The items associated with one category, preparation for the course, did not consistently load on any of the factors.

The varimax rotation method used in the factor analysis is a procedure to identify orthogonal factors in the sample data. As expected, a correlation analysis indicated no correlations between the factors. Table 8 presents these results.

Table 8. Correlation Matrix of Factors in Distributed Learning Survey

Indicator of Completion	1	2	3	4	5	6
1.Computer Confidence	1.000					
2. Enrollment Encouragement	0.000	1.000				
3. External Locus of Control	0.000	0.000	1.000			
4. Motivation	0.000	0.000	0.000	1.000		
5. Study Environment	0.000	0.000	0.000	0.000	1.000	
6. Tenacity	0.000	0.000	0.000	0.000	0.000	1.000

Reliability Analysis

The six factors identified during the construct validity analysis correspond to subscales of the Distributed Learning Survey. These subscales are heterogeneous; therefore, the researcher assessed the internal consistency reliability of each, distinct subscale, rather than calculating an overall alpha coefficient for the instrument (see Table 7). The alpha coefficients ranged from .789 (Factor 1) to .392 (Factor 6).

Predictive Validity Analysis

To determine the predictive validity of the Distributed Learning Survey with respect to the nominal criterion variable, the researcher analyzed the data using discriminant analysis. The criterion variable was dichotomous, completion or non-completion of the course, so the researcher tested predictive validity using a two-group discriminant analysis procedure.

The predictor variables in the discriminant analysis corresponded to variables in the Background Survey and to the indicators of student completion in the Distributed Learning Survey, as identified in the first phase of the study and confirmed in the content and construct validity analysis. The predictor variables from the Background Survey consisted of the following: age, GPA, years out of college, educational level, current credit hours, number of hours working per week, and number of distributed learning courses taken previous to the semester of this study. In the set of predictor variables, the researcher included the six factors in the Distributed Learning Survey: computer confidence, external locus of control, study environment, enrollment encouragement, tenacity, and motivation. To clarify the discussion from this point forward, the researcher will refer to the thirteen predictor variables under the umbrella of the Distributed Learning Survey.

First, the researcher conducted a discriminant analysis of the entire sample. The sample contained 396 student records that were valid for all thirteen predictor variables. The discriminant analysis produced one function that combined the value of each predictor variable with a numerical coefficient, called the canonical discriminant function coefficient. Table 9

presents the canonical coefficients and the constant for the discriminant function. The discriminant function procedure in SPSS used these values to calculate group membership, predicted completion or non-completion, for a given student record (Huck, Cormier, & Bounds, 1974).

Table 9. Canonical Discriminant Function Coefficients

Indicator of Completion	**Coefficient**
Age	-0.055
Computer confidence	0.082
Credit hours this semester	-0.015
Educational level	0.828
Enrollment encouragement	0.119
External locus of control	0.024
GPA	0.912
Hours worked per week	-0.001
Motivation	0.174
Previous distributed courses	0.069
Study environment	0.393
Tenacity	-0.033
Years out of college	0.032
(Constant)	-5.223

In addition, the statistical procedure produced a structure matrix, giving a measure of the correlation of a single predictor variable and the discriminant function. The Product-moment correlation coefficients in the structure matrix indicated the relative ability of each variable to discriminate between students who completed and did not complete the distributed course. The coefficients in the structure matrix also indicate the direction of the association between the variable and completion of the course. According to Klecka (1990), "by knowing these

coefficients, we know the geometric structure of the data space" (p. 31). Table 10 presents the structure matrix for the discriminant function.

Table 10. Structure Matrix

Indicator of Completion	Coefficient
Educational level	0.682
GPA	0.625
Credit hours this semester	-0.406
Study environment	0.381
Motivation	0.225
Previous distributed courses	0.200
Computer confidence	0.193
Enrollment encouragement	0.168
Hours worked per week	0.120
External locus of control	0.049
Years out of college	0.027
Tenacity	-0.013
Age	0.001

The structure matrix suggested that the primary variables responsible for discriminating between completers and non-completers were educational level, GPA, number of credit hours taken in the current semester, study environment, motivation, number of previous distributed courses, and computer confidence. Students were more likely to complete the course if they were graduate students with a higher GPA who were taking fewer credit hours. These students had taken more distributed courses prior to the current semester, perceived their study environment to be more stable and rated themselves higher in terms of motivation and computer confidence.

The next set of variables made a moderate contribution to the discriminant function. Students were more likely to complete the course if they received encouragement to enroll in the course and worked more hours per week. Locus of control, years out of college, tenacity and age made only a slight contribution to the prediction equation. Students who completed the course gave themselves lower scores for tenacity, tended to have a slightly more external locus of control, had been out of college longer, and were older.

The discriminant analysis procedure produced standardized canonical coefficients that also suggested the relative contribution of the predictor variables. For comparison purposes, Table 11 presents these standardized coefficients for the complete sample. Daniel (1990) noted that the structure coefficients are less "affected by collinearity among the variables" and, in general, are more stable indicators of the relationships among the variables (p. 13). In this study, the researcher has used the structure coefficients to present the results of the discriminant analysis, in terms of the contributions of the variables, while acknowledging that the standardized canonical coefficients represent an alternate ranking of those contributions.

The discriminant analysis procedure produced information regarding the accuracy of the discriminant function derived from the entire sample: canonical correlation coefficient, Chi-Square value with degrees of freedom and level of significance, and classification results, indicating the percentage of cases that were

Table 11. Standardized Canonical Coefficients

Indicator of Completion	Coefficient
Educational level	0.643
Age	-0.542
GPA	0.466
Study environment	0.383
Years out of college	0.166
Motivation	0.166
Previous distributed courses	0.126
Enrollment encouragement	0.118
Computer confidence	0.081
Credit hours this semester	-0.057
Tenacity	-0.034
External locus of control	0.024
Hours worked per week	-0.018

correctly classified by the discriminant function (Klecka, 1980). Table 12 presents these results.

The coefficient of discrimination (R squared) shows the amount of variance in the dependent variable, student completion of the course, that is explained by this combination of predictor variables (Gall, Borg, & Gall, 1996). In this case, R squared was 0.176, indicating that 17.6 % of the variance in the sample was accounted for by the predictor variables. The Chi-Square test showed that the function derived from the entire sample distinguished between completing students and non-completing students with a degree of accuracy significantly "above the 50 percent level that would be expected by chance" (Huck, Cormier, & Bounds, 1974, p. 163). The Chi-Square value of 74.887 was significant at the 0.0001 level.

Table 12. Accuracy of the Discriminant Function

Chi-squared	74.887
Degrees of freedom	13
Level of significance	0.0001
Canonical correlation coefficient (R)	0.419
Coefficient of determination (R squared)	0.176
Percentage of cases correctly classified	82.80%

This estimation of accuracy is inflated to a certain extent because the procedure used the same group of cases to derive the discriminant function and to test that function. To gain a better estimate of the discriminating ability of the indicators of completion used in this study, the researcher conducted a double cross-validation of the data. The researcher divided the sample data into two randomly assigned groups (Group A and Group B), using the SPSS random selection procedure. Group A consisted of 189 cases and Group B consisted of 207 cases. Two discriminant functions resulted from this analysis, one derived from Group A and a second function derived from Group B. Appendix O presents the canonical discriminant function coefficients, structure matrix, and classification summary for each function.

The discriminant function derived from the cases in Group A and applied to Group B resulted in a highly significant Chi square value (chi square = 42.090; df = 13; $p < .0001$) that accounted for 20.8 % of the variance in completion for the cases in Group B.

The discriminant function derived from the cases in Group B and applied to Group A also resulted in a significant Chi square value (chi square = 46.043; df = 13; $p < .0001$) that accounted for 20.7 % of the variance in completion for the cases in Group A.

As expected, the accuracy of the two functions was lower than for the function calculated for the entire sample. The two functions in the double cross validation procedure correctly classified 76.20% - 81.60% of the cases, as compared with 82.80% with the original discriminant function. The function calculated with the cases in Group A correctly classified 64.30% of the non-completing students in Group B and the function calculated with the cases in Group B correctly classified 62.50% of the non-completing students in Group A.

The researcher conducted one final test of the instrument's predictive validity. In this study the dependent variable of completion resulted in two unequal groups, completing students and non-completing students. In the sample of 396 students, 38 students did not complete the course and 358 students completed the course. To test the performance of the predictor variables with approximately equal groups of completing and non-completing students, the researcher conducted the discriminant analysis based on the cases in the sample data, using all of the non-completing participants (38 cases) and a randomly selected comparison group of completing students (41 cases). Appendix P presents the results of this analysis: the canonical discriminant function coefficients, structure matrix, and classification summary for the discriminant function.

This test of equal groups confirmed the previous findings. The discriminant function resulted in a significant Chi square value (chi square = 34.839; df = 13; $p < .001$) that accounted for 39.0 % of the variance in the selected cases. The function correctly classified 80.50% of the completing students and 76.30% of the non-completing students.

In summary, the discriminant analysis indicated that the thirteen predictor variables were significantly related to course completion at the 0.0001 level. A discriminant function based on these variables could distinguish between completing and non-completing students at a level above the 50% level expected by chance.

Based on this analysis, the researcher designed the method for scoring responses on the Distributed Learning Survey. The steps for calculating a student's score on the survey are listed below and a worksheet is provided in Appendix Q.

1. Recode the value for computr5 and persist3 (survey item #15 and survey item #22) as follows: change 5 to1; 4 to 2; 3 unchanged; 2 to 4; and 1 to 5.
2. For each student record, create totals for the six factor scores by adding the values for the items in that factor. Refer to Table 7 for a listing of the items in each factor.
3. Multiply each of the thirteen predictor variable values by the corresponding weight for that variable given in Appendix Q.
4. Total the thirteen values created in Step 3, and then add constant value. This value gives the discriminant function value for a given student.

5. For each student record, the function value calculated in Step 4 may be used to indicate "whether the individual in question will eventually become a member" of the completion group or non-completion group (Huck, Cormier, & Bounds, 1974, p.163).
6. To determine the indicated group membership (completion or non-completion) for a given student:
    a. subtract the student's discriminant function value from the centroid for the completion group and determine the absolute value;
    b. subtract the student's discriminant function value from the centroid for the non-completion group and determine the absolute value;
    c. select the minimum of the two absolute values.
7. The minimum value indicates the student's group membership based on the discriminant function.

Summary of Findings for Research Question Two

To address the second research question and establish the construct validity of the Distributed Learning Survey, the researcher conducted a factor analysis of the items in the instrument. This analysis indicated that the instrument encompassed six factors, with three or four items per factor. Subsequent reliability analysis showed that the Coefficient Alpha for the factors ranged from .3916 to .7890.

Using the six factors and seven interval and ratio-level variables, the researcher investigated the predictive validity of the Distributed Learning Survey. A weighted combination of these thirteen predictor variables in the discriminant analysis identified the students at-risk for not completing the course with an accuracy of 62.50% to 64.30%. In the double cross validation procedure, the instrument gave an overall predictive ability of 76.20% to 80.20%.

Analysis for Research Question Three

Research Question Three: Do the critical factors correlate with the student's level of satisfaction in the course?

The researcher asked each participant in the study to complete the student satisfaction instrument near the end of the semester. The completion rate for this instrument was low, with 238 students completing the satisfaction survey in the sample of 423 participants who completed the Distributed Learning Survey (56.26 %). As a practical matter, only students who completed the course participated fully in course activities at the end of the semester. Consequently, these observations regarding student satisfaction are limited to the completion group in the sample.

For the participants who completed the student satisfaction instrument, the researcher correlated the total satisfaction score with the discriminant function value. A significant correlation did not exist. Next, the researcher correlated the total satisfaction score with the set of seven interval and ratio-level variables and the six indicators of completion identified in the Distributed Learning Survey. Table 13 presents the results of the correlation analysis, showing

the Pearson correlation values. At an alpha level of 0.01, only the number of previous distributed learning courses taken by the student correlated significantly with the satisfaction score. At the 0.05 alpha level, age, computer confidence, and motivation correlated positively with the total satisfaction score.

Table 13. Correlation of Satisfaction with the Indicators of Completion

Indicator of Completion	Correlation with Total Satisfaction Score
A. Background Variables	
Age	0.158*
Credit hours this semester	-0.069
Educational level	0.108
GPA	0.044
Hours worked per week	0.078
Previous distributed courses	0.306**
Years out of college	-0.026
B. Factors in the Distributed Learning Survey	
Computer Confidence	0.160*
Enrollment Encouragement	0.014
External Locus of Control	-0.129
Motivation	0.153*
Study Environment	0.012
Tenacity	0.041

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Summary of Findings for Research Question Three

This correlation analysis indicated that student satisfaction was connected most closely with the number of distributed learning courses that a student had taken prior to participating in

the study. In addition, the researcher found smaller, statistically significant correlations of the total satisfaction score with one ratio-level variable and two of the subscales in the Distributed Learning Survey. Older students in the sample were more satisfied with the course. The more highly motivated students with higher levels of computer confidence were also more satisfied with the course.

Summary

The findings in this study addressed three research questions, providing affirmative answers to those questions.

Research Question One: The researcher identified thirteen indicators of completion for students in distributed learning courses: seven interval and ratio-level variables and six factors represented by three or four Likert-scale items.

Research Question Two: Using a brief survey instrument with eleven categorical, interval, and ratio-level items and twenty Likert-scale items, a weighted combination of the indicators of completion identified at-risk students with an accuracy of 62.50% to 64.30%.

Research Question Three: The level of student satisfaction in the course correlated with two ratio-level variables (age and number of previous distributed learning courses taken) and two of the factors in the Distributed Learning Survey (computer confidence and motivation).

The thirteen indicators of completion encompassed by the Distributed Learning Survey do not represent a deterministic model. Rather, the instrument confirmed the models of attrition

in higher education developed by Tinto, Kember, and others, and presented an assessment to assist faculty and students at the beginning of a course.

CHAPTER 5

CONCLUSIONS

Introduction

The current period of rapid technological change is the best of times and the worst of times. The influence of technological innovation, particularly in the area of mediated communication, has combined with new philosophies of education and market forces to bring upheaval to the realm of higher education. Technical capabilities exceed our knowledge of whether expenditures on hardware and software lead to corresponding gains in student learning. Educators do not yet possess sophisticated assessments of what we may be gaining or losing as we widen the scope of distributed learning.

The purpose of this study was not to draw sweeping conclusions with respect to the costs or benefits of technology in education. The researcher focused on a single issue involved in educational quality: assessing the ability of a student to complete a course. Those who have investigated traditional distance education have noted that attrition rates are often higher than in face-to-face classroom situations. Now that video conferencing and Web-based courses are being introduced with greater frequency to an expanding group of students, educators and students may benefit from a reliable instrument to identify those students who may encounter difficulty in these distributed learning environments.

Discussion of Findings

Student Profiles

The students in the sample were predominantly graduate students in the School of Library and Information Sciences. Given this context, the indicators of completion from the Distributed Learning Survey gave an outline of potentially at-risk students. Figure 1 presents this profile. As in the structure matrix (see Table 10), this representation shows the correlation of each predictor variable with the discriminant function value. It depicts the at-risk situation for students in distributed environments as a combination of background characteristics, situational variables and student attitude variables.

In this study, the at-risk students were taking more credit hours and working fewer hours per week. They tended to be slightly younger. They had not taken distributed courses before and were continuing students or students who had been away from college about two years or less. Compared to the completing students, at-risk students had less stable study environments, lower motivation, and less computer confidence. They tended to be undergraduates with lower GPAs, who gave themselves higher ratings for tenacity, tended to view their success as under their control, and received less encouragement to take the course.

In the comparison of completing and non-completing students, one striking feature was the relatively slight difference between the mean for the two groups with respect to each attribute. The two groups were not vastly different; instead, it was the consistency

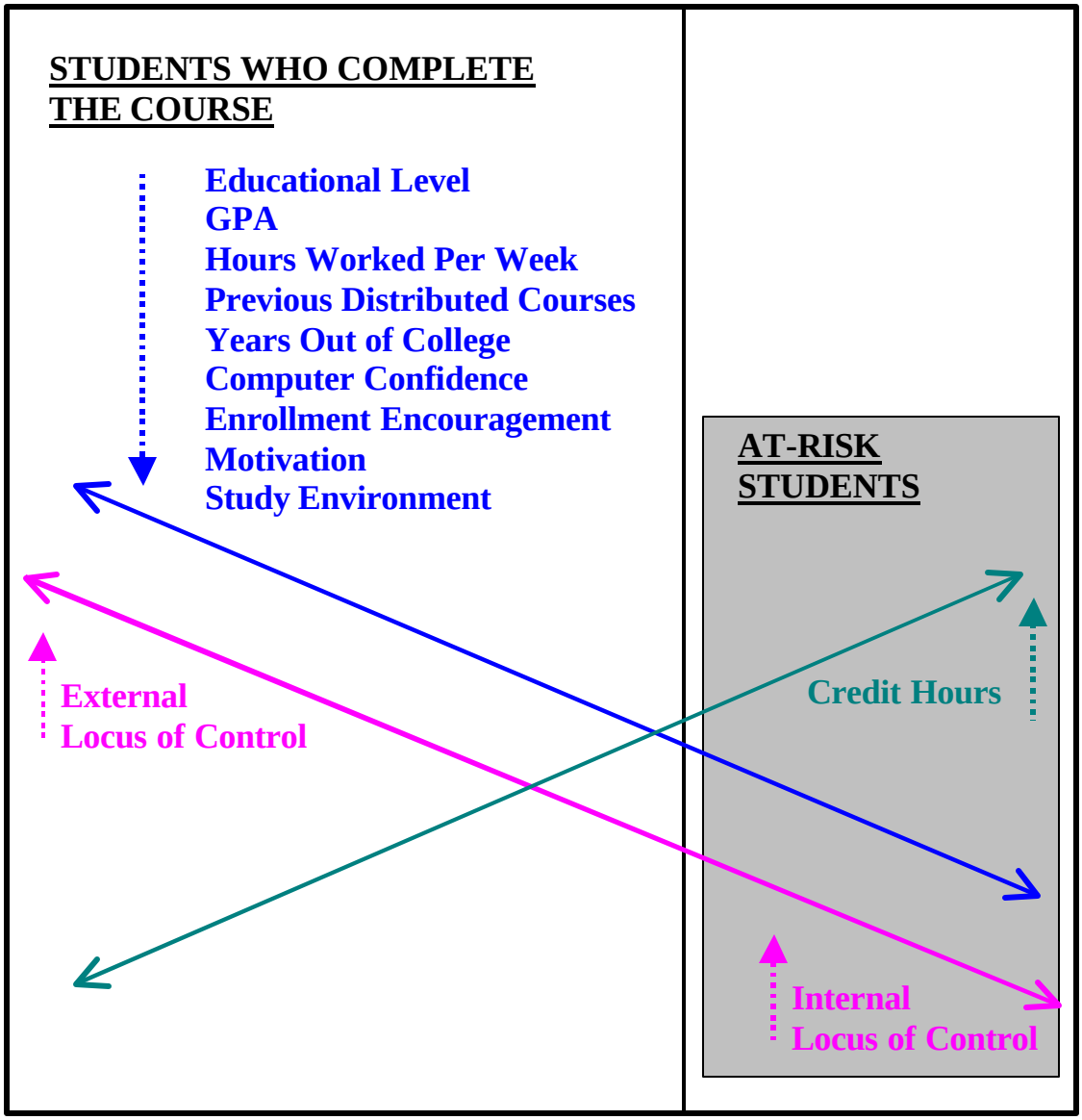


Figure 1. Framework for At-Risk Students

and direction of the differences that made it possible for the combination of predictor variables to detect the at-risk students.

Relative Contributions Made by the Indicators of Completion

The structure matrix produced by the discriminant analysis for the entire sample shows the correlation of each single predictor variable with the discriminant function (see Table 10).

This matrix indicated that educational level, GPA, credit hours taken, study environment, motivation, computer confidence, and number of previous distributed learning courses taken, accounted for most of the predictive power in the discriminant function. As in previous research, this study has shown that entry characteristics, such as GPA and educational level, made an important contribution to the prediction equation, but are not sufficient predictors in isolation. Completing students typically had taken at least one distributed learning course prior to their participation in the study, whereas non-completing students did not have prior experience with this type of course. Students taking a high number of credit hours had more difficulty completing the course.

In addition, the major criteria differentiating completing students from non-completing students included three indicators that correspond to subscales in the Distributed Learning Survey: study environment, motivation, and computer confidence.

Two of these indicators of completion show relatively high internal consistency reliability: study environment (alpha = .682) and computer confidence (alpha = .789). The motivation items, on the other hand, though important in terms of identifying at-risk students in this sample, displayed lower reliability (alpha = .392) and cohesiveness as a factor in the instrument. This finding merits further investigation for the improvement of the Distributed Learning Survey.

The next four indicators of completion in the discriminant analysis structure matrix made a marginal contribution in terms of identifying at-risk students. In this group, the measure of enrollment encouragement had the highest discriminating power. The enrollment encouragement

items were relatively reliable (alpha = .573) and cohesive as a subscale in the Distributed Learning Survey. In general, students in the sample did not perceive a high degree of encouragement when they enrolled in the course, with an average of 7.27 points (standard deviation of 2.93) out of a possible 15. On the other hand, the difference between completing and non-completing students is distinct: 7.34 for completing students (standard deviation of 2.94) and 6.55 for non-completing students (standard deviation of 2.70).

Hours worked per week and the external locus of control subscale made modest contributions. With respect to the number of hours worked per week, at-risk students actually worked fewer hours per week. It might seem logical that a student working fewer hours per week would have more time for study and, consequently, that student would have an increased likelihood of completion. This unexpected result may indicate that, in reality, working more hours contributes to a student handling assignments efficiently and approaching all tasks in a disciplined manner because that student has little time to spare. Further investigation is necessary to find evidence for this preliminary hypothesis.

The data corresponding to locus of control subscale also gave an unexpected result. One might expect an internal locus of control to contribute to completion of distributed course; instead, a tendency toward external locus of control characterized those who completed the course. Closer inspection of the sample data indicated that students in both completion and non-completion groups tended toward an internal locus of control, with a mean of 7.69 (standard deviation of 2.18) for the completing students and 7.45 (standard deviation of 2.29)

for the non-completing students. For the locus of control subscale, a value of 13 to 20 indicated an external locus of control, while 4 to 11 indicated an internal locus of control. A score of 12 was the midpoint in the scale.

Within a narrow range, the students with a less extreme internal locus of control tended to complete the course. One possible explanation may be that while an internal locus of control contributes to autonomy needed in a distributed learning environment, it may also have a negative consequence. Students with a higher internal locus of control score may be less integrated into academic life and, therefore, they may be less accepting of the demands and procedures associated with coursework. Additional research is needed to test the relationship of the locus of control variable with completion of the course.

Finally, age, number of years out of college, and tenacity made a negligible contribution to the discriminant function. Older students were at a slight advantage for completing the course. In addition, continuing students or students who had been out of college fewer years were at-risk. A slight correlation existed between age and the number of years out of college, so maturity may be one reason that, though a student had been away from college, such a student might have an increased likelihood for completing the course. It may be that a student who made the decision to return to college might also be more determined to succeed than other students who have not had a break in the continuity of their education. Like the motivation items, the tenacity items displayed low reliability and cohesiveness as a factor in the

instrument. Completing students in the sample rated themselves as less persistent in pursuing reading assignments and other projects than the non-completing students did.

Satisfaction in Distributed Learning Courses

For those students participating in the course near the end of the semester, satisfaction with the distributed learning course was loosely connected with several of the indicators of completion. For this study, the researcher operationalized satisfaction with the course as the student's total score on a satisfaction instrument consisting of twenty Likert-scale items. The most significant connection existed between satisfaction and the student's experience with distributed learning courses. The evidence in this sample suggests that when students know what to expect, they rate the course as more satisfactory.

Overall, the students who completed the evaluations for this study were generally satisfied with the course. The average satisfaction score was 82.53 out of a possible 100 points. As noted in prior studies of course evaluation, this result does not give an indication of the instructional effectiveness of the courses. Older, more motivated students who were confident in their ability to use computers tended to view the course more positively. These indications, however, were slight. The student attitudes, background characteristics, and situational variables identified here as composing an at-risk situation, do not contribute in any definitive way to course satisfaction or dissatisfaction.

The evidence regarding satisfaction given by the current study raises questions about the areas of satisfaction and dissatisfaction experienced by non-completing students. The method

of surveying students at the end of the course, a typical procedure in higher education, systematically excludes those students who dropout. Though the lack of information regarding these students is not unusual, it is certainly an area of investigation worth pursuing in the future.

Significance of the Findings

The current study was not a search for the reasons or causes of student attrition. Such causes often lie in the area of unforeseen circumstances, such as illness or unexpected responsibilities at work. Instead, this study sought to identify student characteristics and aspects of the student's environment that create a greater sensitivity to unforeseen circumstances. Given this sensitivity, illness or a family problem or changes at work might lead at-risk students to withdraw from distributed learning courses, implicitly or explicitly, at a rate that exceeds the dropout rate for the overall student population.

The indicators of completion included in the Distributed Learning Survey are predictors only in the statistical sense. The framework for at-risk students is not a deterministic model and a score on the Distributed Learning Survey is not intended to be used to exclude or discourage prospective students in a distributed learning program. The instrument represents a vehicle for communication and assistance for the institution, faculty and the student. For example, a student without previous experience in distributed learning courses, with a GPA of B or lower and with a relatively unstable study environment, may need additional encouragement, feedback on initial assignments, and assistance with the use of e-mail and other software used in the course. Rather than a survival of the fittest approach to student completion, administrators and faculty

can take a proactive stance in helping students succeed in a learning environment that emphasizes skills and characteristics not possessed by all students. The value of the Distributed Learning Survey, for the student and for the instructor, lies in its ability to identify at-risk students before they encounter difficulties in the course.

This study contributes to the knowledge base on student attrition in video conferencing and Web-based courses by providing detailed information regarding the variables that contribute to an at-risk situation for students. In the current study, the set of thirteen indicators of completion correlated significantly with the outcome variable of course completion. In keeping with this evidence, a researcher would be justified in using the Distributed Learning Survey, and the weights represented in the discriminant function, for similar groups of students in comparable distributed learning courses (Huck, Cormier, & Bounds, 1974).

Because the researcher selected the indicators of completion and the survey items based on the models developed by Tinto, Kember, and other prominent authors, this study supports the constructs encompassed by those theories. The research findings give support for focusing on the student's background characteristics, social integration, and academic integration, as significant aspects of the relationships and experiences of the distributed learner.

Recommendations for Further Research

The results of the study suggest five areas that merit further research:

- application of the Distributed Learning Survey, including tests of its validity, for specific groups of students, at other institutions, and over time.

- improvement of the subscales of the instrument;
- investigation, using qualitative methods, of the causes of student non-completion of video conferencing and Web-based courses; and
- development of the student satisfaction instrument for distributed learning courses.

Application of the Distributed Learning Survey

In the sample for the current study graduate students and a small group of academic departments predominated. This situation reflects the fact that these departments, particularly for their graduate courses, were the early adopters of video conferencing and Web-based formats for instruction at the University of North Texas. The uneven distribution of departments represented in the sample, though an accurate reflection of distributed learning at the institution, is a limitation of the study with respect to the generalizability of the results. A follow-up study involving a broader spectrum of departments would be appropriate.

The researcher conducted preliminary discriminant analysis of the Distributed Learning Survey for several subsets of the sample: undergraduate students; graduate students; participants in Web-based courses; and participants in video conferencing courses. In the cases with adequate sample size, the results confirmed the predictive validity of the instrument. These results are indicative, but not conclusive. An alternate discriminant function, with different weights for the indicators of completion, may be warranted for each subset of the student population. Further research is needed to study these specific groups of students.

Another application of the Distributed Learning Survey involves tracing student persistence from the beginning of a distributed learning program through graduation to determine the instrument's predictive validity over an extended time period. Other applications include testing groups of students in private universities and community colleges; focusing on host or remote site students in video conferencing courses; studying students in elective or required courses; and selecting participants enrolled in established or recently developed courses. Such studies might lead to more precise predictive equations consistent with the purpose of the current study: to identify at-risk students in distributed learning courses and, thus, allow faculty and administrators to give appropriate assistance to those students.

Finally, additional study is needed to distinguish among categories of non-completing students. In this case, the research could expand the data collection procedure to account for students who withdraw immediately (non-starters), withdraw with a passing grade, withdraw with a failing grade, attain an incomplete grade in the course, or receive a low grade (D or F) due to non-completion of assignments, examinations, or both.

Improving the Subscales of the Instrument

The results of the study suggest that further research in three areas could improve the reliability and validity of the subscales in the Distributed Learning Survey. First, because the tenacity and motivation subscales displayed relatively low reliability, they could be strengthened by addition of items. This step is warranted in light of the importance of these two constructs in this study and in previous investigations of student attrition rates.

Second, the Distributed Learning Survey contains few items related to social integration. Initially, the instrument included one item centered on the student's financial concerns. The researcher eliminated this item during the content validity phase of the study. In the final version of the instrument, only the enrollment encouragement subscale corresponded to the social integration construct. Further study might identify additional, appropriate items that could be included in the Distributed Learning Survey.

Finally, the researcher represented the student's learning style by adopting items related to locus of control. As noted by one of the expert evaluators, other aspects of learning style might be important predictors of completion in distributed learning courses. A study involving both the Distributed Learning Survey and a learning style inventory, such as the Canfield Learning Style Inventory (Canfield, 1976), could test the contribution of additional learning style dimensions relevant to identification of at-risk students.

Qualitative Studies

The current study did not include follow-up interviews with non-completing students. Reflections by these students on barriers to persistence and on the effect of mediated communication with the instructor and with fellow students would give depth to the description of the at-risk situation. The researcher observed that faculty members were eager to contribute their perceptions of the changing role of the instructor and on the quality of communication with students in these learning environments. Systematic analysis of such contributions by faculty and students could facilitate the improvement of distributed learning courses and the instrument.

Investigation of Student Satisfaction

Though previous research indicates that end of semester course evaluations are not closely connected with instructional effectiveness, such evaluations do give an indication of student satisfaction. At the end of the semester, participants in this study completed a twenty-item, Likert-scale course evaluation instrument. The total score on the evaluation corresponded to a measure of student satisfaction in the course. For the course evaluation instrument, the researcher selected only items with published information regarding reliability and this requirement eliminated many items recently developed, and untested, regarding the influence of technical media on student satisfaction. An in-depth investigation of the subscales within the instrument, as well as expanding it to include items designed to parse out the contribution of the instructor from the impact of technical media, is needed.

Summary

The purpose of this study was to identify background variables, situational variables, and attitudinal variables important for student completion of distributed learning courses and to construct an assessment instrument based on these factors. The researcher found that the Distributed Learning Survey represents a reliable and valid instrument for identifying at-risk students in video conferencing and Web-based courses where the student population is similar to the study participants. Educational level, GPA, credit hours taken in the semester, study environment, motivation, computer confidence, and the number of previous distributed learning

courses accounted for most of the predictive power in the discriminant function based on student scores from the survey.

In marked contrast to a survival of the fittest stance, the framework for identifying at-risk students represented in the survey provides a vehicle for communication and assistance to students in distributed learning courses. The data presented here confirmed the models of student attrition developed by prominent theorists such as Tinto and Kember. In addition, the results of the study indicated that completing students were satisfied with the distributed learning courses. Total satisfaction scores correlated with the number of previous distributed learning courses taken, age, motivation, and computer confidence.

This study points to additional avenues of investigation regarding the applicability of the Distributed Learning Survey for specific groups of distance learners, such as remote-site students in video conferencing courses. Further research could contribute to the improvement and expansion of the subscales of the instrument. A qualitative study of non-completing students and their instructors could enrich our understanding of the impact of current changes in course offerings. Finally, additional research involving factor analysis of a student satisfaction instrument for distributed learning environments would assist educators in gauging student reactions to these changes.

In conclusion, this study addressed an expressed need in the area of distributed learning for a valid and reliable instrument to identify potentially at-risk students. Such an instrument is a vehicle for communication and represents one method to assist students, instructional designers,

faculty, and administrators. As mentioned previously, this is a time of experimentation in higher education. As technology changes and influences society in innumerable ways, including commerce, communication and the legal system, students enroll in distributed learning courses because of their own preference or because the instruction they desire is offered by the institution in a non-traditional format. These students come with a wide variety of skills and expectations. If the student has not previously enrolled in a video-conferencing or Web-based course, they have little to guide them in assessing their skills and expectations. The students who complete the Distributed Learning Survey at the beginning of the course or program acquire feedback on their current situation and attitudes with respect to a given educational environment. In conjunction with other forms of orientation offered by the faculty and the administration, this feedback may lead the students to ask questions, request assistance, and adjust their expectations so that they are in a better position to succeed.

Instructional designers work as part of a team in creating course materials for a distributed learning course. They integrate their own skills in analysis, graphics, design, and programming with the knowledge and skills of others with respect to learning philosophy, needs assessment, and subject matter expertise. The delivered product is seldom considered finished. Rather, educators and designers view instructional materials as subject to continuous evaluation and revision. They value quality feedback on the changing landscape of student needs and responses. When instructors use the Distributed Learning Survey, they create a profile of the student population, in terms of the students' confidence, experience, motivation, and study

environment. This information could assist designers in refining information presentation, projects, and timelines.

Underlying the development of the Distributed Learning Survey is a philosophy of education that emphasizes service to the student, in contrast to a survival of the fittest mentality. In general, faculty and administrators want students to acquire knowledge and skills, complete courses and programs, and find satisfaction in their educational experience and subsequent careers. Educators understand the importance of knowing their audience and addressing the issues relevant to that audience. The aspect of separation introduced into the learning environment through the use of technical media highlights the importance of assessing student needs. The Distributed Learning Survey is intended to provide information regarding student needs very early in the semester, making schedule, communication, and curriculum adjustments easier to define and implement.

APPENDIX A

SURVEY INSTRUMENTS

Distributed Learning Research Project

Consent Form

Description of the Research Project

The number of courses using video-conferencing and Internet delivery is increasing. The quality of educational offerings depends on whether these changes in course format maximize the opportunities for student learning and minimize any negative effects. Evaluation plays a key role in this effort. The research proposed here addresses this need for accurate information about the students who enroll in these courses.

The results of this study will provide assessment information for students, faculty, course designers, and administrators. The results will provide guidance for students with respect to the appropriateness of a given course of instruction. In addition, this information will allow faculty to adjust the course structure, in terms of course activities and the level of interaction, to meet the identified student needs. Taking a long-range view, the results of this study will assist those who design instructional materials and instructional system interfaces. They may revise course components to increase compatibility with the identified aptitudes and attitudes of the students. The research may assist university administrators as they choose (1) the type and format of the courses offered and (2) the type of support services provided to students.

Respondent Consent

As part of my participation in this study, I agree to complete three forms:
1. a background survey, at the beginning of the course;
2. a distributed learning survey, at the beginning of the course; and
3. a student satisfaction survey, at the end of the course.

My results on the above surveys will be used in conjunction with my completion of the course. If I do not complete the course, my data will be used in this study to understand non-completion of video conferenced and Web-based courses. The nature of the study has been explained to me. I understand that:

- I may choose to withdraw at any time from the study task.
- I may ask questions at any time, before, during, or after the study.
- The information I provide will be kept confidential. I will not be identifiable in any reports or publications.
- My participation in this study will not affect my grade for any course in any way.
- At my discretion, I may request and, at the end of the semester, receive my results from the instruments used in this study.

I understand that this study is being used as dissertation research for Viola Osborn, doctoral candidate in Information Science at the University of North Texas.

I give my consent to participate in the above study.

_____ _____
Signature Date

_____ _____
Please print your last name Last 4 digits of your student id number

Course: _____ Section or Location: _____

E-mail address (optional) _____

Thank you for agreeing to participate in this study.

For further information, contact:
Viola Osborn (osborn@tac.coe.unt.edu)
Doctoral Candidate in Information Science
University of North Texas
UNT Box 309116, Denton, TX 76203

School of Library and Information Sciences
University of North Texas
940-565-4538

This project has been reviewed and approved by the UNT Committee for the Protection of Human Subjects (940/565-3940).

To the student:

The information that you provide on the following questionnaire will be used to increase our understanding of students who take video-conferencing and Internet-based courses. This questionnaire could require 10-15 minutes of your time. Please complete all items even if you feel that some are redundant. Respond with your first impression for each question. **It is very important that every question be answered. Your answers will remain confidential.**

Thank you for your cooperation!

Viola Osborn
Doctoral Candidate in Information Science
University of North Texas

Background Information

1. Gender: ( ) female ( ) male

2. Are you currently married? ( ) yes ( ) no

3. What is your age? _____ years

4. How many hours do you work each week, on average? _____ hours/ week

5. Is this a required course for your degree or major? ( ) yes ( ) no ( ) don't know

6. Do you have access to a computer at home or at work that you can use for class assignments? ( ) yes ( ) no

7. What is your current level of education?
   ( ) freshman ( ) sophomore ( ) junior ( ) senior
   ( ) master's level ( ) doctoral level

8. What is your current college GPA? (e.g. 2.5, 3.6, etc.) _____

9. How many total credit hours are you currently taking? ____

10. How many videoconferencing or Web-based courses have you enrolled in prior to this semester? _____

11. How long has it been since you completed a college course?
    _____ years (enter 0 if less than 1 year)

Distributed Learning Survey

Instructions: Please read each statement and then circle the number which best shows how you feel.

SD = Strongly Disagree D = Disagree U = Undecided
A = Agree SA = Strongly Agree

		SD	D	U	A	SA
1. My formal educational background has given me adequate preparation for this course.	(1)	1	2	3	4	5
2. I need support and encouragement from others to complete difficult tasks.	(2)	1	2	3	4	5
3. I am able to set aside regular times to study and do course assignments.	(3)	1	2	3	4	5
4. I am a good time manager.	(4)	1	2	3	4	5
5. I feel I will do well in this class.	(5)	1	2	3	4	5
6. My decision to enroll in this course was influenced by family concerns.	(6)	1	2	3	4	5
7. My work experience, and other experiences outside of formal schooling, have prepared me for this course.	(7)	1	2	3	4	5
8. I need to discuss course work with other students.	(8)	1	2	3	4	5
9. I have a designated place for studying that is relatively free from interruptions.	(9)	1	2	3	4	5
10. My employer encouraged me to enroll in this course.	(10)	1	2	3	4	5
11. Not passing this course would be a serious set-back in relation to my educational goals.	(11)	1	2	3	4	5
12. I think I will enjoy doing outside readings and projects for this class.	(12)	1	2	3	4	5
13. My friends encouraged me to enroll in this course.	(13)	1	2	3	4	5

SD = Strongly Disagree **D = Disagree** **U = Undecided**
A = Agree **SA = Strongly Agree**

		SD	D	U	A	SA
14. I plan to work hard at my homework for this class.	(14)	1	2	3	4	5
15. I hope I never have a job which requires me to use a computer.	(15)	1	2	3	4	5
16. I don't read new articles when they look too difficult for me.	(16)	1	2	3	4	5
17. I am not very interested in this class.	(17)	1	2	3	4	5
18. The grade I get in a course depends more on how hard the instructor grades than on how carefully I study.	(18)	1	2	3	4	5
19. When I decide to read something, I go ahead and do it.	(19)	1	2	3	4	5
20. I find using the computer easy.	(20)	1	2	3	4	5
21. Good luck is more important for college academic success than hard work.	(21)	1	2	3	4	5
22. It is difficult for me to concentrate on my learning task.	(22)	1	2	3	4	5
23. I feel comfortable working with computers.	(23)	1	2	3	4	5
24. Getting a good grade in a college course depends more on being "naturally smart" than on how hard I work.	(24)	1	2	3	4	5
25. If I can't understand a reading the first time, I keep trying until I can.	(25)	1	2	3	4	5
26. When I have trouble learning the material in a course it is because the professor isn't doing a very good job.	(26)	1	2	3	4	5
27. I can study well when there are other interesting things to do.	(27)	1	2	3	4	5
28. I learn new computer programs easily.	(28)	1	2	3	4	5

Distributed Learning Research Project

To the student:

The information that you provide on the following questionnaire will be used to increase our understanding of students who take videoconferencing and Web-based courses. Please complete all items even if you feel that some are redundant. This questionnaire could require 10-15 minutes of your time. Respond with your first impression for each question. Your answers will remain confidential.

Thank you for your cooperation!

Viola Osborn
Doctoral Candidate in Information Science
University of North Texas

Course: _____ Course Section or Location: _____

Last name (please print): _____

Last four digits of your student identification number: _____ ____

Course Evaluation

Instructions: Please read each statement and then circle the number which best shows how you feel.

SD = Strongly Disagree D = Disagree U = Undecided
A = Agree SA = Strongly Agree

		SD	D	U	A	SA
1. The instructor presented ideas and theories very clearly.	(1)	1	2	3	4	5
2. The instructor stimulated students to intellectual effort beyond that required by most courses.	(2)	1	2	3	4	5
3. I was satisfied with the amount of interaction I had with the instructor during this course.	(3)	1	2	3	4	5

SD = Strongly Disagree **D = Disagree** **U = Undecided**
A = Agree **SA = Strongly Agree**

		SD	D	U	A	SA
4. I felt comfortable contacting the instructor to ask questions.	(4)	1	2	3	4	5
5. Examples and illustrations were effectively used by the instructor.	(5)	1	2	3	4	5
6. The instructor was responsive to students' needs.	(6)	1	2	3	4	5
7. The instructor encouraged student participation.	(7)	1	2	3	4	5
8. Assignments and tests were returned in a timely fashion.	(8)	1	2	3	4	5
9. The amount of material was adequate for the credit received.	(9)	1	2	3	4	5
10. Course content was presented in a well-organized manner.	(10)	1	2	3	4	5
11. A variety of activities were used to help present course content.	(11)	1	2	3	4	5
12. The course grading policies seemed fair.	(12)	1	2	3	4	5
13. Students were strongly encouraged to think for themselves.	(13)	1	2	3	4	5
14. I would rate the subject matter of this course as very interesting.	(14)	1	2	3	4	5
15. The topics and class activities were closely related to each other.	(15)	1	2	3	4	5
16. I had a sense of accomplishment after completing this course.	(16)	1	2	3	4	5
17. The method of course presentation kept my interest high through the entire course.	(17)	1	2	3	4	5

SD = Strongly Disagree **D = Disagree** **U = Undecided**
A = Agree **SA = Strongly Agree**

		SD	D	U	A	SA
18. I would recommend that other students take similar courses to this one.	(18)	1	2	3	4	5
19. Overall, this instructor is an excellent teacher.	(19)	1	2	3	4	5
20. Overall, this is an excellent course.	(20)	1	2	3	4	5

APPENDIX B

STUDENT SATISFACTION ITEMS

STUDENT SATISFACTION ITEMS

The researcher drew items for the student satisfaction instrument from the following three sources.

IDEA Survey Form, Center for Faculty Evaluation and Development, Kansas State University (1988)

1. The instructor stimulated students to intellectual effort beyond that required by most courses.
2. The topics and class activities were closely related to each other.
3. Overall, this instructor is an excellent teacher.
4. Overall, this is an excellent course.

Silvernail and Johnson (1992):

1. The instructor presented ideas and theories very clearly.
2. I was satisfied with the amount of interaction I had with the instructor during this course.
3. Students were strongly encouraged to think for themselves.
4. I would rate the subject matter of this course as very interesting.

Thomerson and Smith (1996):

1. I felt comfortable contacting the instructor to ask questions.
2. Examples and illustrations were effectively used by the instructor.
3. The instructor was responsive to students' needs.
4. The instructor encouraged student participation.
5. Assignments and tests were returned in a timely fashion.
6. The amount of material was adequate for the credit received.
7. Course content was presented in a well-organized manner.
8. A variety of activities were used to help present course content.
9. The course grading policies seemed fair.
10. I had a sense of accomplishment after completing this course.
11. The method of course presentation kept my interest high through the entire course.
12. I would recommend that other students take similar courses to this one.

APPENDIX C

LETTERS FROM THE INSTITUTIONAL RESEARCH BOARD

University of North Texas
Research Services

March 23, 1999

Viola Osborn
301 Coronado Drive, #1068
Denton, TX 76201

RE: Human Subjects Application No. 99-066

Dear Ms. Osborn:

Your proposal entitled "Identifying At-Risk Students: An Assessment Instrument for Distributed Learning Courses in Higher Education," has been approved by the Institutional Review Board and is exempt from further review under 45 CFR 46.101.

The UNT IRB must re-review this project prior to any modifications you make in the approved project. Please contact me if you wish to make such changes or need additional information.

Sincerely,

Sandra L. Terrell, Chair
Institutional Review Board

ST:sb

P.O. Box 305250 - Denton, Texas 76203-5250
(940) 565-3940 - Fax (940) 565-4277 - TDD
(800) 735-2989 e-mail: lane@ abn.unt.edu

University of North Texas

Robert B. Toulouse School of Graduate Studies

June 17, 1999

Ms. Viola Osborn
301 Coronado Drive, # 1068
Denton, TX 76201

Dear Ms. Osborn:

As the Chair of the University of North Texas Institutional Review Board (IRB), I have received an inquiry regarding your request that various instructors of video conferenced and web-based courses release grades of student subjects to you for your dissertation research project. In response to this inquiry, I have conducted a second review of your IRB application and can verify that you did indicate that you would request that instructors provide information to you regarding course grades and course completion for the participants. This research protocol was approved by the IRB in accordance with federal law governing the protection of human subjects in research. However, an additional federal law, called the Family Educational Rights and Privacy Act (FERPA) does prohibit university personnel from releasing grades or other identifying student information to anyone other than the student without the student's expressed, written permission.

Since your IRB application conformed with federal law regarding the use of human subjects in research, and I was uncertain regarding whether the confidentiality measures stated in your approved IRB application would meet FERPA requirements for the release of student grade records, I asked Dr. Richard Rafes, UNT Vice President for Legal Affairs and General Counsel, for his opinion.

In the opinion of the university General Counsel, it will be a violation of FERPA to release any part of a student's record to you without the student's expressed written and signed consent. If your dissertation study requires that you have final grades of the student participants, there are two ways that you can obtain this information.

1. **Add a consent form that meets FERPA requirements.** Dr. Rafes stated that there are four elements of FERPA consent. These include 1) who is to receive the student

P.O. Box 305459 - Denton, Texas 76203-5459
(940) 565-2383 - FAX (940) 565-2141 - TDD (800) 735-2989
Internet: gradsch@abn.unt.edu

record(s); 2) statement of the specific record(s) to be released; 3) purpose of the disclosure (how the records will be used); and 4) student's signature and date of signature. A sample release form is worded as follows: *In accordance with the Family,Educational Rights and Privacy Act, I agree that Ms. Viola Osborn has access to my final grade for UNT courses BBCC 5= 002 and CCDD 5=. 003 taken in the Spring 1999 semester. The grades will be used as data for my dissertation research project.*

Student signature: Date:

This FERPA consent form can be in addition to the IRB consent, or both consents can be combined on one document for future student research participants. In order to receive the final grades of students who have already completed the survey instrument, you will need to obtain the signed and dated FERPA consent from each of these students.

2. **Your committee can obtain the grades for you.** For this option, you will turn over all consent forms and completed surveys that contain any identifying information (including all or part of a student's social security number) to your committee. Your committee can obtain the grade reports and match the survey results with the appropriate final grade for each student participant. The committee then records the subject's grade on the appropriate survey form and removes any identifying information from the survey, including all or part of the student's social security number. A member of your faculty committee will retain consent forms and all other documents and records that contain any identifying information. You are not to have access to these documents.

I am sure that you will want to discuss this issue with your dissertation committee. While you cannot receive the final grades of the student participants until FERPA release conditions are met, you can continue to collect the survey data for your dissertation research in accordance with your IRB-approved protocol.

If you have any questions, please contact me at (940) 565-3946 or Sheila Bourns at (940) 565-3940.

Sincerely,

Sandra L. Terrell, Chair
Institutional Review Board

cc: Dr. Mark Mortenson
Ms. Denise Stansell
Dr. Rollie Schafer
Dr. Richard Rafes
Ms. Sheila Bourns

APPENDIX D

SURVEY EVALUATION FORM

SURVEY EVALUATION FORM

Part I: In addition to the variables in the Background Survey, the Distributed Learning Survey includes nine factors or categories of variables. Indicate whether these factors represent significant predictors of student completion in distributed learning courses:

· computer confidence	___ yes	___ no
· course specific motivation and need for success	___ yes	___ no
· enrollment encouragement	___ yes	___ no
· financial stability	___ yes	___ no
· locus of control	___ yes	___ no
· need for support	___ yes	___ no
· persistence	___ yes	___ no
· rating of previous education and experience	___ yes	___ no
· study habits	___ yes	___ no

Comments:

_____

_____

_____

Part II: Please evaluate the survey items according to the following criteria:

- The item represents a variable that is appropriate for the study of student completion of distributed learning courses.
- The wording of the item is clear.
- The item is suitable for presentation to students in higher education courses.
- The item is classified correctly, in the sense that the indicated category is the most appropriate one for this item.

Computer Confidence (Levine & Donitsa-Schmidt, 1998)

1. I find using the computer easy.
   ___ acceptable ___ not acceptable
2. I feel comfortable working with computers.
   ___ acceptable ___ not acceptable
3. I get confused with all the different keys and computer commands.
   ___ acceptable ___ not acceptable
4. I learn new computer programs easily.
   ___ acceptable ___ not acceptable
5. I hope I never have a job which requires me to use a computer.
   ___ acceptable ___ not acceptable

Comments:

_____
_____
_____

Concrete Study Habits (Powell, Conway, & Ross, 1990)

6. I am able to set aside regular times to study and do course assignments.
   ___ acceptable ___ not acceptable
7. I have a designated place for studying that is relatively free from interruptions.
   ___ acceptable ___ not acceptable

Comments:

_____
_____
_____

Course Specific Motivation (Perrin & Rueter, 1997)

8. I feel I will do well in this class.
   ___ acceptable ___ not acceptable
9. I think I will enjoy doing outside readings and projects for this class.
   ___ acceptable ___ not acceptable
10. I plan to work hard at my homework for this class.
   ___ acceptable ___ not acceptable
11. I am not very interested in this class.
   ___ acceptable ___ not acceptable

Comments:

_____
_____
_____

Enrollment Encouragement (Kember, 1995)

12. My family encouraged me to enroll in this course.
   ___ acceptable ___ not acceptable
13. My employer encouraged me to enroll in this course.
   ___ acceptable ___ not acceptable
14. My friends encouraged me to enroll in this course.
   ___ acceptable ___ not acceptable

Comments:

_____
_____
_____

Financial Stability (Powell, Conway, & Ross, 1990)

15. I have financial security for the coming year.
   ___ acceptable ___ not acceptable

Comments:

_____
_____
_____

Internal Locus of Attribution for Academic Success
(Pascarella, Bohr, Nora, Ranganathan, Desler, & Bulakowski, 1994)

16. The grade I get in a course depends on how hard the instructor grades, not on how carefully I study.
___ acceptable ___ not acceptable

17. Good luck is more important for college academic success than hard work.
___ acceptable ___ not acceptable

18. Getting a good grade in a college course depends more on being "naturally smart" than on how hard I work.
___ acceptable ___ not acceptable

19. When I have trouble learning the material in a course it is because the professor isn't doing a very good job.
___ acceptable ___ not acceptable

Comments:
_____
_____
_____

Need for Success (Powell, Conway, & Ross, 1990)

20. Not passing this course would be a serious set-back in relation to my educational goals.
___ acceptable ___ not acceptable

Comments:
_____
_____
_____

Need for Support (Powell, Conway, & Ross, 1990)

21. I need support and encouragement from others to complete difficult tasks.
___ acceptable ___ not acceptable

22. I need to discuss course work with other students.
___ acceptable ___ not acceptable

Comments:
_____
_____
_____

Persistence (Mikulecky, Lloyd, & Huang, 1996)

23. I avoid trying to read new articles when they look too difficult for me.
    ___ acceptable ___ not acceptable
24. When I decide to read something, I go ahead and do it.
    ___ acceptable ___ not acceptable
25. It is difficult for me to concentrate on my learning task.
    ___ acceptable ___ not acceptable
26. If I can't understand a reading the first time, I keep trying until I can.
    ___ acceptable ___ not acceptable
27. I can study well when there are other interesting things to do.
    ___ acceptable ___ not acceptable

Comments:

_____
_____
_____

Persistence (Powell, Conway, & Ross, 1990)

28. I am a good time manager.
    ___ acceptable ___ not acceptable

Comments:

_____
_____
_____

Rating of Previous Education (Powell, Conway, & Ross, 1990)

29. My formal educational background has given me adequate preparation for this course.
    ___ acceptable ___ not acceptable
30. My work experience, and other experiences outside of formal schooling, have prepared me for this course.
    ___ acceptable ___ not acceptable

Comments:

_____
_____
_____

APPENDIX E

WEB PAGE

DISTRIBUTED LEARNING RESEARCH

Thank you for participating in this study of distributed learning courses at the University of North Texas. Your responses will help us evaluate distributed learning courses from the student's viewpoint.

1. At the beginning of the semester, click here to complete the consent form and the Distributed Learning Survey.
2. At the end of the semester, click here to complete your evaluation of the course.
3. Click here to request a copy of your survey results
4. Click here to view or print a copy of the Consent Form

This study is being used as dissertation research for Viola Osborn, doctoral candidate in Information Science at the University of North Texas. To view the dissertation proposal slides, click here.

The results of the study will be available in July, 2000.
Return to the University of North Texas Homepage
Please direct questions and comments to Viola Osborn.

Viola Osborn
Ph. D. Candidate in Information Science
University of North Texas
UNT Box 309116, Denton, TX 76203
E-mail address: **osborn@tac.coe.unt.edu**

Last modified: August 27, 1999

APPENDIX F

REPORT TO STUDENTS

REPORT TO STUDENTS

The report sent to the students who requested a copy of their own survey results included a description of the results of the study, with a copy of the individual student's responses to the Background Survey, Distributed Learning Survey and the student satisfaction instrument. The report also included the following message:

> Thank you for participating in the Distributed Learning Study during the _____ semester. I am enclosing a description of the study and your responses to the Background Survey, the Distributed Learning Survey, and the Course Satisfaction Survey.
>
> Enclosed are the following files in Word97 format:
>
> **Survey.doc**: a summary of the study; and
>
> **Responses.doc:** a report of your answers for each of the surveys. The responses for the Course Satisfaction Survey are included only if you completed that portion of the study.
>
> By May 2000, I will post additional information about the study on the research Web site. You may check these results using the following URL: http://courses.unt.edu/osborn/
>
> Thank you again.
>
> Sincerely,
> Viola Osborn (osborn@tac.coe.unt.edu)
> Ph. D. Candidate, Information Science

APPENDIX G

REPORT TO INSTRUCTORS

REPORT TO INSTRUCTORS

The report to the instructors who participated in the study included a description of the results of the study; statistics for the class's responses to the Background Survey, Distributed Learning Survey, and student satisfaction instrument; and a message similar to the following:

Dear Dr. _____:

Thank you for participating in the distributed learning study the _____ semester.

With this letter, I am enclosing a report of the data from the _____ class. This information includes the following:

- A report on the reliability analysis and validity analysis for the Distributed Learning Survey;
- A copy of the survey with instructions for scoring student data;
- Descriptive statistics of your class data for the Background Survey;
- Frequency data for your class on the factors in the Distributed Learning Survey; and
- Frequency data for your class on the Course Satisfaction Survey.

The assistance you have given during the data collection phase of this study is immeasurably important and I appreciate your help.

Sincerely,

Viola Osborn
Ph. D. Candidate in Information Science
University of North Texas

APPENDIX H

CORRESPONDENCE WITH DEVELOPERS OF SURVEY ITEMS

CORRESPONDENCE WITH DEVELOPERS OF SURVEY ITEMS

For each item included in the Distributed Learning Survey, the researcher contacted the developer of the item by telephone or by sending an e-mail message to request permission to use the item in this study. The message below is representative of the messages sent to these authors and researchers.

> Dear Dr. _____,
>
> I am a doctoral candidate at the University of North Texas in Denton, Texas. My dissertation research investigates student completion of courses that include video conferencing and Internet delivery of instruction. The study involves testing a survey instrument, based on survey questions that have been validated in previous research. Dr. Philip Turner, Associate Vice President for Academic Affairs for Distance Education, and Dr. Samantha Hastings, Associate Professor of Information Science, will be advising me in this project.
>
> In _____, you presented a _____. I am writing to request your permission to use the items from the questionnaire in my research. Of course, credit would be given to you for your work in developing this instrument.
>
> Thank you for your time and I look forward to hearing from you.
>
> Sincerely,
> Viola Osborn
> Ph. D. Candidate, Information Science
> University of North Texas
> osborn@tac.coe.unt.edu

APPENDIX I

SURVEY ITEMS WITH VARIABLE NAMES

SURVEY ITEMS WITH VARIABLE NAMES

Background Survey

(gender) Gender: **1** female **2** male

(marital) Are you currently married? **1** yes **0** no

(age) What is your age? _____ years

(work) How many hours do you work each week, on average? _____ hours/ week

(major) Is this a required course for your degree or major? **1** yes **0** no **2** don't know

(access) Do you have access to a computer at home or at work that you can use for class assignments? **1** yes **0** no

(level) What is your current level of education?
1 freshman **2** sophomore **3** junior **4** senior **5** master's level **6** doctoral level

(gpa) What is your current college GPA? (e.g. 2.5, 3.6, etc.) _____

(credit) How many total credit hours are you currently taking? ____

(dl) How many videoconferencing or Web-based courses have you enrolled in prior to this semester? _____

(college) How long has it been since you completed a college course?
_____ years (enter 0 if less than 1 year)

Distributed Learning Survey

(preped) My formal educational background has given me adequate preparation for this course.

(support1) I need support and encouragement from others to complete difficult tasks.

(studytm) I am able to set aside regular times to study and do course assignments.

(timemg) I am a good time manager.

(motive1) I feel I will do well in this class.

(enrlfam) My decision to enroll in this course was influenced by family concerns.

(prepwk) My work experience, and other experiences outside of formal schooling, have prepared me for this course.

(support2) I need to discuss course work with other students.

(studypl) I have a designated place for studying that is relatively free from interruptions.

(enrlemp) My employer encouraged me to enroll in this course.

(goals) Not passing this course would be a serious setback in relation to my educational goals.

(motive2) I think I will enjoy doing outside readings and projects for this class.

(enrlfrn) My friends encouraged me to enroll in this course.

(motive3) I plan to work hard at my homework for this class.

(cmputr5r) I hope I never have a job which requires me to use a computer.*

(persist1) I don't read new articles when they look too difficult for me.

(motive4) I am not very interested in this class.

(control1) The grade I get in a course depends more on how hard the instructor grades than on how carefully I study.

(persist2) When I decide to read something, I go ahead and do it.

(computr1) I find using the computer easy.

(control2) Good luck is more important for college academic success than hard work.

(prsist3r) It is difficult for me to concentrate on my learning task.*

(computr2) I feel comfortable working with computers.

(control3) Getting a good grade in a college course depends more on being "naturally smart" than on how hard I work.

(persist4) If I can't understand a reading the first time, I keep trying until I can.

(control4) When I have trouble learning the material in a course it is because the professor isn't doing a very good job.

(persist5) I can study well when there are other interesting things to do.

(computr4) I learn new computer programs easily.

Student Satisfaction Survey

(instruc1) The instructor presented ideas and theories very clearly.

(instruc2) The instructor stimulated students to intellectual effort beyond that required by most courses.

(instruc3) I was satisfied with the amount of interaction I had with the instructor during this course.

(instruc4) I felt comfortable contacting the instructor to ask questions.

(instruc5) Examples and illustrations were effectively used by the instructor.

(instruc6) The instructor was responsive to students' needs.

(instruc7) The instructor encouraged student participation.

(course1) Assignments and tests were returned in a timely fashion.

(course2) The amount of material was adequate for the credit received.

(course3) Course content was presented in a well-organized manner.

(course4) A variety of activities were used to help present course content.

(course5) The course grading policies seemed fair.

(course6) Students were strongly encouraged to think for themselves.

(course7) I would rate the subject matter of this course as very interesting.

(course8) The topics and class activities were closely related to each other.

(course9) I had a sense of accomplishment after completing this course.

(course10) The method of course presentation kept my interest high through the entire course.

(recomm) I would recommend that other students take similar courses to this one.

(instruc8) Overall, this instructor is an excellent teacher.

(course11) Overall, this is an excellent course.

* indicates a reverse-coded item

APPENDIX J

MODIFICATION OF DISTRIBUTED LEARNING SURVEY ITEMS

MODIFICATION OF DISTRIBUTED LEARNING SURVEY ITEMS

Each item included in the Distributed Learning Survey is listed below, arranged according to the source of the item. The indicator of completion associated with the item is also given. The wording used in the Distributed Learning Survey is given first. If the researcher modified the wording of the item, the original wording is also listed.

Kember (1995)

Enrollment Encouragement

1. My decision to enroll in this course was influenced by family concerns.
   Original wording: My family encouraged me to enroll in this course.
2. My employer encouraged me to enroll in this course.
3. My friends encouraged me to enroll in this course.

Levine and Donitsa-Schmidt (1998)

Computer Confidence:

1. I find using the computer easy.
2. I feel comfortable working with computers.
3. I learn new computer programs easily.
4. I hope I never have a job which requires me to use a computer.

Mikulecky, Lloyd, & Huang (1996)

Tenacity

1. I avoid trying to read new articles when they look too difficult for me.
   Original wording: I don't read new articles when they look too difficult for me.

2. When I decide to read something, I go ahead and do it.

3. It is difficult for me to concentrate on my learning task.

4. If I can't understand a reading the first time, I keep trying until I can.

5. I can study well when there are other interesting things to do.

Perrin and Rueter (1997)

Course Specific Motivation

1. I feel I will do well in this class.

2. I think I will enjoy doing outside readings and projects for this class.

3. I plan to work hard at my homework for this class.

4. I am not very interested in this class.

Powell, Conway, and Ross (1990)

Concrete Study Habits

1. I am able to set aside regular times to study and do course assignments.

2. I have a designated place for studying that is relatively free from interruptions.

Need for Success

1. Not passing this course would be a serious set-back in relation to my educational goals.

Need for Support

1. I need support and encouragement from others to complete difficult tasks.

2. I need to discuss course work with other students.

Rating of Previous Education

1. My formal educational background has given me adequate preparation for this course.

2. My work experience, and other experiences outside of formal schooling, have prepared me for this course.

Tenacity

1. I am a good time manager.

Pascarella and Terenzini (1994)

Locus of Control

1. The grade I get in a course depends on how hard the instructor grades, not on how carefully I study.
   Original wording: The grade I get in a course depends more on how hard the instructor grades than on how carefully I study.

2. Good luck is more important for college academic success than hard work.

3. Getting a good grade in a college course depends more on being "naturally smart" than on how hard I work.

4. When I have trouble learning the material in a course it is because the professor isn't doing a very good job.

APPENDIX K

COMPLETION RATE AND PARTICIPATION RATE

FOR COURSES IN THE SAMPLE

COMPLETION RATE AND PARTICIPATION RATE

FOR COURSES IN THE SAMPLE

Dept	Course Number	Semester	N	Participants	Participation Rate	Non-Completions	Completion Rate
AGER	5600	Fall	13	13	1.000	1	0.923
CECS	1100	Fall	40	29	0.725	19	0.525
CECS	5210	Fall	54	51	0.944	5	0.907
CECS	5300	Summer	33	28	0.848	2	0.939
EDAD	5540	Summer	18	18	1.000	1	0.944
EDAD	6580	Summer	3	3	1.000	0	1.000
EDCI	6460	Summer	12	10	0.833	0	1.000
KINE	3090	Fall	29	26	0.897	6	0.793
PHED	1000	Summer	39	3	0.077	0	1.000
SLIS	5000	Summer	44	40	0.909	4	0.909
SLIS	5000	Fall	127	114	0.898	28	0.780
SLIS	5200	Summer	26	22	0.846	6	0.769
SLIS	5300	Summer	60	40	0.667	0	1.000
SLIS	5340	Summer	26	21	0.808	5	0.808
SLIS	5600	Summer	20	20	1.000	2	0.900
SLIS	5600	Fall	47	40	0.851	2	0.957
SLIS	5710	Summer	9	8	0.889	1	0.889
SLIS	5720	Summer	27	6	0.222	1	0.963
SLIS	5960	Summer	19	17	0.895	3	0.842
		Total:	**646**	**509**		**86**	

APPENDIX L

SAMPLE STATISTICS FOR BACKGROUND SURVEY VARIABLES

SAMPLE STATISTICS FOR BACKGROUND SURVEY VARIABLES

Age: chronological age in years

Credit Hours: number of credit hours taken by the student in the current semester

Educational Level: college level on a scale of 1 (freshman) to 6 (doctoral level)

Gender: nominal variable indicating gender as female (1) or male (2)

GPA: cumulative college grade point average on a scale of 0.00 (F) to 4.00 (A)

Hours working per week: number of hours the student worked during the week

Marital Status: nominal variable indicating current marital status as married (1) or not married (1).

Previous distributed courses: number of distributed learning courses taken by the student prior to the current semester.

Years out of college: the number of years since the student enrolled in a college course

Means and Standard Deviations

Variable	**Completing Students**		**Non-completing Students**		**Entire Sample**	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Age	34.49	9.59	34.47	11.58	34.49	9.78
Credit Hours	6.40	3.72	8.84	4.84	6.64	3.90
Educational level	4.86	0.71	4.03	1.26	4.78	0.81
Gender	1.22	0.41	1.37	0.49	1.23	0.42
GPA	3.51	0.48	3.01	0.76	3.46	0.53
Hours working per week	34.63	15.80	31.63	17.07	34.34	15.93
Marital Status	0.58	0.49	0.37	0.49	0.56	0.50
Previous distributed courses	1.15	1.88	0.58	0.92	1.09	1.82
Years out of college	2.51	5.15	2.29	5.89	2.49	5.22
	N=358		**N=38**		**N=396**	

Medians

Variable	Completing Students Median	Non-completing Students Median	Entire Sample Median
Age	33.00	35.00	33.00
Credit Hours	6.00	9.00	6.00
Educational level	5.00	4.50	5.00
Gender	1.00	1.00	1.00
GPA	3.60	3.20	3.50
Hours working per week	40.00	30.00	40.00
Marital Status	1.00	0.00	1.00
Previous distributed courses	0.00	0.00	0.00
Years out of college	0.00	0.00	0.00
	N=358	**N=38**	**N=396**

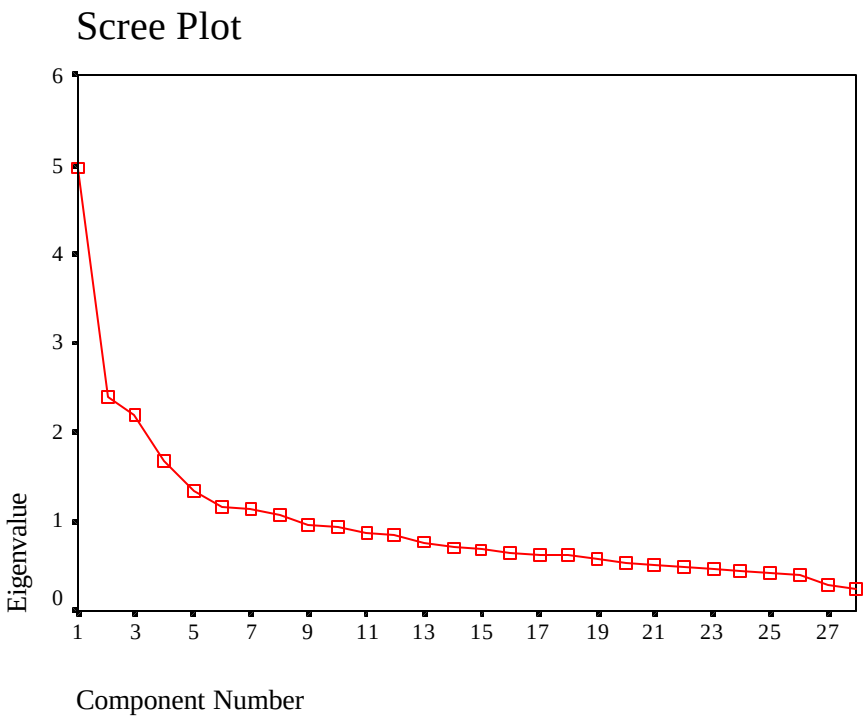
APPENDIX M

FACTOR LOADING FOR INITIAL EIGHT-FACTOR AND SIX-FACTOR SOLUTIONS

FACTOR LOADING FOR INITIAL EIGHT-FACTOR AND

SIX-FACTOR SOLUTIONS

Eight-Factor Solution

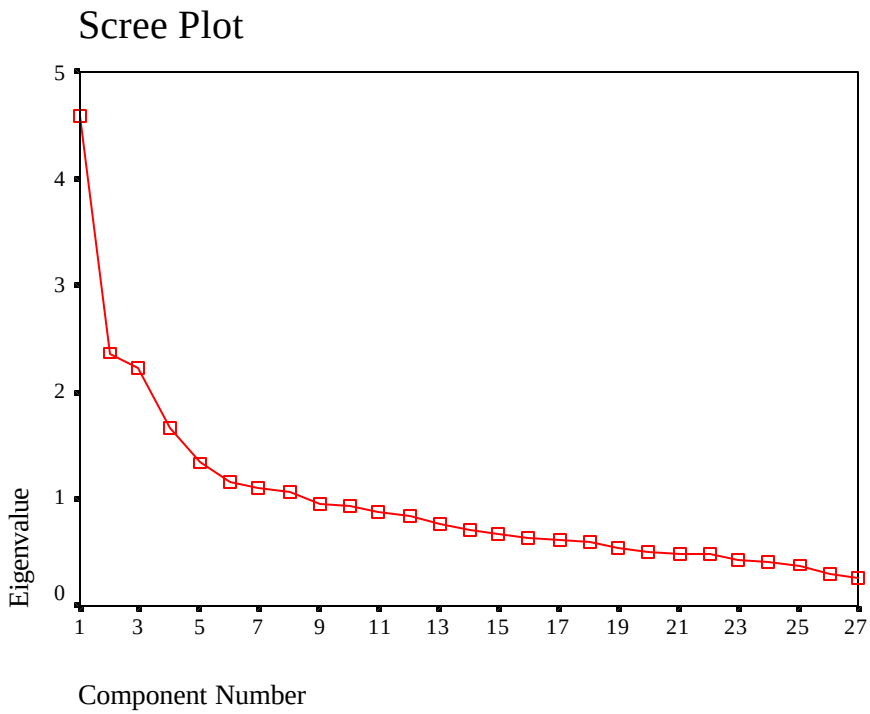


Eight-Factor Solution (continued)

Rotated Component Matrix

Variable	Component 1	2	3	4	5	6	7	8
cmputr5r								0.759
computr1	0.823							
computr2	0.817							
computr4	0.794							
control1		0.600						
control2		0.713						
control3		0.689						
control4		0.548						
goals							0.707	
motive1	0.521							
motive2						0.639		
motive3							0.561	
motive4						-0.629		
persist1								-0.432
persist3r					0.567			
persist2								
persist4					0.633			
persist5					0.697			
preped	0.467							
prepwk	0.609							
studypl			0.758					
studytm			0.765					
support1							0.472	
support2							0.597	
timemg			0.674					
enrlemp				0.727				
enrlfam				0.677				
enrlfrn				0.713				

Initial Six-Factor Solution



Initial Six-Factor Solution (continued)

Rotated Component Matrix

	Component					
Variable	**1**	**2**	**3**	**4**	**5**	**6**
cmputr5r						
computr1	0.852					
computr2	0.846					
computr4	0.828					
control1		0.620				
control2		0.653				
control3		0.616				
control4		0.632				
goals					0.472	
motive2					0.461	
motive3					0.565	
motive4		0.534				
persist1		0.433				
persist3r						0.510
persist2			0.419			
persist4						0.611
persist5						0.722
preped	0.421					
prepwk	0.528					
studypl			0.716			
studytm			0.744			
support1					0.530	
support2					0.668	
timemg			0.680			
enrlemp				0.704		
enrlfam				0.678		
enrlfrn				0.717		

APPENDIX N

MEANS AND STANDARD DEVIATIONS FOR SIX FACTORS

MEANS AND STANDARD DEVIATIONS FOR SIX FACTORS

Variable	Completing Students		Non-completing Students		Entire Sample	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Computer confidence	16.79	2.67	15.92	2.94	16.71	2.71
Enrollment encouragement	7.34	2.94	6.55	2.70	7.27	2.93
External locus of control	7.69	2.18	7.45	2.29	7.67	2.19
Motivation	11.96	1.90	11.08	2.01	11.88	1.92
Study environment	11.60	2.19	10.29	2.69	11.48	2.27
Tenacity	11.23	1.84	10.92	2.19	11.20	1.87

Note: These statistics are based on adding actual item scores for each factor, rather than on factor scores generated by the factor analysis.

APPENDIX O

RESULTS OF DISCRIMINANT ANALYSIS DOUBLE CROSS VALIDATION

RESULTS OF DISCRIMINANT ANALYSIS DOUBLE CROSS VALIDATION

Canonical Discriminant Function Coefficients

Group A

Indicator of Completion	Coefficient
Age	-0.035
Computer confidence	0.373
Credit hours this semester	-0.035
Educational Level	0.755
Enrollment encouragement	0.070
External locus of control	0.043
GPA	0.290
Hours worked per week	0.001
Motivation	0.290
Previous distributed courses	0.160
Study environment	0.380
Tenacity	0.053
Years out of college	0.075
(Constant)	-3.484

Group B

Indicator of Completion	Coefficient
Age	-0.062
Computer confidence	-0.071
Credit hours this semester	0.030
Educational Level	0.768
Enrollment encouragement	0.176
External locus of control	0.035
GPA	1.321
Hours worked per week	-0.004
Motivation	0.073
Previous distributed courses	-0.004
Study environment	0.359
Tenacity	-0.160
Years out of college	-0.016
(Constant)	-6.278

Structure Matrix

Group A

Indicator of Completion	Coefficient
Educational Level	0.728
Credit hours this semester	-0.537
GPA	0.428
Computer confidence	0.314
Motivation	0.306
Study environment	0.299
Hours worked per week	0.258
Enrollment encouragement	0.201
Years out of college	0.201
Previous distributed courses	0.186
Age	0.113
Tenacity	0.089
External locus of control	-0.001

Group B

Indicator of Completion	Coefficient
GPA	0.705
Educational Level	0.490
Study environment	0.353
Years out of college	-0.198
Previous distributed courses	0.186
Tenacity	-0.164
Credit hours this semester	-0.160
Age	-0.129
Enrollment encouragement	0.104
External locus of control	0.102
Hours worked per week	-0.094
Motivation	0.049
Computer confidence	0.036

Classification Summary

Group A function applied to Group B

Chi-squared	42.09
Degrees of freedom	13
Level of significance	0.0001
Canonical correlation coefficient (R)	0.456
Coefficient of determination (R squared)	0.208
Percentage of cases correctly classified	81.60%
Completions correctly classified	82.90%
Non-completions correctly classified	64.30%

Group B function applied to Group A

Chi-squared	46.043
Degrees of freedom	13
Level of significance	0.0001
Canonical correlation coefficient (R)	0.455
Coefficient of determination (R squared)	0.207
Percentage of cases correctly classified	76.20%
Completions correctly classified	78.20%
Non-completions correctly classified	62.50%

APPENDIX P

RESULTS OF DISCRIMINANT ANALYSIS OF EQUAL GROUPS

RESULTS OF DISCRIMINANT ANALYSIS OF EQUAL GROUPS

Canonical Discriminant Function Coefficients

Indicator of Completion	**Coefficient**
Age	-0.071
Computer confidence	-0.037
Credit hours this semester	-0.007
Educational level	0.759
Enrollment encouragement	0.092
External locus of control	0.088
GPA	0.748
Hours worked per week	0.010
Motivation	0.295
Previous distributed courses	0.182
Study environment	0.399
Tenacity	-0.203
Years out of college	0.045
(Constant)	-3.808

Structure Matrix

Indicator of Completion	Coefficient
Educational level	0.567
GPA	0.540
Credit hours this semester	-0.459
Study environment	0.356
Motivation	0.228
Enrollment encouragement	0.222
Years out of college	0.200
Hours worked per week	0.154
Previous distributed courses	0.107
Age	0.038
External locus of control	-0.025
Computer confidence	-0.023
Tenacity	0.014

Classification Summary

Chi-squared	34.84
Degrees of freedom	13
Level of significance	0.001
Canonical correlation coefficient (R)	0.624
Coefficient of determination (R squared)	0.389
Percentage of cases correctly classified	78.50%
Completions correctly classified	80.50%
Non-completions correctly classified	76.30%

APPENDIX Q

WORKSHEET FOR CALCULATING STUDENT SCORES ON THE DISTRIBUTED LEARNING SURVEY

WORKSHEET FOR CALCULATING STUDENT SCORES

ON THE DISTRIBUTED LEARNING SURVEY

Worksheet

Indicator of Completion	**Survey Items**	**Weight****	**Value**
Age	background #3	-0.057	
Hours worked per week	background #4	0.000	
Educational level	background #7	0.844	
GPA	background #8	0.924	
Credit hours this semester	background #9	-0.016	
Previous distributed courses	background #10	0.069	
Years out of college	background #11	0.031	
Computer confidence	survey #**15***, 20, 23, 28	0.012	
Enrollment encouragement	survey #6, 10, 13	0.033	
External locus of control	survey #18, 21, 24, 26	0.018	
Motivation	survey #8, 11, 14	0.066	
Study environment	survey #3, 4, 9	0.160	
Tenacity	survey #**22***, 25, 27	-0.025	
constant			-8.242
TOTAL			

*Recode these items, as described in the scoring procedure in Chapter 4, page 90.

**The weights given in this table were calculated as follows:

1. Using the sample data, the scores for each of the six factors in the Distributed Learning Survey were computed by adding the scores for the items in the factor.
2. The discriminant function procedure was run on the sample data to generate the canonical discriminant function coefficients. The weights in the table correspond to these canonical discriminant function coefficients.

3. The weights presented here differ from the values in Table 9 on page 85 because the coefficients in Table 9 were based on factor scores derived from the factor analysis of the sample data. Instructors using the Distributed Learning Survey in the future may not be involved in research and may not have the entire sample data and access to statistical software. This method of scoring the survey makes the survey useful for these instructors.

Group Centroids

Group Centroids	
Completion	0.1483
Non-completion	-1.3970

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