TECHNOLOGY ACCEPTANCE IN A MANDATORY TECHNOLOGY-BASED LEARNING ENVIRONMENT

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ABSTRACT

TECHNOLOGY ACCEPTANCE IN A MANDATORY TECHNOLOGY-BASED LEARNING ENVIRONMENT

Kyle Ray Hurst

Understanding the influences of technology acceptance factors on students participating in mandatory, technology-based learning is an essential element of the instructional design and implementation of technology-based learning programs. The purpose of this ex post facto correlation study was to examine factors influencing technology acceptance in a mandatory, technology-based learning program. The Unified Theory of Acceptance and Usage of Technology (UTAUT) established the theoretical framework of this study. A UTAUT instrument was administered to a convenience sample of 105 participants in a mandatory, technology based learning program to determine the technology acceptance of participants. A content-driven, summative performance-based instrument was administered to assess the performance behavior of participants. The primary statistical tools used in the study were the Pearson correlation, Spearman Rho and multiple regression analysis procedures. Two primary factors influencing performance behavior of participants in the study were (a) attitude towards usage of technology and (b) age of the participant. Gender, experience, and voluntariness were not significant contributors to performance behaviors; this finding is consistent with recent technology acceptance research in a mandatory, technology-based environment.

CHAPTER I

INTRODUCTION

Background of the Study

Technology-based learning has become a popular delivery system in postsecondary education environments. Many colleges and universities have instituted technology-based learning programs to achieve their individual organizational goals. The United States Federal Government is implementing technology-based programs to satisfy the training and education requirements of the federal workforce through the framework of the Advanced Distributed Learning Initiative (ADLI). The Air Force, a branch of the Department of Defense (DOD), relies on technology-based learning programs to train and educate its personnel. The shift from face-to-face education and training settings to a technology-based learning environment introduces a change from the traditional classroom to one where the use of technology-based systems is a necessary component of education and training.

The behavior of individuals participating in technology-based training programs has been investigated through the framework of technology acceptance research (Sitzmann, Brown, Casper, Ely, & Zimmerman, 2008). Technology acceptance research models have been successfully employed by researchers to investigate the influences of technology acceptance on the behavior of participants in voluntary technology-based programs. Technology acceptance research models have been successfully employed by

researchers to investigate technology acceptance within voluntary technology-based postsecondary programs (Cetron, 2007; Lin, 2005; Thomas, 2008). Multiple researchers indicate there is a need for technology acceptance research focusing on non-volitional settings (Thomas; Brown, Massey, Montoya-Weiss, & Burkman, 2002).

The purpose of this ex post facto correlation study is to examine technology acceptance in a mandatory technology-based learning program. This chapter will introduce technology acceptance and the theoretical framework for the proposed study. A synopsis of the Theory of Planned Behavior (TPB), the (UTAUT), and ADLI will introduce the primary elements of the study. The statement of the problem, research questions, variables, population, statistical procedures and other relevant information pertaining to the proposed research methodology will be identified in this chapter.

Theoretical Framework

The following paragraphs provide a brief introduction to the main theories of technology acceptance research. The TPB (Ajzen, 1991) provides the theoretical underpinning of technology acceptance research. A review of technology acceptance models begins with the TAM (Davis, 1989). An overview of the UTAUT (Venkatesh, Morris, Davis & Davis, 2003), which is based on the TAM, introduces the research model which was used in the present study. Descriptions of terms central to the theories presented in this study are offered:

1. Behavior is commonly defined as the way in which someone or something behaves (Stein, 1982). Relevant to technology acceptance research, Fishbein and Ajzen (1975) provided a modified definition by limiting behavior to overt

behaviors. Fishbein and Ajzen describe overt behaviors as observable acts of the subject which are studied in order to understand what determinants caused the behavior. Of relevance to the present study, Carswell and Venkatesh (2002) in their study of technology acceptance in an asynchronous distance learning environment utilized behavior as a dependent variable measured by the summative learner outcomes (grades) of students participating in the study.

2. Attitude is an individual's positive or negative feelings about performing a target behavior (Fishbein & Ajzen, 1975).
3. Subjective norm is the perceived social pressure to engage or not to engage in a behavior (Lin, 2005).
4. Perceived behavioral control is the extent to which a person feels able to enact the behavior (Lin, 2005).

These terms are associated with many of the constructs of the theories and are defined and illustrated in greater detail in the literature review. The overview of technology acceptance models begins with a discussion of the TPB.

Theory of Planned Behavior (TPB)

In TPB, Ajzen (1985) posits knowing whether a person favors a behavior (attitude), feels social pressure to perform a behavior, and feels in control of the behavior in question are predictors of planned behaviors. A central factor in the TPB is the individual's intention to perform a given behavior. Ajzen (1991) explains intentions are assumed to capture the motivational factors that influence a behavior and; they are indications of how hard people are willing to try and of how much of an effort they are

planning to exert in order to perform the behavior. The stronger the intention an individual has towards performing a behavior, the greater the likelihood the behavior will be performed. Of relevance to the setting of the study, behaviors can only find expression if the behavior in question is under volitional control. The primary constructs of the TPB are identified in attitude toward the behavior, subjective norm, and perceived behavioral control. These constructs are discussed in greater detail in Chapter Two. The TAM, which is based on the TPB, is discussed in the next section.

Technology Acceptance Model (TAM)

Information systems researchers have extended the TPB, adapting it to support the field of information systems and technology research by utilizing the TPB as the theoretical model for investigating the technology acceptance of new systems and technologies. Davis' (1989) TAM builds on the constructs of the TPB, suggesting that when presented with a new technology, the factors of perceived usefulness and perceived ease of use influence decisions about actual usage of a technology. Davis defines perceived usefulness as the degree to which a person believes that using a particular system would enhance his or her job performance. Davis defines perceived ease of use as the degree to which a person believes that using a particular system would be free from effort. Like the TPB, TAM has strong behavioral elements that propose that when an individual forms an intention to act they will be free to act without limitation. Subsequent research identified a need for a theoretical model to address additional constructs, resulting in the UTAUT. The study is based on the UTAUT which is introduced and discussed further in the following paragraphs.

Unified Theory of Acceptance and Usage of Technology (UTAUT)

In an effort to integrate the most reliable and valid elements of TAM, TPB, and other models, Venkatesh et al. (2003) formulated the UTAUT. The UTAUT aims to explain a potential user's behavior associated with using a technology. The UTAUT holds that five key constructs (performance expectancy, effort expectancy, attitude towards usage of technology, social influence, and facilitating conditions) are direct determinants of usage intention and behavior (Venkatesh et al.). Performance expectancy is "the degree to which an individual believes that using the system will help him or her better attain significant rewards" (Venkatesh et al., p. 447). Effort expectancy is defined as "the degree of ease associated with the use of the system" (Venkatesh et al., p. 450). Attitude towards usage of technology is defined as "an individual's overall affective reaction to using a technology" (Venkatesh et al., p. 455). Social influence is defined as "the degree to which an individual perceives that important others believe he or she should use a technology" (Venkatesh et al., p.451). Facilitating conditions are defined as "the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system" (Venkatesh et al., p. 453).

Gender, age, experience, and voluntariness of use are posited to mediate the impact of the four key constructs on usage intention and behavior (Venkatesh et al., 2003). The UTAUT incorporates the constructs of eight existing technology acceptance model created and utilized in technology acceptance research. UTUAT researchers have found the model accounted for 70% of the variance in behavior associated with technology (Venkatesh et al.). This study utilized the UTAUT to further validate the model and enhance understanding of behaviors associated with technology acceptance in

a mandatory technology-based learning environment. The element of mandatory participation is central to the research problem of the present study.

Statement of the Problem

The Department of Education (DOE) reports participation in both college programs and adult education activities has increased in recent decades (DOE, 2008). The use of technology in education has also been increasing (DOE). Previous research on technology acceptance has been conducted within a voluntary setting. Several studies have examined the question of technology acceptance in voluntary postsecondary education environments (Hannafin & Land, 1997; Moran, 2006). The technology acceptance constructs of performance expectance, effort expectance, attitude towards usage of technology, social influence, and facilitating conditions have been found to influence behaviors associated with technology acceptance in voluntary settings. Technology acceptance researchers have found that gender, age, and experience moderate these constructs (Cetron, 2007; Gibson & Harris, 2008). An investigation of the individual and combined influences of the constructs of technology acceptance aids in the understanding of behavior associated with a mandatory technology-based learning program. While the influences of the technology acceptance constructs are supported in volitional contexts (Ajzen, 1991), it is unclear whether these influences are present when participation in a technology-based learning environment is mandatory.

A mandatory technology-based learning environment is one in which participants are required to use a specific technology or system to fulfill a requirement or condition of their employment. In the present setting, the participants must use the technology to

complete the training program. The problem discussed in this research is that mandatory technology-based learning programs are implemented with little knowledge of the effects of technology acceptance, particularly volition, on the performance behavior of participants in the program (Brown et al., 2002). Understanding the influences of performance expectancy, effort expectancy, attitude towards usage of technology, social influence and facilitating conditions on behavior is a consideration in the design of any mandatory technology-based learning program. The influences of age, gender, previous experience in a technology-based learning environment and whether or not the participant is voluntarily participating in the technology-based learning program are also factors in the performance behavior of participants and are considerations key to the design and implementation of technology-based learning programs. Thorough examinations of the factors influencing technology acceptance may assist instructional designers, developers, and instructors to create more effective technology-based learning programs that result in satisfactory behaviors and successful technology-based learning programs.

Purpose of the Study

The purpose of this study was to examine the influences of the individual and combined factors of technology acceptance to performance behavior in a mandatory technology-based learning environment. The aim of this study was to examine the influences of the UTAUT factors of performance expectancy, effort expectancy, attitude towards usage of technology, social influence and facilitating conditions on the performance behavior of students participating in a mandatory technology-based learning environment. Specifically, the goal of this study was to determine if there are

interrelationships between the factors of technology acceptance and performance behavior in a mandatory technology-based learning environment.

Significance of the Study

This study is based on a theoretical framework grounded in the UTAUT (Venkatesh et al., 2003). The behavior of students participating in a mandatory technology-based learning environment was examined to aid in understanding how the constructs of the UTAUT model influenced their behavior. Interactions between the UTAUT constructs were examined to determine the existence of significant relationships between UTAUT model determinants and behavior in a mandatory technology-based learning environment. A discussion of the variables used in the study is presented in the next section.

Variables

There were five independent, four moderating and one dependent variable used in this study. All variables were based directly upon the determinants provided by the UTAUT model of technology acceptance. The following paragraphs provide an introduction to these variables.

Independent Variables

The five independent variables in this study are the key constructs of the UTAUT model. These constructs are performance expectancy, effort expectancy, attitude towards usage of technology, social influence, and facilitating conditions. Performance expectancy is an individual's assessment of the probability that performing a behavior

such as using a technology will lead to certain outcomes. Effort expectancy is an individual's assessment of the degree of ease associated with using the technology. Attitude towards usage of technology is an individual's overall affective reaction to using a technology. Social influence is the degree to which an individual perceives that important others believe he or she should use the technology. Facilitating conditions is the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the technology.

Moderating Variables

The four moderating variables based on the UTAUT model are age, gender, experience, and volition. Age is an individual's development measured in terms of the year's requisite for like development of an average person. Gender is the socially constructed roles, behaviors, activities, and attributes that a given society considers appropriate for men and women. Experience is the practical knowledge, skill, or practice derived from direct observation of or participation in events or in a particular activity. Volition is the capability of conscious choice and decision and intention.

Volition is a central element of the proposed study since it is integral to the concept of mandatory or voluntary participation in the technology-based learning program. Volition is described as the faculty or power of using one's will (Stein, 1982). Within the context of technology acceptance, Venkatesh et al. (2003) described voluntariness of use as the degree to which use of the technology is perceived as being voluntary or of free will. In the present study, the participants will not have volitional control over the decision to participate in the technology-based learning program.

Dependent Variable

The dependent variable in the present study is the performance behavior of students participating in the mandatory technology-based learning program. In technology acceptance research, behavior as a dependent variable has been measured by learning outcomes such as student grades and test or examination scores (Carswell & Venkatesh, 2002). In the present study, behavior was measured with a technology-driven, summative performance evaluation in the mandatory technology-based learning environment.

Research Questions

The following research questions were addressed in the study:

1. What are the individual and combined contributions of performance expectancy, effort expectancy, attitude towards usage of technology, social influence, and facilitating conditions to the performance behavior of students in a mandatory technology-based learning environment?
2. What are the individual and combined contributions of gender, age, experience and volition to the performance behavior of students in a mandatory technology-based learning environment?

These research questions provided the framework for the present study and were used to investigate the relationships between the primary and moderating constructs of the UTAUT model and the dependent variable of behavior as measured by a technology-driven, summative performance evaluation. The hypotheses framing this study are founded on these research questions.

Hypotheses

The research questions are framed by the UTAUT constructs and formed the hypotheses of this quantitative study. The research questions are restated as empirically-testable statements about a relationship involving two or more variables and presented as null hypotheses. The independent and moderating variables within the hypotheses are aligned with UTAUT. The following hypotheses guided the study and aligned the statistical procedures with the research questions:

H_1: There is a relationship among the independent variables of performance expectancy, effort expectancy, attitude towards usage of technology, social influence and facilitating conditions and the dependent variable of performance behavior in a mandatory technology-based learning environment when the independent factors are considered singularly or in combination.

H_{o1}: There is no relationship among the independent variables of performance expectancy, effort expectancy, attitude towards usage of technology, social influence and facilitating conditions and the dependent variable of performance behavior in a mandatory technology-based learning environment when the independent factors are considered singularly or in combination.

H_2: There is a relationship among the independent variables of gender, age, experience and volition and the dependent variable of performance behavior in a mandatory technology-based learning environment when the independent factors are considered singularly or in combination.

H_{o2}: There is no relationship among the independent variables of gender, age, experience and volition and the dependent variable of performance behavior in a mandatory technology-based learning environment when the independent factors are considered singularly or in combination.

Importance of the Study

This study is important because technology-based learning environments are growing in number throughout corporate and government education and training programs. The DOD is migrating traditional face-to-face training to technology-based programs, relying on ADLI to provide the infrastructure for these programs, many of these in a non-volitional environment. Little research has been conducted to analyze the effectiveness of these mandatory training programs through the holistic framework of technology acceptance. Instructors and instructional designers will be able to incorporate the findings to improve technology-based learning programs in ways that meet the individual needs of students in a non-volitional setting such as a mandatory, technology-based learning environment.

Scope of the Study

An ex post facto correlation study of a convenience sample of student participants in a non-volitional technology-based course was used to investigate individual and combined influences of the factors of technology acceptance on the performance behavior of participants in a mandatory technology-based learning environment. The settings and procedures of the study will be described in Chapter Three.

Limitations

The sample population is a limitation because the participants were drawn from one group of participants, i.e., a convenience sample. A second limitation is inherent to the nature of the research design, i.e., correlation research. These limitations will be discussed in greater detail in Chapter Three.

Definitions of Terminology

To facilitate a clear understanding of the present research study, several key terms are defined below.

Advanced Distributed Learning Initiative. The ADLI was established in 1997 to standardize and modernize training and education management and delivery. The DOD Under Secretary of Defense for Personnel and Readiness oversees the ADLI. The vision of the ADLI to "provide access to the highest-quality learning and performance aiding that can be tailored to individual needs and delivered cost-effectively, at the right time and in the right place" (Advanced Distributed Learning Network [ADLN], 2007).

Behavior. Behavior is defined as the way in which someone or something behaves (Stein, 1982). In the present study, behavior was the dependent variable examined through the lens of learner outcome and quantified through a summative, performance-based, technology-driven measurement instrument. In their study of technology acceptance in an asynchronous distance learning environment, Carswell and Venkatesh (2002) utilized behavior as a dependent variable measured by the summative learner outcomes (grades) of students participating in the study. Creswell (2003) describes dependent variables as the outcomes that are observed to change because of the influence

of the independent variables. Hildebrand (2009) investigated the influences of the independent variables of the technology acceptance model on the dependent variable of behavior as learner outcome measured by test scores in a technology-driven learning environment.

Distance Education. Distance education, or distance learning, is structured instruction and learning that takes place without the physical presence of the instructor. Distance education allows for access to the learning environment by a broader base of learners in ways more adaptable to the military and their other personal and professional commitments. Traditional distance education is enhanced with technology drawing upon resources that are physically distant from the location of the learner (DOD, 1999).

Technology Acceptance. Technology Acceptance is an information systems theory that models how users come to accept and use a technology. Researchers apply technology acceptance models to investigate the factors that influence individual decisions about how and when they will use a technology.

Technology-based Learning. Technology-based learning is a planned learning experience that uses a wide spectrum of technologies to deliver learning content to students. Technology-based learning is mainly Internet or computer-based learning programs.

Chapter Summary

The basis of this study is an ex post facto correlation research design investigating the performance behavior of students in a mandatory, technology-based learning program. The framework of the ADLI is the overarching setting of the study. The TPB,

the TAM, and the UTAUT were identified as theories and models of technology acceptance. The purpose of the study, variables, and problem statement were introduced. Major research questions, significance of the problem, and definitions of terms were introduced. A complete review of the literature is provided in Chapter Two.

CHAPTER II

REVIEW OF THE LITERATURE

Introduction

A review of the literature relating to the theory of technology acceptance and the ADLI is presented in Chapter Two. The chapter begins with an introduction to the theoretical framework of the study which is based upon the UTAUT. A conceptual discussion of technology acceptance is followed by an introduction of the primary theories underlying technology acceptance research. An overview of the TPB, the TAM, and the UTAUT provides an understanding of technology acceptance research models, specifically the UTAUT and its constructs, which are pertinent to the proposed study. The theoretical framework of the study is based on the UTAUT. Previous researchers have utilized the UTAUT to examine technology acceptance in various settings. The UTAUT is based on the TAM (Davis, 1989), which is founded upon the psychology-based TPB (Ajzen, 1985). Technology acceptance and the theories underlying and supporting technology acceptance models and previous research will be defined, explained, and illustrated in subsequent sections of this chapter. The chapter concludes with an introduction to the ADLI. The ADLI is the federal government's technology-based learning environment which provides the framework for the technology-based learning program examined in the study.

Technology Acceptance

Acceptance of technology continues to be of primary interest within the field of information systems research. The adoption of technology by users remains a central concern of researchers. Low usage of technology has been identified as a major factor behind low productivity and low returns on investment in technology (Sichel, 1997). Understanding and subsequently creating the conditions under which technology will be embraced by users is the purpose of technology acceptance research. Technology acceptance models are theory-based models used by researchers to predict the acceptability of a technology and to identify the modifications which must be brought to the technology in order to make it acceptable to users (Davis, Bagozzi &Warshaw, 1989). Researchers have developed numerous theories that are used to describe and explain how technologies have been adapted by users. The purpose of technology acceptance research is to understand behavior as a dependent variable. Behavior as a predictor of technology acceptance is a critical element which has been established in information systems theory and other research disciplines (Ajzen, 1991; Taylor & Todd, 1995). The basic conceptual framework of technology acceptance models (Figure 1) forms the basis of this research.

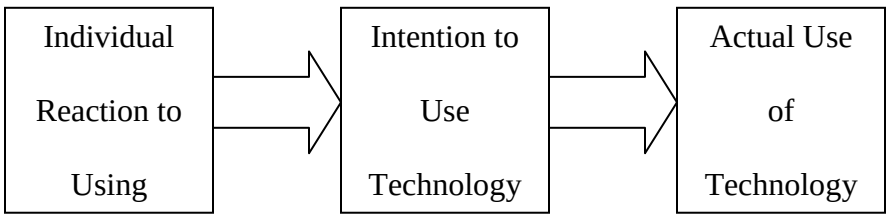

Figure 1. Basic concept underlying user acceptance of technology.

Conceptually, technology acceptance researchers explore the interaction between an individual's reactions to using technology, how reaction affects intention to use a technology, and the actual behavior of the individual. The theories and associated models used to explain behavior within the context of technology acceptance will be defined and explained in subsequent sections beginning with the TPB.

TPB

Ajzen (1985, 1991) proposes the TPB as a model for understanding how human actions are guided and to predict the occurrence of a specific behavior provided the behavior is intentional. Ajzen (1985) identifies three variables (Figure 2) which are used to predict an individual's intention to perform a behavior. The variables are attitude, subjective norms, and perceived behavioral control. According to Ajzen (1991), the central factor in the TPB is the individual's intention to perform a given behavior.

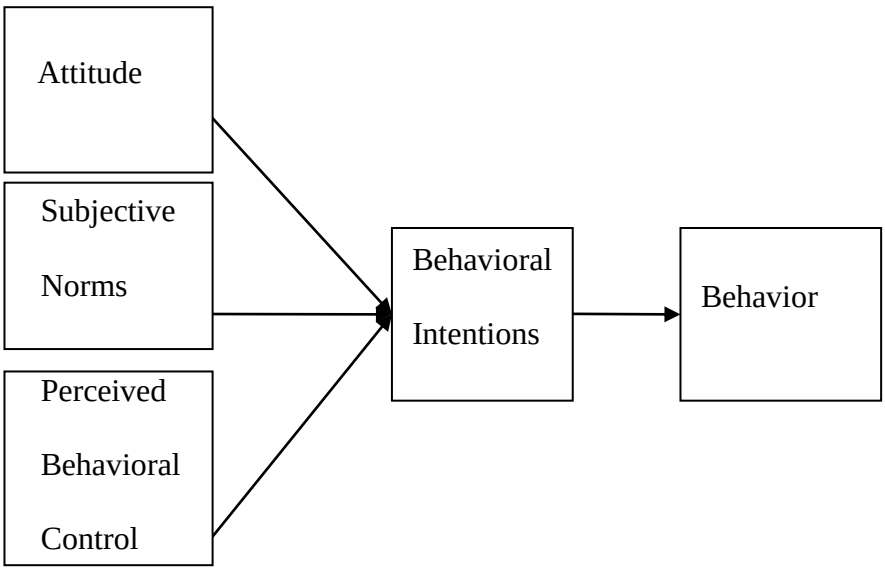

Figure 2. The Theory of Planned Behavior.

TPB Constructs

There are multiple constructs within the TPB. These constructs include behavior, intention, attitude, subjective norm, and perceived behavioral control. A brief discussion of each of these constructs is presented in the following paragraphs.

Behavior. Within the construct of the TPB and information systems research, behavior is the target of interventions specifically designed to change the behaviors of individuals (Ajzen, 1991).

Intention. Intention to perform a behavior can be used as a proximal measure of behavior. Ajzen (1991) states that intention is one of the most important contributions of the TPB mode in comparison to previous models of the attitude-behavior relationship in that TPB can be used to determine the effectiveness of interventions even if there is not a readily available measure of actual behavior.

Attitude. Attitude towards the behavior is a person's overall evaluation of the behavior. Ajzen (1991) posits two components of attitude which interact to form attitude: beliefs about how other people, who are in some way important to the person, expect them to behave (normative beliefs) and the positive or negative judgments about each belief (outcome evaluations) regarding the person's decision to perform the behavior.

Subjective norm. Subjective norm is the perceived social pressure to engage or not to engage in a behavior. Azjen (1991) explains that subjective norm is determined by the total set of accessible normative beliefs concerning the expectations of important referents.

Perceived behavioral control. Perceived behavioral control is the extent to which a person feels able to enact the behavior. Ajzen (1991) states there are two aspects to this construct: How much a person has control over the behavior and how confident a person feels about being able to perform or not perform the behavior.

TPB Research

The TPB has been used in numerous research settings. Francis et al. (2004) report the TPB was the theoretical basis for 832 studies conducted between 1985 and 2004. Pertinent to this study, prior researchers have used summative performance behavior as a dependent variable (Locke, Frederick, Lee & Bobko, 1984). The following paragraphs introduce and describe several previous research studies which utilized the constructs of the TPB.

Davis, Ajzen, Saunders and Williams (2002) conducted a study based on the TPB to examine high-school completion among African-Americans. Their sample, N=166, consisted of male and female high-school students aged 14-17. The study was conducted early in their second year of high-school. Consistent with the TPB, intentions to complete the second year of high-school were predicted based on the students' personal attitudes toward school completion, from perceived social pressure (subjective norm), and from perceived control over attending and staying in school. Additionally, the variables offered good prediction of actual behavior. High-school graduation could be predicted with considerable success from intentions to complete the second year and from perceived control over this behavior. The results of these TPB-based studies indicate that intention predicts behavior. Bamberg, Ajzen and Schmidt (2003) conducted a study to investigate

the effects of an intervention, the introduction of a pre-paid bus ticket, on increased bus use among college students. Consistent with the TPB, Bamberg et al. found the intervention influenced attitudes toward bus use, subjective norms and perceptions of behavioral control. Specifically, Bamberg et al. reported the TPB provided for accurate prediction of behavior both before and after the intervention. Their findings supported the conclusion that choice of travel mode is largely a reasoned decision, that this decision can be affected by interventions that produce change in attitudes, subjective norms, and perceptions of behavioral control.

The TPB provides a useful conceptual framework for research into behavior associated with technology acceptance. Attitudes towards the behavior, subjective norms with respect to the behavior, and perceived control over the behavior will usually be found to predict behaviors. Intentions, in conjunction with perceived behavioral control, have been found to account for a sizeable proportion of variance in behavior (Ajzen, 1991).

Intentions are assumed to capture the motivational factors that influence a behavior; they are indications of how hard people are willing to try, of how much of an effort they are planning to exert, in order to perform the behavior. As a general rule, the stronger the intention to engage in a behavior, the more likely should be its performance. It should be clear, however, that a behavior can find expression only if the behavior in question is under volitional control, i.e., if the person can decide at will to perform or not perform the behavior (Ajzen, 1991). In practice, constraints such as limited ability, time, environmental or organizational limits, and unconscious habits will limit the freedom to act. Within the field of information systems, researchers seeking to understand conditions

under which technologies will be embraced by individuals created the need for a theoretical model explaining behaviors relative to technology acceptance. The TAM (Davis et al., 1989) is specifically adapted for modeling user acceptance of information systems and the voluntary adaptation of new technologies by users. The TAM is discussed in greater detail in the next section.

TAM

Davis et al. (1989) present the TAM as a means of explaining the determinants of behaviors associated with technology acceptance across a broad range of technologies and populations. The primary purpose of TAM is to provide researchers a framework for identifying the effect of external factors on individual beliefs, attitudes, intentions and ultimately individual behavior associated with technology acceptance. The TAM (Figure 3) builds upon the constructs of the TPB by incorporating two additional elements to address acceptance and usage behaviors. These additional elements are the constructs of perceived usefulness and perceived ease of use which is added to the TPB constructs of attitude, subjective norms, and perceived behavioral control to form the TAM.

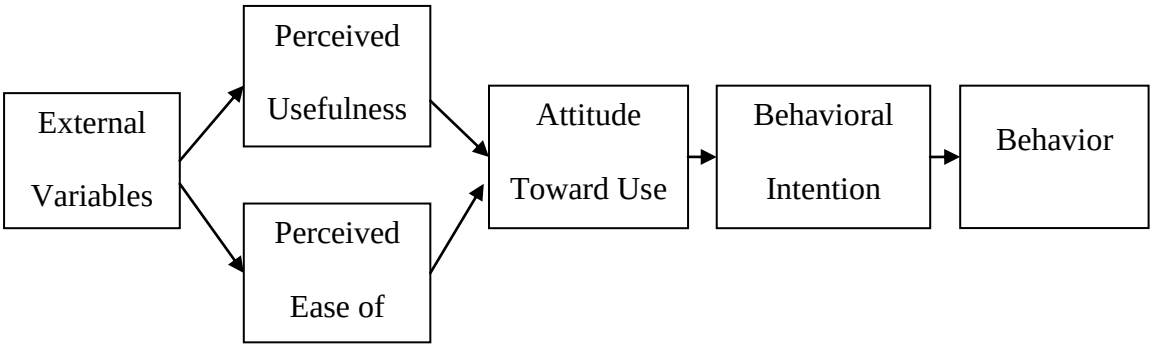

Figure 3. Technology Acceptance Model.

Davis et al. (1989) posit perceived usefulness and perceived ease of use are of primary relevance for behaviors associated with technology acceptance. A discussion of the TAM constructs is presented in the following sections. External variables are described and the additional constructs of perceived usefulness and perceived ease of use are defined.

TAM Constructs

The TAM introduces external variables to the constructs of the TPB. These external variables are perceived usefulness and perceived ease of use. Davis et al. (1989) explain an external variable refers to the various external factors such as individual differences, situational constraints, and managerially controlled interventions that are determinants of perceived usefulness and perceived ease of use. Davis et al. recommended these external factors be tested in future technology acceptance research. Al-Gahtani and King (1999) divided external variables into three groups: demographic variables, (age and gender), end-user background variables (training, computer experience, computing support); and system variables (system rating and compatibility) to examine factors of acceptance of information technology.

Perceived usefulness. Davis et al. (1989) define perceived usefulness as the prospective user's belief that a technology will increase their performance or provide a benefit. People tend to use or not to use an application to the extent that they believe it will enhance their job performance (Davis et al., 1989). Phillips, Calantone and Lee (1994) suggest the probability a prospective user will accept a new technology is based on their assessment of whether the technology will be beneficial.

Perceived ease of use. Perceived ease of use refers to the degree to which the prospective user expects the technology to be free of effort (Davis, 1989). While a potential user may believe that a technology will be useful, the user may believe the technology will be too difficult to use. Davis posits it is possible for perceived usage to be outweighed by perceived ease of use.

Significantly, researchers (Davis et al., 1989; Venkatesh & Davis, 1996) have found variables similar to perceived usefulness and perceived ease of use to be linked to attitudes and behavior. In addition, researchers report that perceived usefulness and perceived ease of use are statistically distinct dimensions (Hauser & Shugan, 1990; Larcker & Lessig, 1980). Substantial theoretical and empirical support has developed in support of the TAM (Davis, 1989; Davis et al., 1989). Venkatesh (1999) found that TAM has consistently explained 40% of the variance in usage intentions and behavior.

Davis et al. (1989) posit behavior associated with technology acceptance is determined by behavioral intention, but differs in that behavior is viewed as being jointly determined by attitude toward the technology and perceived usefulness, with relative weights of each estimated by regression. In contrast to TPB, TAM does not include subjective norm as a determinant of behavior. According to Fishbein and Ajzen (1975), it is difficult to delineate the direct effects of subjective norm on behavior from the indirect effects of attitude toward technology. Moran (2006) noted that previous literature on technology acceptance indicated that additional factors not found in TPB, TAM, and other models needed to be included. Examples of these variables are demographics, social factors, and the perception that users will want to perform a behavior because it is perceived to be instrumental in achieving a valuable outcome.

TAM Research.

Researchers have validated and extended the application of TAM, but researchers using TAM were only capable of predicting technology adoption success between 30% (Meister & Compeau, 2002) and 40% of the cases (Venkatesh & Davis, 2000). As a result of these findings, researchers have searched for better technology acceptance models that can deliver a higher prediction of success (Legris, Ingham & Collerette, 2003; Plouffe, Hulland, & Vandenbosch, 2001). The call for a modified model that incorporates both human and social variables led to the development of the UTAUT (Venkatesh et al., 2003). A review of UTAUT is provided in the following paragraphs.

UTAUT

The UTAUT has emerged as one of the most reliable theoretical models available to investigate technology acceptance and usage. Venkatesh et al. (2003) provides the theory, development and initial empirical tests of UTAUT. Empirical testing of eight existing models allowed for between 17% and 53% percent of the variance in user intentions to accept and use technology. Venkatesh et al. explain UTAUT was formed by integrating and refining eight existing models, explaining seventy percent of the variance in technology acceptance and use. Venkatesh et al. hold that five key factors (performance expectancy, effort expectancy, attitude towards usage of technology, social influence and facilitating conditions) influence performance behavior. Concurrently, an individual's gender, age, experience, and voluntariness of use are variables that may also affect performance behaviors associated with technology acceptance. The following paragraphs further define and describe the individual factors of the UTAUT model.

UTAUT Constructs

Performance expectancy, effort expectancy, social influence and facilitating conditions are the primary constructs of UTAUT and serve as the independent variables in UTAUT-based research. Gender, age, experience, and voluntariness of use are moderating variables and are independent factors within the present study (Figure 4).

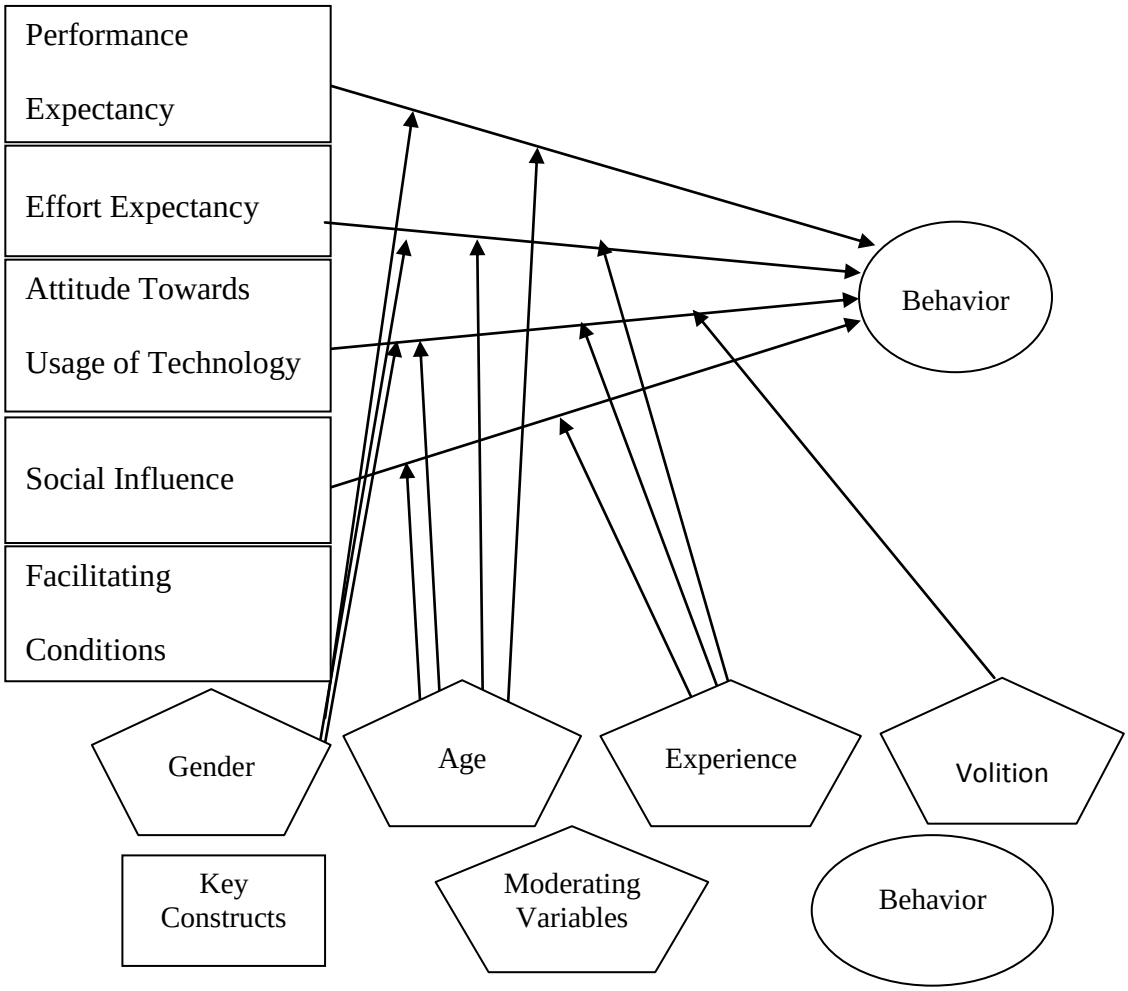

Figure 4. Unified Theory of Acceptance and Use of Technology.

Behavior is the dependent variable in research based upon the UTAUT model. UTAUT holds that the primary constructs of performance expectancy, effort expectancy,

attitude towards usage technology, social influence, and facilitating conditions may, either individually or in combination, contribute to an individual's performance behavior. Additionally, the moderating constructs of gender, age, experience, and voluntariness of use may contribute to performance behavior. UTAUT provides a theoretical model and framework for examining the interactions between the model constructs and their individual and combined contributions to an individual's behavior in a technology-based environment. The following paragraphs provide a review of these constructs.

Behavior. Behavior, within the context of technology acceptance research, has been measured in terms of technology-based, performance-oriented outcomes (Venkatesh et al., 2003). Performance-oriented outcomes of behavior are described by Compeau and Higgins (1995) as the performance-related consequences of behavior. Within the present study, behavior was measured by summative technology-driven, performance-oriented outcomes.

Performance expectancy. Venkatesh et al. (2003) defines performance expectancy as the degree to which an individual believes that using the system will help him or her better attain significant rewards. Performance expectancy has been found to be a significant determinant of behavior, with its effect varying across gender and age such that the effect is strongest for younger men. UTAUT theorizes the influence of performance expectancy on behavior is the strongest for younger men because they have the strongest desire for material success, such as performance achievement at work (Venkatesh & Zhang, in press). Performance expectancy is, simply put, what a user expects performance-wise from the technology they are using. Cetron (2007) offers as an

example of the performance expectation of someone purchasing a cell phone, i.e., does the cell phone they just bought send and receive clear calls without static and without dropping the person on the other end and does this coincide with what they expected or not?

Effort expectancy. Effort expectancy is defined as the degree of ease associated with the use of the system and it has been found that the effect of effort expectancy on behavior varies across gender and age such that the effect is strongest for older women in early stages of experience (Venkatesh et al., 2003). This variable incorporates the constructs of perceived ease of use, complexity, and ease of use from previous technology acceptance models. Effort expectancy is moderated by gender, age, and experience, becoming insignificant with periods of extended usage when users learn to effectively operate the new technology (Venkatesh et al.).

Attitude towards usage of technology. Attitude toward usage of technology is defined as an individual's overall affective reaction to using a technology (Venkatesh et al., 2003). Attitude towards usage of technology as a construct is drawn from the attitude towards behavior construct found in the Theory of Planned Behavior and the Theory of Reasoned Action.

Social influence. Social influence is defined as the degree to which an individual perceives that important others believe he or she should use a technology. The effect of social influence on individual behavior is mainly through three mechanisms: compliance, internalization, and identification (Venkatesh & Davis, 2000; Warshaw, 1980).

Venkatesh and Davis argue the effect of social influence on behavior will be moderated by gender, age, voluntariness and experience.

Facilitating conditions. Thompson, Higgins, and Howell (1991) explain facilitating conditions are the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system and it has been found that the effect of facilitating conditions on technology use was moderated by age and experience such that the effect was strongest for older workers in later stages of experience. Thompson et al. describe facilitating conditions as objects in the environment that make an act easy to do, including the provision of the availability of computer support.

Gender, age, experience, and voluntariness of use. Researchers utilizing the UTAUT model in a voluntary setting have identified gender, age, experience, and voluntariness of use (volition) as determinants that have a moderating influence on performance behavior (Venkatesh et al., 2003). Venkatesh et al. explains these influences are more pertinent in mandatory settings and the effect of internalization and identification associated with experience are more pertinent in voluntary settings. In addition, women are more sensitive to others' opinions (Venkatesh et al.). When it comes to the role of age, older workers have a stronger desire for affiliation needs and are thus more likely to be affected by others' views and opinions. Finally, people are generally more responsive to others' opinions when they do not possess much experience with the target behavior—here, using the technology (Venkatesh and Davis, 2000). A review of previous research based on the UTAUT is presented in the next section.

UTAUT Research

Researchers have conducted several studies focused on behaviors associated with technology acceptance among post-secondary students and faculty. Moran (2006) conducted a study examining student acceptance of mobile computing devices. The objective of the study was to evaluate students' acceptance of Tablet Personal Computers (TPC) as a means to forecast, explain, and improve usage patterns. Moran confirmed the ability of the UTAUT model in determining student acceptance of TPC. Moran measured acceptance using a modification of the original Venkatesh et al. (2003) UTAUT model. The UTAUT model in this study was modified by including the constructs of attitude toward technology use, self efficacy and anxiety. Moran found the variables of performance expectancy, effort expectancy, attitude toward usage of technology and self efficacy are key components of behavioral intent. In this setting, social influence and anxiety do not appear to contribute to behavioral intent. However, these factors were shown to have a different impact on different social groups and therefore should be included in an acceptance study. Moran's study included moderating conditions that affected the independent variables which subsequently influenced the dependant variables. The moderating conditions were gender, age, experience and voluntary use acting as independent variables, which are relevant to the present study.

Cetron (2007) examined the acceptance of wireless technologies in a university setting based upon the constructs and items of the UTAUT. The research was conducted using a random sample drawn from the university's student population. Students surveyed ranged from new freshman up to matriculated graduate students. The results were then tabulated using multiple methods and the data analyzed. Cetron reported a

clear trend of technology acceptance by both young adults (18-20) and older students (23-up). Cetron found each of the age brackets want wireless technology for different reasons: The younger group for factors related to subjective norms, and the other for the performance factor associated with performance expectancy. These findings suggest that UTAUT constructs are useful in determining performance behaviors associated with technology acceptance among different age groupings.

Relevant to the present study, technology acceptance research of performance behaviors in a mandatory, technology-driven environment have found the constructs of gender, experience and volition do not significantly influence performance behavior. Thomas (2008) found that while age was a predictor of performance behavior, the influences of gender, experience and volition were not significant when participation in the technology-driven environment was mandated.

Pertinent to the present research, Brown et al. (2002) investigated the acceptance of technology in a mandated usage environment. Researchers have applied technology acceptance models to further develop and test the relationships among beliefs, attitudes, behavior, and usage behavior where usage was voluntary (Davis, 1989; Davis et al., 1989; Taylor & Todd, 1995). Voluntariness of use is described as the degree to which use of the innovation is perceived as being voluntary or of free will (Moore & Benbasat, 1991). While the relationships between the theoretical constructs have been consistently supported in voluntary settings (Ajzen, 1991), it remains uncertain if the same relationships will exist when the behavior is mandatory. A mandatory use environment is one in which users are required to use a technology in order to keep or perform their jobs (Brown et al). When individuals must perform specific behaviors, the importance of their

beliefs and attitudes as antecedents to behaviors is likely to be minimized. In a mandatory environment where individuals must use the technology, their satisfaction, feelings towards their supervisors or others in authority positions, and loyalty toward the organization can be severely and negatively affected.

The TPB and the TAM form the theoretical and practical foundation for the UTAUT. The UTAUT integrates various theories and research on individual acceptance of technology into a single, unified theory that has been successfully tested and accepted as a valid model of technology acceptance (Venkatesh et al., 2003). Researchers apply UTAUT as a theoretical framework for research into the behavior associated with technology acceptance of adult students in a mandatory technology-based learning environment. The next section of this chapter contains a review of the literature concerning the ADLI, a technology-based learning environment in use by the Federal Government.

ADLI

The ADLI began during the Clinton Administration when the DOD began designing the ADLI (ADLN, 2007). The ADLI was created in order to standardize training software, facilitate and develop key technical training standards and establish guidelines on the use of standards and provide a mechanism to assist DOD and other federal agencies in the development, implementation and assessment of interoperable and reusable learning systems (ADLN). In responding to those demands, the military departments, defense agencies, joint staff, and Office of the Secretary of Defense have taken action to develop and apply advanced distributed learning technologies. President

Clinton's Presidential Executive Memorandum of January 30, 1998 expressed the need for a federal government-wide effort to explore how federal programs and initiatives can better support the use of technologies for lifelong learning. The memorandum directed the creation of a plan to incorporate technology in existing traditional federal training and learning activities (DOD, 1999).

In Joint Vision 2010, the strategic vision of the DOD, the Chairman of the Joint Chiefs of Staff (CJCS, 1996) described the need for increased technology in education and training by stating that the DOD education and training programs must prepare joint warriors to meet the challenges of the future battlespace. These programs must emphasize employment of new technologies and achieving the operational concepts outlined in this vision. Training and education in the future can leverage information superiority and much more effectively use remote approaches to train large groups of geographically distributed people. The introduction of technology could change how all training, from basic to advanced, is addressed in Joint Vision 2010 (CJCS).

Executive Order No. 13,111 (2000) established the President's Task Force on Federal Training Technology (Task Force). Members of the Task Force provide leadership regarding the effective use of technology in training and education, make training opportunities an integral part of continuing employment in the federal government, and facilitate the ongoing coordination of federal activities concerning the use of technology in training. Subsequently, Congress issued the Congressional Strategic Plan for Expansion of Distance Learning which directed the Secretary of Defense to develop a strategic plan for guiding and expanding distance learning initiatives within the DOD. The strategic plan required the DOD to devise measurable goals and objectives for

developing and executing distance learning initiatives, focusing on the training and education goals and objectives of the DOD. The resulting DOD Strategic Plan for Advanced Distributed Learning was included in the National Defense Authorization Act for Fiscal Year 1999 (1998). The National Defense Authorization Act provided for the dedicated funding of the ADLI.

The benefit of Advanced Distributed Learning (ADL) is its adaptable nature and application to training requirements after initial basic training (DOD, 1999). The aim is to provide for the distribution of as much learning as possible while maintaining the service-directed standards for quantity and quality of instruction. Many current systems and approaches, such as centralized basic training, will continue as they are taught today, which is appropriate. The DOD envisioned using the Internet and other virtual or private wide-area networks, distributed learning experts, learning management and diverse support tools to ensure a "learner-centric" ADL system that delivers high quality training, education, and job performance aiding (Government Accounting Office, 2003).

The department intends for ADL to deliver extensive transformations in training by enhancing the skills of individuals and provide capabilities training to support service component, joint and interagency, intergovernmental, and multinational military operations (DOD, 2000). Consequently, the senior leadership within the DOD and military services has set high expectations for ADL. These expectations are expressed in the DOD's training strategy and are centered on new technologies providing greater learning opportunities. This strategy includes increased accessibility, interoperability of components in varied locations by different services, reusability in multiple applications, durability despite changes in technology, and affordability (DOD, 2000).

The ADLI has achieved a level of success, measurable by cost avoidance, through conversion from traditional to ADL learning. The Army's Battle Staff Noncommissioned Officer Course conversion to an ADL format resulted in a $2.9 million annual cost avoidance with no reduction in student performance (DOD, 2000). The Air Force created a computer-based hazardous material incident response training and certification course for DOD firefighters and law enforcement personnel that reportedly resulted in both a significant increase of certified first-responders and a projected $16.6 million cost avoidance (DOD, 2000). The Air Force's Air Education and Training Command (AETC) leads the Air Force ADL program. AETC's 2008 report on the future of Air Force education and training (AETC, 2008) offers insight into the service's plans for technology-based learning environments. In the report, the Air Force identifies a requirement based on a systematic approach for inserting and integrating technology into education and training. An enterprise-wide architecture for education and training is necessary to provide common standards and compliance for the communities within the Air Force and interoperability with DOD standards. A new approach must provide more diverse training delivery methods that are available to Airmen anywhere, anytime through a robust integration of technology.

Education and training organizations within the DOD are making a concentrated effort to move from the traditional classroom to an ADL construct. ADLI will require an additional focus on methodologies and theories to include needs assessment and analysis, performance objectives, instructional strategies, media considerations, performance assessments, and learner motivation. These elements should be key considerations in the design and delivery of ADL content (Curda & Curda, 2003). Not all ADL students will

be successful. Researchers have indicated successful distance students share common characteristics of intrinsic motivation and internal locus of control (Hannafin & Land, 1997). While students in public education settings may voluntarily enroll in distance education programs, military personnel will increasingly be required to enroll in distance learning courses regardless of whether or not they possess those traits which are associated with success in distance learning. ADL course designers consider learner needs, motivations, and technical capabilities when designing and developing programs.

Researchers have demonstrated the negative consequences that may result when externally-driven learning methods have been applied in a distance-learning environment. Theorists have speculated that external control tends to minimize the personal investment and responsibility individuals feel for their learning. Learners in this type environment often fail to assume responsibility for their learning, instead viewing the learning tasks as meeting the expectations of others instead of learning for their own understanding. Learners attempt to model their views on those of others rather than evaluating their own needs and then react accordingly (Hannafin & Land, 1997). This understanding of learner reaction was a driving force behind the early movement for increased learner control of computer-based instruction (Hannafin & Rieber, 1989). This theory also applies to ADLI's student-centered system which relies on the learner to take responsibility for their learning. In order for learners to take responsibility in an ADL program, they must accept the technology and intend to use it in a manner that results in learning achievement. Technology acceptance researchers may apply the UTAUT to help explain the variances within learners that are associated with their intention toward using technology (Venkatesh & Zhang, in press).

Summary

In Chapter Two, the UTAUT was identified as the theoretical framework for the present study. The concept of technology acceptance within information systems research is a basis for understanding factors behind technology acceptance and usage by individuals. Conceptually, technology acceptance begins with individual reaction to using technology, which in turn shapes individual intention to use technology and ultimately the actual behavior associated with technology acceptance. Technology acceptance is rooted in the psychology-based TPB. TPB is the psychological and behavioral underpinning of technology acceptance models. TPB constructs of behavior, intention, attitude, subjective norm and perceived behavioral control provide a conceptual framework for research into social behavior (Ajzen, 1991). The TAM (Davis, 1989) is based on the constructs of the TPB and offers a model specifically designed for researching technology acceptance of information systems. TAM builds upon TPB through the addition of external variables which influence the perceived usefulness and perceived ease of use of a system. In previous studies utilizing the TAM, researchers have been capable of predicting behaviors associated with technology acceptance in between 30% and 40% of the cases (Venkatesh & Davis, 2000). In the UTAUT, Venkatesh et al. built upon the TAM by introducing human and social variables which raised the prediction rate to 70%. The UTAUT constructs of performance expectancy, effort expectancy, attitude towards usage of technology; social influence and facilitating conditions determine behavior associated with technology acceptance (Venkatesh et al., 2003). In the UTAUT, Venkatesh et al. also indentifies gender, age, experience and voluntariness of use as moderating variables which influence technology acceptance

behavior. These moderating variables, specifically voluntariness of use, are factors that are important to the present research because of the nature of the setting within the ADLI framework for distance learning. Chapter Two concludes with a discussion of the ADLI, its purpose and the growth of distributed learning within the DOD which underscores the timeliness and relevance of the proposed study. The research methodology is discussed in Chapter Three.

CHAPTER III

METHODOLOGY

Introduction

The purpose of this chapter is to discuss the methodology of the study. The objective of this study was to assess the contributions of the constructs of the UTAUT in the performance behavior of students in a mandatory usage setting. The expectations were that the study would provide evidence of performance behavior associated with technology acceptance by participants within a mandatory technology-based instructional environment. An ex post facto research design was implemented to operationalize the theoretical constructs of technology acceptance in the research setting. Specifically, the constructs of the UTAUT presented in the literature review were applied to investigate technology acceptance of participants in a mandatory technology-based training program. In the study, the individual and combined effects of performance expectancy, effort expectancy, attitude towards usage of technology, social influence, and facilitating conditions on the performance behavior of students in a mandatory, technology-based learning environment were examined. The influences of age, gender, recent experience participating in ADL and volition on performance behavior were also examined. Volition, identified in the literature review as a moderating variable, is pertinent to the study because the participants were required to take part in the training program as a condition of military service. This chapter is divided into four sections. The research

questions are reviewed in the first section. The second section contains information on research design and data collection methods. Data analysis methods and procedures are described in the third section. The fourth section describes the relationships between the UTAUT variables and the instrumentation aligned with the variables. The two research questions framing the present study are presented in the following section.

Research Questions

The following research questions were the basis for the study:

1. What are the individual and combined contributions of performance expectancy, effort expectancy, attitude towards usage of technology, social influence, and facilitating conditions to the performance behavior of students in a mandatory technology-based learning environment?
2. What are the individual and combined contributions of gender, age, experience and volition to the performance behavior of students in a mandatory technology-based learning environment?

The purpose of the research was to answer these questions by investigating the relationships between the primary and moderating constructs of the UTAUT model and the dependent variable of behavior as measured by a technology-driven, summative performance evaluation in the mandatory technology-based learning environment. The constructs of the UTAUT model provide the independent and moderating variables forming the framework for the study. The next section describes the ex post fact correlation research design of the present study. Power analysis, the sample population, and limitations of the research design are also addressed in this section.

Research Design and Data Collection

This ex post facto predictive analytic study was designed to examine the performance behavior of participants in a mandatory, technology-based learning environment using correlation and regression analysis procedures. Creswell (2003) explains that a correlation research design is used when a researcher seeks to relate two or more variables to see if they influence each other. The design is based on the UTAUT model developed by Venkatesh et al. (2003). The primary statistical tools used in the study were the Pearson correlation, Spearman Rho and multiple regression analysis procedure. A Pearson correlation was used to determine if relationships exist between the existing interval-level independent variables derived from the UTAUT model and the dependent variable of written assessment scores. Spearman Rho was used to determine relationships between the existing, non-interval-level moderating variables and independent variables derived from the UTAUT model. Multiple regression analysis was performed to analyze multiple relationships, contributing variability, and potential predictability between the set of independent variables and the dependent variables.

Prior to analysis, data were examined for possible violations of statistical assumptions for multiple regression analysis and the followings conditions were noted: (a) the relationships between independent, moderating and dependent variables were non-linear; (b) the dependent variable is interval level; and (c) serial correlation was not evident in the data. Within multiple regression analysis, non-linearity increases the risk of a Type II error where the interrelationships between independent variables sharing variance are over-estimated (Cohen & Cohen, 1983). The presence of autocorrelation in the residuals was examined by the Durbin-Watson Test. The value of the Durbin-Watson

statistic was 2.2, indicating there was no serial correlation. These findings indicate slight heteroscedasticity exists, i.e., the variance of errors differs at different values across all levels of the independent variables.

According to Berry and Feldman (1985) and Tabachnick and Fidel (1996) slight heteroscedasticity has little effect on significance tests; however, when heteroscedasticity is marked it can lead to the distortion of findings and seriously weaken the analysis thus increasing the possibility of a Type I error resulting in the false rejection of the hypothesis.

Residuals were computed and examined; the resulting distribution was slightly skewed in the positive direction with a mean of .58 rather than a mean of zero. Ideally, residuals are randomly scattered around 0 (the horizontal line) providing a relatively even distribution. Heteroscedasticity is indicated when the residuals are not evenly scattered around the line.

Power Analysis

Power in quantitative hypothesis testing is the probability of correctly rejecting a false null hypothesis (Creswell, 2003.). Power analysis is a means of identifying an appropriate sample size for group comparisons by considering the level of statistical significance (alpha), the amount of power desired in a study, and the effect size (Creswell). Effect size in correlation research is aligned with R^2 and is indicative of the strength of the relationship between variables. A significance level, or alpha, is a probability level that reflects the minimum risk the researcher is willing to take that any observed differences are due to chance (Creswell). Alpha is typically set at .01 (one out

of one hundred times the occurrence will be due to chance) or .05 (five out of one hundred will be due to chance). In this study, alpha was established at the .05 level. Power analysis performed prior to the sample selection process revealed that the findings from the sample size (N=105) of participants in the present study will generalize to the population (N=1050) of total expected annual participants within the specified mandatory technology-based learning environment used in the present study. The next section provides a description of the population and the sample used in the study.

Population and Sample Size

The participants in the study are military students enrolled in a mandatory ADL program administered by an Air Force education and training organization in the southeastern portion of the United States. The average class size established by the Air Force for technology-based learning environments is 130. The sample size in the present study was N = 105. The sample was consistent with representing average class sizes although a convenience sample was utilized in the study. The unit of analysis was the individual student.

Sample Selection

The sample selection was derived from the following process: A convenience sample of 105 students selected by the Air Force to participate in the mandatory, technology-based learning program provided by the Air Force. A request letter (Appendix A) to the commander of the organization seeking permission to conduct the study was submitted and approved. Upon approval of the research request, the organizations' technology-based learning program administrator agreed to act as the

intermediary research assistant. The technology-based learning program administrator is provided a list of participants by the Air Force. The administrator had access to the participants through the learning management system (LMS) within the technology-based learning program. As both administrator and research assistant, this person was responsible for contact with the participants and coordinating their mandated participation in the both the technology-based learning program and the research present study. However, participants were allowed to decide if they wished to participate in the research project. Research study participation was not mandated. The University of West Florida granted approval for the study and an approval letter (Appendix B) was received prior to the start of data collection activities.

Demographics of the Sample

There were 105 participants in the mandatory technology-based learning program. As a prerequisite to participation in the technology-based learning program, the enlisted participants must have attained a minimum score of 48 on the Air Force Qualification Test. Officer participants must have attained a minimum score of 50 on the Air Force Officer Qualification Test. The Air Force and Air Force Officer Qualification Tests are similar to commercially available achievements such as the *Stanford Achievement Test* (Pearson Educational Assessment Solutions, 2009) and other similar standardized tests used for college admissions in the United States. The average age of the participants comprising the sample population was 35. Twenty-three of the participants were female. Fifty-three participants had participated in technology-based learning within the twelve months prior to the study.

Limitations

Limitations are potential weaknesses or problems with the study identified by the researcher. In quantitative research, limitations often relate to inadequate measures of variables, loss or lack of participants, small sample size, errors in measurement and other factors typically related to data collection and analysis (Creswell, 2003). Relative to the present ex post facto correlation research design, the following limitations are noted:

1. The sample for the study was a convenience sample with no random assignment possible. In this study, there was no control group or treatment allowing for the utilization of an experimental or quasi-experimental research design.
2. Correlation research designs do not support interpretation of causal relationships since correlation designs do not permit direct observation of behavior under the conditions necessary to establish causality.
3. The lack of random assignment of participants and differential selection is a potential threat to validity created by the nature of the correlation research design.

A discussion of data collection procedures for the independent, moderating and dependent variables is presented in the next section.

Data Collection Procedures

The following paragraphs contain descriptions of the independent, moderating, and dependent variables used in the study. The instrumentation and processes used to collect data relative to these variables are also discussed.

Independent Variables

A UTAUT instrument (Appendix C) was administered within the technology-based learning program. A third-party administered the on-line LMS hosting the technology-based learning program. When the participants first entered the program, they were presented an orientation module explaining the technology-based learning program. Orientation included instructions on site navigation and other information necessary to participate in the program. Upon completion of the orientation module, participants were presented with a request to participate in the present study. The request included an informed consent statement and a description of the study and its purpose. Participation consisted of completing a pre-ADL course survey instrument prior to beginning the content-related portion of the course. If participants agreed to participate in the study, the UTAUT-based instrument was presented. The instrument was a Likert-scale questionnaire consisting of two sections. Section one contained twenty-five UTAUT-specific items which were constructed to collect participant self-reported information concerning the primary UTAUT constructs of performance expectance, effort expectancy, attitude towards usage of technology, social influence and facilitating conditions.

The individual constructs of the UTAUT served as the instrument sub-scales. Each item on the survey was directly aligned with a specific sub-scale. Section two gathered demographical information regarding age, gender, experience and volition aligned with the moderating variables of the UTAUT model. The instrument has been validated through previous research studies and was pilot tested for the present study by a group of thirty volunteers obtained by the research assistant. Principal component

analysis was accomplished utilizing the Varimax with Kaiser Normalization procedure. Analysis found all items were aligned with the expected factors. The pilot test consisted of a group of 30 individuals who volunteered to take the survey. The instruments were electronically submitted to the research assistant through the LMS. Data were transferred into the Statistical Package for the Social Sciences (SPSS) for statistical analysis.

Moderating Variables

In the UTAUT model, gender, age, experience and voluntariness are moderating variables which influence performance behavior. The UTAUT-based instrument used to collect independent variable data was also used to gather data for the moderating variables. This data consisted of descriptive information provided by the participants.

Dependent Variable

The dependent variable of behavior was measured with a summative performance-based instrument measuring the participants' learning outcomes. The measurement was administered electronically to the participants at the completion of the technology-based learning program. The instrument was based on the instructional content delivered by the technology-based, mandatory learning program. The instrument consisted of forty content-based items created in accordance with procedures delineated in *Air Force Manual 36-2235*: *Instructional Systems Development* (Air Force, 1993). The summative performance evaluation items were validated by content subject matter experts and through a series of pilot testing procedures in accordance with *Air Force Manual 36-2235: Instructional Systems Development*. A factor analysis found a reliability of > .75 on the Kuder-Richardson reliability scale for all instrument items.

The use of a summative performance-based outcome instrument as a dependent variable has been supported in previous technology acceptance research (Ajzen, 1985; Locke et al., 1984) and is consistent with the purpose of this study. The next section contains a description of the analysis procedures applied to the collected data.

Data Analysis Procedures

Data collection and analysis procedures for the independent and dependent variables (Figure 5) of the research hypotheses are described in the following paragraphs.

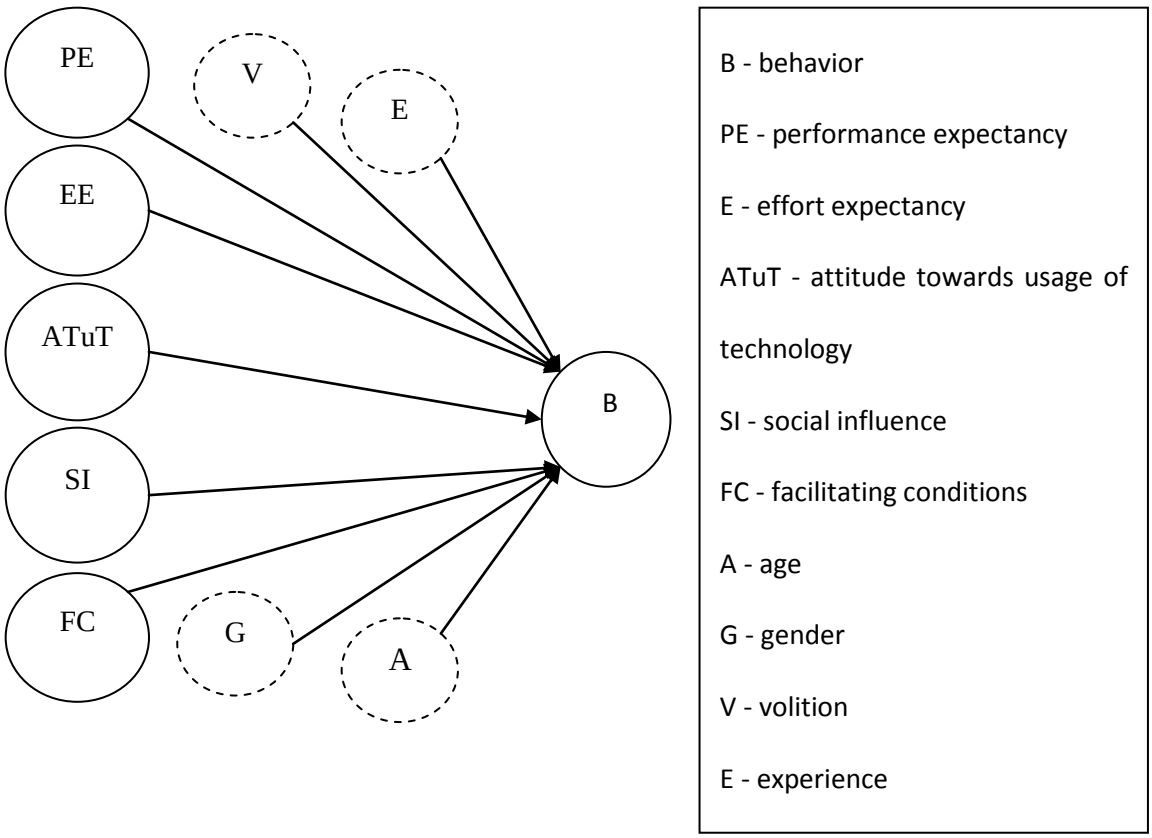

Figure 5. A hypothesized research model illustrating the interrelationships between variables.

Hypothesis One required multiple regression because of the nature of the need to analyze the relationship between the dependent variable of performance behavior and the set of independent variables. The independent variables are performance expectancy, effort expectancy, attitude towards usage of technology, social influence and facilitating conditions. Multiple regression analysis determined variability within the dependent variable that can be explained by the independent variables.

Hypothesis Two required multiple regression analysis because of the nature of the need to analyze the relationship between the dependent variable of performance behavior and the set of moderating variables. The moderating variables are gender, age, experience and volition. Multiple regression analysis determined the variability within the dependent variable that can be explained by the independent variables.

Variable Relationships and Instrumentation

The hypothesized relationships between the variables in the hypothesized model and their individual and combined effects on behavior are discussed in this section. The UTAUT survey instrument used for gathering data supporting the independent variables was designed to investigate interrelationships of the independent variables and as potential predictive measures of contributing factors to students' performance or summative behaviors. An understanding of each of the independent variables is relevant to an overall understanding of the instrumentation and methodology that was used in the proposed study. The hypothesized relationship between performance expectancy, effort expectancy, attitude towards usage of technology, social influence, and facilitating conditions and behavior is central to the hypotheses of the present study. The hypotheses

also include the potential relationship between an individual's age, gender, volition, previous experience and behavior.

Performance Expectancy

Performance expectancy is defined as the degree to which an individual believes that using a technology will help him or her to attain gains in job or other related type of performance (Venkatesh et al., 2003). The performance expectancy construct is the strongest predictor of behavior and remains significant at all points of measurement in both voluntary and mandatory settings (Taylor & Todd, 1995; Venkatesh & Davis, 2000). Venkatesh and Davis theorize there is reason to expect that the relationship between performance expectancy and performance behavior will be moderated by gender and age.

Effort Expectancy

Effort expectancy is defined as the degree of ease associated with the use of the technology system. Effort-related constructs are hypothesized to have greater influence during the early stages of a new behavior (Davis et al., 2002). Prior research supports the theory that effort expectancy will be stronger determinants of behavior for women and for older workers (Morris & Venkatesh, 2008). Venkatesh et al. (2003) propose that effort expectancy will be most salient for women and older members of society.

Attitude Towards Usage of Technology

Attitude toward usage of technology is defined as an individual's overall affective reaction to using a system (Venkatesh, 2003). Attitude towards behavior, intrinsic motivation, affect towards use, and affect are sub-constructs which shape an individual's

overall attitude towards usage of technology. Attitude towards behavior is an individual's positive or negative feelings about performing the target behavior (Davis et al., 1989; Fishbein & Ajzen, 1975; Taylor & Todd, 1995). Intrinsic motivation is the perception that users will want to perform an activity for no apparent reinforcement other than the process of performing the activity (Davis et al., 2002). Affect towards use describes the feelings associated by an individual with a particular act (Thompson et al., 1991). Affect describes an individual's liking of the behavior (Compeau & Higgins, 1995).

Social Influence

Venkatesh et al. (2003) defined social influence as the degree to which an individual perceives that important others believe he or she should use a technology. Social influence as a direct determinant of behavior is represented as subjective norm in both TPB and TAM. While titled differently, these constructs posit individual behavior as influenced by the way in which they believe others will view them as a result of having used the technology. Of particular relevance to the proposed study, prior research suggests that none of the social influence constructs are significant in voluntary contexts; however, each becomes significant when use is mandated (Venkatesh, 1999). Venkatesh et al. (2003) theorize social influence is greater in women, with the effect declining with experience (Morris & Venkatesh, 2008).

Facilitating Conditions

Facilitating conditions are defined as the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the technology (Venkatesh et al., 2003). Thompson et al. (1991) describe facilitating conditions as

objective factors in the environment that make an act easy to do, including the provision of computer support.

Moderating Variables

Gender, age, experience, and voluntariness are identified in the literature as moderating variables which may, either individually or in combination, influence behavior (Morris & Venkatesh, 2008; Venkatesh et al., 2003). The individual and combined effects of these constructs upon behavior are the basis for the proposed research. Performance expectancy, effort expectancy, social influence, attitude towards usage of technology, facilitating conditions, and moderating variables are present in the UTAUT model and form the structure of one of the study instruments designed to measure the independent variables. A discussion of the instruments and their alignment with these variables is presented in the following sections.

Instrumentation for Independent and Moderating Variables

The instrument used to gather data supporting the independent variables is founded on the instrument created by Venkatesh et al. (2003) to support the UTAUT model and has been validated in research studies by Moran (2006) and Cetron (2007). The instrument contained statements addressing each of the constructs within the model. Survey participants were asked to indicate their response to each statement using a seven item Likert scale with one representing a strong disagreement and seven being a strong agreement with the statement. The LMS specialist at the research site prepared the instrument for readiness to use in the assessment of students' responses by placing the survey in the Internet-based LMS. The instrument was beta-tested by volunteers at the

research site who are experts in technology-based learning. The questions that comprise the content of the instrument are available in Appendix C. Participants received an e-mail notification of mandatory selection and enrollment in a learning program.

Students were asked to participate in the study the first time they accessed the program. Students received an informed consent notice and were allowed to either exit the survey or enter the survey instrument. If students chose not to participate, they were permitted to continue through the program. Students who elected to continue as study participants proceeded to the website containing the instrument. Survey questions were categorized based on UTAUT model constructs; however, the instrument questions were randomly placed on the instrument for participants and are presented in subscales only for purposes of clarity within Appendix C.

A beta test group of 30 students, consisting of voluntary participants, completed the instrument prior to the N=105 students who completed the instrument as participants. Upon completion, instruments were electronically submitted to the database and transferred to SPSS for analysis. Results of the reliability and validity analyses for the independent measures instrument are presented in the following paragraphs.

Cronbach's Alpha reliability estimate for scale items was performed and all item measurements exhibited Cronbach Alpha values of .72, which is considered acceptable for social science research (Creswell, 2003). This result was expected given that the scale items had been previously validated in other research (Hildebrand, 2009; Carswell & Venkatesh, 2002; Venkatesh et al., 2003).

Construct validity was accomplished by assessing the 25 scale items in an exploratory factor analysis using the Varimax procedure with an Eigenvalue >1.0.

Findings indicated scale items were aligned with their respective constructs and are consistent with item validity reported in previous research (Cetron, 2007; Thomas, 2008).

Instrumentation Supporting the Dependent Variable

The dependent variable in this study is behavior quantified by a summative, technology-based outcome instrument measuring participants' content-based performance within the mandatory technology-based learning environment. This methodology is theoretically aligned with previous research by Locke et al. (1984) where performance outcome was synonymous with behavior and consistent with the theoretical framework of technology acceptance as presented by Ajzen (1985). The dependent variable instrument was using web-page design software and placed within the training organization's Internet-based LMS which stored the instrument in readiness for use in the study data. Content items were created in accordance with *Air Force Manual 36-2234, Instructional Systems Development* (Air Force, 1993). Items were constructed by instructional systems design specialists and content subject matter experts to measure participant outcomes within the technology-based learning environment. Validation for the UTAUT instrument was accomplished through pilot testing by a group of volunteer participants. Validation for the dependent variable's performance-based, technology-driven performance behavior instrumentation was performed through a series of pilot tests accomplished by a group of volunteer participants. Data for each item were then assessed for validity using Cronbach's Alpha; all items exhibited values > .75. Content validation was accomplished by a group of subject matter experts who examined and approved each item for content validity.

Summary

A quantitative, ex post facto correlation research design was used to investigate the technology acceptance of participants of a mandatory technology-based training program. The setting of the study is an Air Force education and training program within the DOD ADLI framework. The theoretical framework and the constructs for the independent variable research instrument used in the study were based on the UTAUT model. The independent variables are directly aligned with UTAUT constructs of performance expectancy, effort expectancy, attitude towards usage of technology, social influence, and facilitating conditions. The UTAUT constructs of gender, age, experience, and volition were identified as moderating variables. Individually and in combination, independent and moderating variables are posited to influence participant behavior. The dependent variable behavior was measured using a summative, technology-driven performance outcome assessment Multiple regression analysis is the statistical procedure which examined the effects of the independent and moderating variables on the dependent variable of behavior. The sample size in the study was N = 105; consistent with representing average class sizes although a convenience sample was utilized in the study. The unit of analysis was the individual student. Descriptive statistics characterized the sample population. Multiple regression analysis identified the relationships among the variables. A primary limitation of the ex post facto design was the lack of researcher control in manipulating the variables or randomization of subjects. This limitation is consistent with the concept of the non-volition environment that is not under the control of the researcher yet is a key variable in the study. Interpretive discussion of these findings is presented in Chapter Four.

CHAPTER IV

FINDINGS

Introduction

Findings of the data collected and analyzed from participants in a non-voluntary mandatory technology-based learning program are presented in Chapter Four. The first section of the chapter contains a description of the research problem, research questions, and associated research hypotheses. Descriptive statistics that describe the subjects within the sample population are presented in the second section. Descriptive statistics relative to the subscale of the UTAUT that formed the framework for the independent and moderating variables are also described in the second section, along with the descriptive statistics associated with the dependent variable of performance behavior. The final section presents the results of the inferential statistical analysis of each hypothesis, a description of the statistical procedures utilized for each hypothesis, and the results and findings of each procedure.

Research Problem, Research Questions, and Hypotheses

The research problem, research questions, and associated hypotheses provide the framework of this quantitative research study. The research problem guiding the present study is presented in the following section. The research questions and associated hypotheses are also introduced and described in the following paragraphs.

Research Problem

Higher education and other institutions providing education and training programs to adult learners are increasingly offering technology-based courses to their students. Technology acceptance of voluntary participation within technology-based courses has been addressed in previous research. Relevant to the present study, the Air Force, as part of the larger DOD, is implementing technology-based programs as prescribed by the federal government's ADLI. The ADLI mandates the implementation of technology-based learning for their personnel. The UTAUT has provided a model for researchers to investigate technology acceptance among voluntary users of technology through the constructs of performance expectancy, effort expectancy, attitude towards usage of technology, social influence and facilitating conditions (Gibson & Harris, 2008). The present study examined these constructs within a mandatory technology-based learning environment, applying the UTAUT constructs as independent variables. The UTAUT model also provided the moderating variables of age, gender, experience and volition which have been shown to moderate the effects of the independent variables in voluntary settings. The present study applied the UTAUT model in a non-volitional setting. The results provide useful insight to anyone with an interest in the effectiveness of technology-based learning in a non-volitional environment and are presented in this chapter. Specifically, the study identified interrelationships between the independent, moderating and dependent variables and determined which UTAUT constructs influence performance behavior in the mandatory technology-based learning environment. The following paragraphs present the research questions framing the present study.

Research Questions

The following research questions were addressed in the study:

1. What are the individual and combined contributions of performance expectancy, effort expectancy, attitude towards usage of technology, social influence, and facilitating conditions to the performance behavior of students in a mandatory technology-based learning environment?
2. What are the individual and combined contributions of gender, age, experience, and volition to the performance behavior of students in a mandatory technology-based learning environment?

The research questions were used to investigate the relationships between the primary and moderating constructs of the UTAUT model and the dependent variable of behavior as measured by a technology-driven, summative performance assessment in a mandatory technology-based learning environment.

Hypotheses

The research questions were restated as empirically-testable statements about a relationship involving two or more variables and presented in the form of null hypotheses. The following hypotheses were used to guide the study and align the statistical procedures with the research questions.

H_1: There is a relationship among the independent variables of performance expectancy, effort expectancy, attitude towards usage of technology, social influence, and facilitating conditions and the dependent variable of performance behavior in a mandatory technology-based learning

environment when the independent factors are considered singularly or in combination.

H_{o1}: There is no relationship among the independent variables of performance expectancy, effort expectancy, attitude towards usage of technology, social influence, and facilitating conditions and the dependent variable of performance behavior in a mandatory technology-based learning environment when the independent factors are considered singularly or in combination.

H_2: There is a relationship among the independent variables of gender, age, experience and volition and the dependent variable of performance behavior in a mandatory technology-based learning environment when the independent factors are considered singularly or in combination.

H_{o2}: There is no relationship among the independent variables of gender, age, experience, and volition and the dependent variable of behavior in a mandatory technology-based learning environment when the independent factors are considered singularly or in combination.

Descriptive statistical information is presented in the next section. These data were gathered using the UTAUT-based instrument described in the previous chapter.

Descriptive Statistics

The descriptive statistics of the sample population and the specific independent and dependent variables are summarized in the following sections. Frequency counts and percentages regarding participant age, education level, gender, experience participating in

a technology-based learning program in the twelve months preceding the study, use of computers in a learning environment within the twelve months preceding the study, and the perception of voluntary participation in the mandatory technology-based learning environment provide a description of the sample population. The factors of age, gender, recent participation in technology-based learning, and volition are aligned with the moderating variables found in the UTAUT model. Frequency counts and percentages regarding performance expectancy, effort expectancy, attitude towards usage of technology, social influence, and facilitating conditions are aligned with the independent variables identified in the UTAUT model. Descriptive statistics relative to the dependent variable of performance behavior are also presented. The findings of the descriptive statistical analyses are presented in the following paragraphs.

Sample Population

The participants ranged in age from 20 to 58, the mean age of the sample population was 35. In comparison, the average age of the Air Force officer force is 35, for enlisted airmen it is 29 (AETC, 2008).

The participants reported education levels ranging from master's degrees to high school diplomas (Table 1). Thirty-two respondents reported a master's degree as their highest educational attainment, aligning with 32 respondents reporting bachelor's degrees. These two groups represented the highest educational categories, each representing 30%. Those participants reporting a high school diploma as their highest educational attainment represented the smallest educational category with .04% of the sample population.

Table 1

Participant Education Levels

Variable	Frequency	Percentage
Education Level		
High School	4	.04
Some College	19	.19
Associate's	18	.17
Bachelor's	32	.30
Graduate	32	.30
Total	105	100

The sample population consisted of 23 females and 82 males (Table 2). AETC (2008) reports 19.5% of the Air Force population are women and 81.5% are men. Therefore, the sample retrieved for this study aligns with the Air Force population descriptive statistics by gender (21.9 and 78.1% respectively).

Table 2

Participant Gender

Variable	Frequency	Percentage
Gender		
Female	23	22
Male	82	78

Of the 105 members of the sample population within this study, 53 reported participating in technology-based learning within the past year (Table 3). Therefore, half

of the participants had previous experience with the technology-driven instructional environment.

Table 3

ADL Experience in Last Year

Variable	Frequency	Percentage
ADL participation in last year		
Yes	53	50
No	52	50

Note: ADL is Advanced Distributed Learning

Of the 105 members of the sample population within this study, 83 reported using a computer as a student within the past year (Table 4). These results indicate 79% of the participants had used computers in a learning environment within the past year.

Table 4

Used Computers in School Within Last Year

Variable	Frequency	Percentage
Used Computers in School Within Last Year		
Yes	83	79
No	22	21

The instrumentation for the independent and moderating variables included an item which asked if the respondent was voluntarily participating in the mandatory

technology-based learning program. Of the 105 members of the sample population within this study, 48 reported they perceived their participation in the present ADL course as voluntary (Table 5).

Table 5

Perceive Present ADL Participation as Voluntary

Variable	Frequency	Percentage
Perceive Present ADL Usage as Voluntary		
Yes	48	46
No	57	54

Note: ADL is Advanced Distributed Learning

The next section presents descriptive statistics obtained from analyses of the independent and dependent variables. The statistical processes used in the descriptive statistical analysis are also identified in the next section.

Independent and Dependent Variables

The constructs used for the statistical analyses of the independent variables are based on the UTAUT model and provide the independent and moderating variables for the present study. Descriptive statistics obtained during statistical analyses (Table 6) describe the data obtained from the participants by the UTAUT instrumentation and the summative, technology-based assessment measuring performance behavior. The statistical analyses identified relationships between the independent variables of performance expectancy, effort expectancy, attitude towards usage of technology, social

influence and facilitating conditions and the dependent variable of performance behavior measured by a summative technology-driven performance evaluation in the mandatory technology-based learning environment.

Table 6

Descriptive Statistics for Independent Variables

Variable	Mean	Std Dev	Skewness	Minimum	Maximum
Performance Expectancy	16.15	3.31	.236	4.00	24.00
Effort Expectancy	19.93	2.91	.236	4.00	24.00
Attitude Towards Usage of Technology	16.13	4.87	.236	4.00	24.00
Social Influence	13.35	2.89	.236	3.00	6.00
Facilitating Conditions	27.69	4.65	.236	6.00	39.00

The dependent variable of summative behavior was measured by each individual participant's summative performance using standardized, content-based, technology-driven instrumentation. The performance behavior of all participants was objectively measured as they performed identical tasks under the same condition. The same grading standard was also used to measure the performance of each participant. To insure standardization, the same observer graded the performance of each of the participants. Each individual participant's summative performance was quantified using a metric based on a scale of 0 (indicating lowest possible performance) to 53 (indicating highest possible performance) with an interval of one (Table 7).

Table 7

Descriptive Statistics for the Dependent Variable Performance Behavior

N	Minimum	Maximum	Mean	StdDev
105	18.00	53.0	40.64	8.48

Note: N indicates number of cases

Findings relevant to the research questions and null hypotheses are presented in the next section. Statistical analyses performed for addressing the research questions included multiple regression analysis, Pearson correlation, and Spearman Rho coefficients. Results of these statistical tests and post hoc analyses are presented and described for each hypothesis.

Inferential Statistics

Findings of the inferential statistical analyses conducted to address the research questions and null hypotheses described in previous sections of this study are presented in this section. A discussion of the results of the inferential statistical analyses for each hypothesis is presented in the following paragraphs.

Hypothesis One

The purpose of Hypothesis One was to identify the individual and combined contributions of performance expectancy, effort expectancy, attitude towards usage of technology, social influence, and facilitating conditions to the performance behavior of students participating in a mandatory technology-based learning environment. Multiple regression analysis indicated factors that contributed to the performance behavior of

students. Multiple regression analysis tested Null Hypothesis One, which stated there is no relationship among the independent variables of performance expectancy, effort expectancy, attitude towards usage of technology, social influence, and facilitating conditions and the dependent variable of performance behavior in a mandatory technology-based learning environment when the independent variables are considered singularly or in combination.

Multiple regression analysis was performed to predict the performance behavior of students based on the UTAUT subscales of performance expectancy, effort expectancy, attitude towards usage of technology, social influence, and facilitating conditions. The initial analysis indicated the combined constructs were predictors of behavior ($F(5,104) = 14.885$, $p > .001$), with an R^2 of .429 and f^2 of .751.

The Pearson correlation coefficient was used to test Hypothesis One. Of the 36 correlations within Hypothesis One, four of the correlations were found to be significant at alpha = .05. The results of Pearson correlation analysis are presented as follows: (a) performance expectancy and behavior (.55), (b) effort expectancy and behavior (.30), (c) attitude towards usage of technology and behavior (.64), (c) and social influence and behavior (.27). In the UTAUT model, Venkatesh et al. (2003) theorize the constructs of performance expectancy, effort expectancy, attitude towards usage of technology, social influence and facilitating conditions as influencing performance behavior of participants in the mandatory technology-based learning environment. A Pearson correlation was performed to investigate whether these influences existed in the present study; the results (Table 8) are presented with interpretive discussion in the following paragraphs.

Table 8

Correlation Matrix of Independent Variables and Dependent Variable

Variable	PE	EE	ATUT	SI	FC	B
PE		.44**	.66**	.25**	.27**	.55**
EE	.44**		.50**	.13	.40**	.30**
ATUT	.66**	.50**		.50**	.44**	.64**
SI	.25**	.13	.46**		.30**	.27**
FC	.28**	.40**	.44**	.30**		.24
B	.55**	.30**	.63**	.27**	.24	

Note. The independent variables and dependent variable are the UTAUT constructs. PE = Performance Expectancy; EE = Effort Expectancy; ATUT = Attitude Towards Usage of Technology; SI = Social Influence; FC = Facilitating Conditions; B = Behavior (B).
**p <.01

The correlation between performance expectancy and behavior was found to be significant (r = .55, p < .01). These findings indicate performance expectancy contributed 30% of the variability in the performance behavior of participants in the mandatory, technology-based learning environment of this study. The findings of this study corroborate the theoretical framework of the UTAUT model which asserts performance expectancy influences behavior (Venkatesh et al., 2003). Cetron's (2007) study of performance behaviors associated with wireless technologies found performance expectancy accounted for 21% of the variance in performance behavior. In a study investigating technology acceptance of TPC, Moran (2006) found that performance expectancy accounted for 9% of the variability in performance behavior. These findings

are aligned with the original UTAUT research (Venkatesh et al., 2003) where performance expectancy accounted for 46% of the variability in performance behavior.

The correlation between effort expectancy and behavior was found to be significant ($r = .30$, $p < .01$). These findings indicate effort expectancy contributed .09% of the variability in the performance behavior of participants in the mandatory, technology-based learning environment of this study. Accordingly, the results of this study substantiate the theoretical framework of UTAUT which suggests effort expectancy influences performance behavior. Morris and Venkatesh (2008) found that effort expectancy contributed 20% of the variance in performance behavior in a technology-based environment. Thomas (2008) found effort expectancy accounted for 55% of the variability in performance behavior within a technology-based environment.

The correlation between attitude towards usage of technology and behavior was found to be significant ($r = .64$, $p < .01$). These findings indicate attitude towards usage of technology accounted for 41% of the variability in performance behavior. Consequently, the findings in this study support the theoretical structure of the UTAUT model and are consistent with previous research. Davis (1989) found that attitude towards usage of technology accounted for 37% of the variability in the performance behavior of students in a technology-based learning environment. Davis' finding was further supported by Moran (2006) who found attitude towards usage of technology accounted for 47% of the variability in performance behavior of students in technology-based learning programs.

The correlation between social influence and behavior was found to be significant ($r = .27$, $p < .01$). These findings indicate social influence accounted for .07% of the

variability in performance behavior. Consequently, the data in this study support the theoretical structure of the UTAUT model and is consistent with previous research. Venkatesh et al. (2003) found that social influence accounted for 11% of the variability in performance behavior while Morris and Venkatesh (2008) found that social influence accounted for 14% of the variability in performance behavior of participants' in their study of performance behavior within a technology-driven environment.

The correlation between facilitating conditions and behavior was found to be significant ($r = .24$, $p < .01$). These findings indicate facilitating conditions accounted for .06 % of the variability of performance behavior. This finding conforms to the theoretical framework of the UTAUT model and is consistent with previous research by Williams (2009) who found that facilitating conditions accounted for 32% of the variability of performance behavior in a technology-based learning environment. This finding is congruent with Sykes, Venkatesh and Gosain (2009) who explored performance behavior in a technology-based learning environment and found that facilitating conditions accounted for 21% of the variability of performance behavior.

The findings presented in the preceding paragraphs are consistent with previous research where the UTAUT model's primary constructs of performance expectancy, effort expectancy, attitude towards usage of technology, social influence, and facilitating conditions have been found to correlate significantly with behavior (Venkatesh et al., 2003). Multiple regression analysis was performed to identify the individual and combined contributions of the independent variables (performance expectancy, effort expectancy, attitude towards usage of technology, social influence, and facilitating conditions) to the dependent variable of performance behavior. The following paragraphs

present the results of the multiple regression analysis and discuss the results of this procedure.

Multiple regression analysis was performed to investigate the relationship between each of the independent variables and the dependent variable of behavior. The results indicated a significant predictive relationship existed between each independent variable and the dependent variable, performance behavior. The contribution of performance expectancy to performance behavior was found to be significant ($F(1,104) = 44.255$, $p < .01$) with an R^2 of .301 and an f^2 of .43. The contribution of effort expectancy to performance behavior was found to be significant ($F(1,104) = 9.805$, $p < .01$) with an R^2 of .078 and an f^2 of .08. The contribution of attitude towards usage of technology to performance behavior was found to be significant ($F(1,104) = 66.874$, $p < .01$) with an R^2 of .394 and an f^2 of .65. The contribution of social influence to performance behavior was found to be significant ($F(1,104) = 7.820$, $p < .01$) with an R^2 of .071 and an f^2 of .07. The contribution of facilitating conditions to performance behavior was found to be significant ($F(1,104) =5.794$, $p < .01$) with an R^2 of .053 and an f^2 of .05. Therefore, findings of this study corroborate the UTAUT Model and align with previous studies cited in Chapter Two by Davis (1989), Davis et al. (1989), Taylor and Todd, (1995), Venkatesh (2003), Moran (2006), and Cetron (2007).

The paired contributions of performance expectancy and effort expectancy to performance behavior were found to be significant ($F(2,104) = 22.280$, $p < .01$) with an R^2 of .304 and an f^2 of .43. The combined contributions of performance expectancy and attitude towards usage of technology to performance behavior was found to be significant ($F(2,104) = 37.760$, $p < .01$) with an R^2 of .425 and an f^2 of .74. The combined

contributions of performance expectancy and social influence to performance behavior were found to be significant ($F(2,104) = 23.723$, $p < .01$) with an R^2 of .317 and an f^2 of .46. The combined contributions of performance expectancy and facilitating conditions to performance behavior were found to be significant ($F(2,104) = 22.724$, $p < .01$) with an R^2 of .308 and an f^2 of .46. The combined contributions of effort expectancy and attitude towards usage of technology to performance behavior were found to be significant ($F(2,104) = 33.165$, $p < .01$) with an R^2 of .394 and an f^2 of .65. The combined contributions of effort expectancy and social influence to performance behavior were found to be significant ($F(2,104) = 8.286$, $p < .01$) with an R^2 of .140 and an f^2 of .16. The combined contributions of effort expectancy and facilitating conditions to performance behavior were found to be significant ($F(2,104) = 5.804$, $p < .01$) with an R^2 of .102 and an f^2 of .11. The combined contributions of attitude towards usage of technology and social influence to performance behavior were found to be significant ($F(2,104) = 33.196$, $p < .01$) with an R^2 of .394 and an f^2 of .65. The combined contributions of attitude towards usage of technology and facilitating conditions to performance behavior were found to be significant ($F(2,104) = 33.431$, $p < .01$) with an R^2 of .396 and an f^2 of 66. The combined contributions of facilitating contributions and social influence to performance behavior were found to be significant ($F(2,104) = 5.404$, $p < .01$) with an R^2 of .096 and an f^2 of .10.

Multiple combinations of factors were investigated using multiple regression and were found to be significant. The combined contributions of performance expectancy, effort expectancy, and attitude towards usage of technology to performance behavior were found to be significant ($F(3,104) = 25.194$, $p <.01$) with an R^2 of .428 and an f^2 of

.75. The combined contributions of performance expectancy, effort expectancy, and social influence to performance behavior were found to be significant ($F(3,104) = 15.896$, $p < .01$) with an R^2 of .321 and an f^2 of .47. The combined contributions of performance expectancy, effort expectancy, and facilitating conditions to performance behavior were found to be significant ($F(3,104) = 15.075$, $p < .01$) with an R^2 of .309 and an f^2 of .45. The combined contributions of effort expectancy, attitude towards usage of technology, and social influence to performance behavior were found to be significant ($F(3,104) = 21.961$, $p < .01$) with an R^2 of .395 and an f^2 of .65. The combined contributions of effort expectancy, attitude towards usage of technology, and facilitating conditions to performance behavior were found to be significant ($F(3,104) = 22.076$, $p < .01$) with an R^2 of .396 and an f^2 of .66. The combined contributions of attitude towards usage of technology, social influence, and facilitating conditions to performance behavior were found to be significant ($F(3,104) = 22.101$, $p < .01$) with an R^2 of .396 and an f^2 of .66. The combined contributions of performance expectancy, attitude towards usage of technology, and social influence to performance behavior were found to be significant ($F(3,104) = 24.941$, $p < .01$) with an R^2 of .426 and an f^2 of .72. The combined contributions of performance expectancy, attitude towards usage of technology, and facilitating conditions to performance behavior were found to be significant ($F(3,104) = 25.109$, $p < .01$) with an R^2 of .427 and an f^2 of .75.

The combined contributions of the independent variables to performance behavior were examined by multiple regression analysis of four separate groupings of four-variable sets. All four sets were found to be significant contributors to performance behavior. The combined contributions of performance expectancy, effort expectancy,

attitude towards usage of technology, and social influence to performance behavior were found to be significant ($F(4,104) = 18.733$, $p < .01$) with an R^2 of .428 and an f^2 of .75. The combined contributions of performance expectancy, effort expectancy, attitude towards usage of technology, and facilitating conditions to performance behavior were found to be significant ($F(4,104) = 18.781$, $p < .01$) with an R^2 of .429 and an f^2 of .75. The combined contributions of performance expectancy, effort expectancy, attitude towards usage of technology, and social influence to performance behavior were found to be significant ($F(4,104) = 18.733$, $p < .01$) with an R^2 of .428 and an f^2 of .75. The combined contributions of effort expectancy, attitude towards usage of technology, social influence, and facilitating conditions to performance behavior were found to be significant ($F(4,104) = 16.421$, $p < .01$) with an R^2 of .396 and an f^2 of .66. The combined contributions of performance expectancy, attitude towards usage of technology, social influence, and facilitating conditions to performance behavior were found to be significant ($F(4,104) = 18.649$, $p < .01$) with an R^2 of .427 and an f^2 of .75. Multiple regression analysis of the contributions of all five factors (performance expectancy, effort expectancy, attitude towards usage of technology, social influence, and facilitating conditions) to performance behavior were examined and found to be significant ($F(5,104) = 14.885$, $p < .01$) with an R^2 of .429 and an f^2 of .75. The results of the multiple regression analyses indicate significant relationships exist between the independent factors of the UTAUT model and the dependent variable of behavior.

Therefore, the findings support Hypothesis One, align with the theoretical framework of the UTAUT, and are consistent with previous technology acceptance studies by Davis (1989), Davis et al. (1989), Taylor and Todd (1995), Venkatesh et al.

(2003), Moran (2006), and Cetron (2007) cited in Chapter Two. The next section presents findings relevant to Hypothesis Two.

Hypothesis Two

The purpose of Hypothesis Two was to identify the individual and combined contributions of gender, age, experience, and volition to performance behavior as measured by a technology-driven, summative performance evaluation in a mandatory technology-based learning environment. Multiple regression analysis tested Null Hypothesis Two, which stated there is no relationship among the independent variables of gender, age, experience and volition and the dependent variable of performance or summative behavior in a mandatory technology-based learning environment when the independent factors are considered singularly or in combination.

The Spearman Rho correlation coefficient was used to test Hypothesis Two. Multiple regression analysis was used to depict the direction and strength of the relationship between the moderating variables of age, gender, experience, and volition and the dependent variable performance behavior. The UTAUT model theorizes the moderating factors of age, gender, experience, and volition influence behavior. Behavior in the present study is measured by a technology-driven, summative performance evaluation administered within the mandatory technology-based learning environment. A Spearman Rho correlation was performed for each set of non-continuous variables to investigate whether these influences existed in the present study. The results of the Spearman Rho correlation are presented with interpretive discussion in the following paragraphs (Table 9).

Table 9

Correlation Matrix of Moderating Variables and Dependent Variable

Variable	Age	Gender	Experience	Volition	B
Age		-.20*	-.05*	.04	.24*
Gender	.20*		.07	-.16	.06
Experience	-.05	.07		.14	.04
Volition	.04	-.16	.14		.12
B	.24*	.06	.04	.12	

Note: B represents behavior

* p <.05 Correlation is significant at the 0.05 significance level (2-tailed).

The correlation between age and behavior was found to be significant (r = 24, p < .01). These findings indicate age contributed .06% of the variability in the performance behavior of participants in the mandatory, technology-based learning environment. Consequently, findings conform to the theoretical framework of the UTAUT model of Venkatesh et al. (2003) and are consistent with prior research conducted by Thompson et al. (1991), Moran (2006), Cetron (2007) and Thomas (2008). This finding indicates age has the greatest contribution to the variability of performance behavior within this study and is aligned with Cetron's study of technology acceptance of TPC in a university's voluntary technology-based learning environment. Cetron found that age significantly contributed to the variability in the performance behavior of students in a technology-based learning environment. This finding aligns with the constructs of the UTAUT model which posits age as a moderating variable which influences performance behavior (Venkatesh et al.).

There was no significant correlation found between gender and performance behavior (r = .06, p > .01). The absence of a significant correlation is not congruent with the UTAUT model (Venkatesh et al., 2003) and does not align with previous research (Cetron, 2007). Gibson and Harris (2008) offer a possible explanation for this finding in their study of the role of gender in performance behavior in a technology-based environment, noting that women and men differ in performance expectancy but not in performance behaviors.

There was no significant correlation found between experience and performance behavior (r = .04, p > .01). The absence of a significant correlation is consistent with the UTAUT model and aligns with previous research. Venkatesh et al. (2003) found the contribution of experience accounted for 10% of the variability in performance behavior. Relevant to the present study, Thomas (2008) found that experience had no effect on performance behavior because participants had no choice in the utilization of the technology.

There was no significant correlation found between volition and behavior (r = .04, p > .01). The absence of a significant correlation is consistent with Thomas's (2008) findings where volition does not significantly contribute to performance behavior in a mandatory-usage environment.

Multiple regression analysis was performed to identify the individual and combined contributions of the moderating variables (age, gender, experience and volition) to the performance behavior of participants in a mandatory technology-based learning environment. The results of this analysis are discussed in the following paragraphs.

Multiple regression analysis was performed to identify significant relationships between each moderating variable and the dependent variable. The contribution of age to performance behavior was found to be significant ($F(1,104) = 8.970$, $p < .01$) with an R^2 of .080 and an f^2 of .09. The contribution of gender to performance behavior was found not to be significant ($F(1,104) = .231$, $p > .01$) with an R^2 of .002 and an f^2 of 00. The contribution of experience to performance behavior was found not to be to be significant ($F(1,104) = .001$, $p > .01$) with an R^2 of .000 and an f^2 of .00. The contribution of volition to behavior was not found to be significant ($F(1,104) = .881$, $p > .01$) with an R^2 of .008 and an f^2 of .09.

Multiple regression analysis was performed to determine if significant relationships existed between sets of paired moderating variables and the dependent variable of performance behavior. The factors were paired in six separate paired combinations. The combined contributions of age and gender to performance behavior were found to be significant ($F(2,104) = 5.119$, $p < .01$) with an R^2 of .091 and an f^2 of .10. The combined contributions of gender and experience to performance behavior were not found to be significant ($F(2,104) = .116$, $p > .01$) with an R^2 of .002 and an f^2 of 0. The combined contributions of gender and volition to performance behavior were not found to be significant ($F(2,104) = .643$, $p > .01$) with an R^2 of .112 and an f^2 of .12. The combined contributions of age and experience to performance behavior were found to be significant ($F(2,104) = 4.443$, $p < .01$) with an R^2 of .080 and an f^2 of .09. The combined contributions of age and volition to performance behavior were found to be significant ($F(2,104) = 4.788$, $p < .01$) with an R^2 of .086 and an f^2 of .09. The combined contributions of previous computer experience and perceived volition to performance

behavior were found not to be significant ($F(2,104) = .450$, $p > .01$) with an R^2 of .009 and an f^2 of 0.

Multiple regression analyses of three-factor sets of moderating variables were performed to identify significant contributions to performance behavior. The combined contributions of age, gender, and experience to performance behavior were found to be significant ($F(3,104) = 3.380$, $p < .01$) with an R^2 of .091 and an f^2 of .10. The combined contributions of age, gender and experience to performance behavior were found to be significant ($F(3,104) = 3.734$, $p < .01$) with an R^2 of .100 and an f^2 of .11.

The combined contributions of gender, volition and experience to performance behavior were not found to be significant ($F(3,104) = .442$, $p > .01$) with an R^2 of .013 and an f^2 of .15. The combined contributions of age, experience and volition to performance behavior were found to be significant ($F(3,104) = 3.163$, $p < .01$) with an R^2 of .086 and an f^2 of .09.

Multiple regression analysis of the combined set of four moderating variables was performed. The combined contribution of age, gender, experience and volition to performance behavior was not found to be significant ($F(4,104) = 2.7820$, $p > .01$) with an R^2 of .100 and an f^2 of .11.

Multiple regression analysis of the moderating variables of age, gender, experience and volition was conducted and the findings are presented in the following paragraphs. The absence of a significant relationship between gender and performance behavior is not consistent with all previous UTAUT-based research, but is consistent with Gibson and Harris (2008) who found no difference between the performance behaviors of women and men. The absence of a significant relationship between experience and

performance behavior is not consistent with the UTAUT, which posits experience influences performance behavior. However, the finding is aligned with the finding of Thomas (2008) who found that experience did not influence performance behavior in a mandatory technology-based work environment. The absence of a significant relationship between volition and performance behavior is not congruent with the UTAUT, which posits volition will influence performance behavior in a technology-based learning environment. However, these results are in agreement with Thomas' finding that volition does not significantly contribute variability in performance behavior in a mandatory technology-based work environment. Either singularly or in combination with gender, experience and volition, the construct of age was found to significantly contribute to variability in performance behavior. Within this study, a positive relationship between age and performance behavior existed, i.e., older participants exhibited greater levels of performance behavior.

Therefore, the findings support Hypothesis Two and align with the theoretical framework of the UTAUT. The findings are also consistent with previous technology acceptance studies by Davis (1989), Davis et al. (1989), Taylor and Todd (1995), Venkatesh et al. (2003), Moran (2006), and Cetron (2007).

Summary

The research questions were investigated through the use of correlation and multiple regression analysis statistical processes. Research question one sought to identify the individual and combined contributions of performance expectancy, effort expectancy, attitude towards usage of technology, social influence, and facilitating

conditions to the performance behavior of participants in a mandatory technology-based learning environment. Research question two investigated the individual and combined contributions of age, gender, experience and volition to the performance behavior of the participants. Research questions one was restated as a hypothesis in Hypothesis One which posited a relationship among the constructs of the UTAUT when the independent factors were considered singularly or in combination relative to the dependent variable of behavior as measured by a performance assessment measure. The results of a Pearson correlation analysis indicated the findings of this study are consistent with previous research where the UTAUT constructs of performance expectancy, effort expectancy, attitude towards usage of technology, social influence and facilitating conditions were found to be significantly correlated with the determinant of performance behavior.

Consistent with previous research, the results of multiple regression analysis found that individually and in combination, the UTAUT factors of performance expectancy, effort expectancy, attitude towards usage of technology, social influence, and facilitating conditions are predictors of performance behavior of students in a mandatory technology-based learning environment. Attitude towards usage of technology had the greatest contribution to variability of performance behavior. Research question two was restated and presented in Hypothesis Two which posited a relationship among the variables of age, gender, experience, volition and behavior when the independent factors are considered singularly or in combination. Consistent with UTAUT, a Spearman Rho analysis found a significant correlation between age and performance behavior. The absence of significant correlations among the other variables was not consistent with technology acceptance research in voluntary settings; however, these findings are

pertinent to the present study of technology acceptance in a mandatory technology-based learning environment. The absence of significant relationships between the constructs of gender, experience, volition and performance behavior is consistent with findings from research of technology acceptance in a mandatory technology-based work environment (Thomas, 2008).

Consistent with the UTAUT model, multiple regression analysis found that age, when considered individually or in combination with gender, experience, and volition, was a significant contributor to performance behavior. When considered individually or in combination, the factors of gender, experience, and volition were not found to be significant contributors to behavior. This finding is inconsistent with previous technology acceptance research and suggests that in a mandatory technology-based learning environment, the influences of gender, experience, and volition on performance behavior are not significant. Further discussions of these findings are presented in Chapter Five.

CHAPTER V

DISCUSSION

Introduction

Chapter Five begins with a review of the study which summarizes the purpose, theoretical framework and research problem. The second section provides a summary of research procedures including a discussion of the research setting and sample population, instrumentation, and the research design. The second section concludes with a review of the research questions and associated hypotheses. Section three offers a discussion of the findings and their theoretical alignment with previous technology acceptance research. Section four provides conclusions drawn from the quantitative analysis. The fifth section provides interpretive discussion based on the study findings, presents possible implications for instructional designers and training administrators, and offers recommendations for additional research. The chapter concludes with a section summarizing the study.

Review of the Study

The purpose of the study was to investigate the technology acceptance of ADL in a mandatory technology-based learning environment through the framework of the UTAUT. UTAUT posits the primary constructs of performance expectancy, effort expectancy, attitude towards usage of technology, social influence, and facilitating

conditions influence, in varying degrees, a person's behavior associated with technology acceptance. Venkatesh et al. (2003) also identified gender, age, experience and voluntariness of use (volition) as moderating variables that may influence technology acceptance behaviors. The UTAUT model has served as the framework for previous studies investigating the technology acceptance of students voluntarily participating in technology-based learning activities. Moran (2006) in a study of student acceptance of TPC confirmed the ability of UTAUT to determine technology acceptance in a volitional setting. The present study applied the UTAUT model to a mandatory technology-based learning environment. The setting for the study was a mandatory, technology-based learning environment in which the students were not voluntary participants. The research problem for the present study is centered on the implementation of mandatory technology-based learning programs, a setting where little is known about the influences of technology acceptance factors on the behavior of non-voluntary participants (Brown et al., 2002). The possible effect that mandatory participation may have on students is an important consideration for instructional designers and training administrators seeking to create effective instructional programs. The findings of this study may offer insight into the factors contributing to technology acceptance in a mandatory technology-based learning environment.

Summary of Research Procedures

The setting for this study was a mandatory, technology-based learning program. The participants of this study were a class of 105 military students who were taking the course as a requirement of their military duties. The commander of the training

organization delivering the mandatory technology-based learning program authorized the research study and provided access to the students. All participants completed an informed consent statement and online survey instrument hosted by the LMS supporting the technology-based learning program.

The instrument was a twenty-five item Likert-scale survey based on the UTAUT and gathered quantitative data regarding the performance expectancy, effort expectancy, attitude towards usage of technology, social influence, and facilitating conditions of the participants. Demographic data concerning age, gender, prior experience in a technology-based learning environment, and perceived volition was also obtained. The instrument has been validated in previous research studies investigating technology acceptance. These data supported the independent variables of the study and were entered into SPSS for analysis. The dependent variable of participant behavior was measured by a technology-driven, summative performance evaluation in the mandatory technology-based learning environment. Data were entered into SPSS for analysis. An ex post facto correlation research design was utilized to operationalize the UTAUT constructs of performance expectancy, effort expectancy, attitude towards usage of technology, social influence, and facilitating conditions. Performance expectancy, effort expectancy, attitude towards usage of technology, social influence, and facilitating conditions are the independent variables identified by the UTAUT. Performance behavior, the dependent variable, was measured by a technology-driven, summative performance assessment instrument administered within the mandatory technology-based learning environment. Using the UTAUT constructs, the research design specifically addressed two research questions. The research questions are

1. What are the individual and combined contributions of performance expectancy, effort expectancy, attitude towards usage of technology, social influence, and facilitating conditions to the performance behavior of students in a mandatory technology-based learning environment?
2. What are the individual and combined contributions of gender, age, experience, and volition to the performance behavior of students in a mandatory technology-based learning environment?

The relationships between the UTAUT-based independent variables and the dependent variable of behavior were investigated through the framework of the research questions. The research questions were restated as empirically-testable statements about a relationship involving two or more of the variables and presented in the form of null hypotheses. The following hypotheses provided the guiding framework and aligned the statistical procedures with the research questions.

H_1: There is a relationship among the independent variables of performance expectancy, effort expectancy, attitude towards usage of technology, social influence, and facilitating conditions and the dependent variable of performance behavior in a mandatory technology-based learning environment when the independent factors are considered singularly or in combination.

H_{01}: There is no relationship among the independent variables of performance expectancy, effort expectancy, attitude towards usage of technology, social influence, and facilitating conditions and the dependent variable of performance behavior in a mandatory technology-based learning

environment when the independent factors are considered singularly or in combination.

H_2: There is a relationship among the independent variables of gender, age, experience, and volition and the dependent variable of performance behavior in a mandatory technology-based learning environment when the independent factors are considered singularly or in combination.

H_{02}: There is no relationship among the independent variables of gender, age, experience, and volition and the dependent variable of performance behavior in a mandatory technology-based learning environment when the independent factors are considered singularly or in combination.

A summary and interpretive discussion of the findings of the statistical analyses of data relevant to the research questions and associated research hypotheses is presented in the next section. A discussion of the findings and their alignment with the theoretical base is provided.

Summary of Findings

Research Hypothesis One was investigated using multiple regression analysis and was supported by positive correlations between the independent variables of performance expectancy, effort expectancy, attitude towards usage of technology, social influence, and facilitating conditions and the dependent variable of performance behavior as measured by a summative technology-driven performance evaluation. Analyses indicated the individual and combined contributions of performance expectancy, effort expectancy, attitude towards usage of technology, social influence and facilitating conditions

contributed to the performance behavior of students participating in a mandatory technology-based learning program. The independent factor of attitude towards usage of technology was identified in the analyses as the single UTAUT construct with the highest contribution (.41%) to the variability of performance behavior. This finding supports Hypothesis One and is consistent with Moran's (2006) finding that attitude towards usage of technology accounted for 47% of the variability of performance behavior in a technology-based learning environment. This finding is aligned with Ajzen's (1985) research study of the influences of attitude on behavior which found an individual's attitude towards a behavior significantly contributed to the performance of a behavior. In the present study, the independent variables which had the greatest influence on performance behavior were attitude towards usage of technology, performance expectancy, effort expectancy, and social influence. These findings align with previous studies cited in Chapter Two by Davis (1989), Davis, et al. (1989), Taylor and Todd (1995), Venkatesh and Davis (2000), Moran (2006), and Cetron (2007).

The two strongest influences on performance behavior, attitude towards usage of technology and performance expectancy, are consistent with the findings by Thomas (2008), which used the UTAUT to examine factors in a mandatory, technology-based setting within a government organization. These findings illustrate that any positive increases in participant attitudes towards using technology and performance expectancy will also provide improved performance behavior. This finding will be useful for instructional designers and training administrators in both military and private-sector settings desiring to increase the performance of participants in mandatory, technology-based learning environments. The interpretations of this finding provides some evidence

in support of the constructs of the UTAUT as an important consideration of instructional designers, instructors and other stakeholders involved in the creation and implementation of technology-based learning programs.

Research Hypothesis Two was investigated using multiple regression analysis. The findings supported the hypothesis that when considered individually and in combination, the moderating variables of age, gender, experience and volition contributed to the performance behavior of students participating in a mandatory, technology-based learning environment. Age was identified as the moderating variable having the greatest contribution (.06%) to the variability of performance behavior. All combinations of the moderating variables in which age was included were found to be significant contributors to the variability of performance behavior, while combinations excluding age as a factor were not significant contributors to variability of performance behavior.

Hypothesis Two is partially supported by the finding that age significantly contributes to performance behavior, while gender, experience and volition were not found to significantly contribute to performance behavior. This finding partially corroborates the UTAUT Model and is not supportive of previous research (Venkatesh et al., 2003) in voluntary technology-based environments where gender, experience, and volition also contributed to performance behavior. Pertinent to the present study of technology acceptance in a mandatory technology-based learning environment, the absence of significant relationships between the constructs of gender, experience, volition, and performance behavior is consistent with findings from research of technology acceptance in a mandatory technology-based work environment (Thomas, 2008). The finding that participant age is positively related to performance behavior in

the sample population of military students presents an area in which further analysis is necessary to examine the differences between the generational age groupings of students in mandatory, technology-based learning environments. This finding does indicate that student age may be a consideration for instructional designers and training administrators within mandatory environments such as military training environments.

Conclusion

Based on the quantitative analysis described in Chapter Four, the following conclusion may be drawn from the findings presented. Based on the findings of Hypothesis One, as tested by Pearson correlation and multiple linear regression analysis, the independent variable attitude towards usage of technology exerted a positive influence on the performance behavior of participants in the mandatory technology-based learning environment. Based on this finding, the conclusion that a participant's attitude will influence their performance behavior may be drawn. The findings suggest that students with a positive attitude towards usage of technology will display higher levels of performance behavior.

Based on the findings of Hypothesis Two, as tested by Spearman Rho and multiple regression analysis, a positive relationship exists between participant age and performance behavior. In the present study, older participants displayed higher performance behaviors. Based on this finding, the conclusion that a participant's age will influence their performance behavior may be drawn. The next section provides a discussion of the findings of the study and offers recommendations for future research of technology acceptance in mandatory technology-based learning environments.

Discussion

As discussed in Chapter Two, higher education institutions, government agencies, private corporations, and military training organizations are increasingly turning to technology-based learning environments to meet the training and education needs of their student population or workforce members. The findings of the present study are aligned with the theory base presented in the literature review and support Venkatesh et al. (2003) in positing the UTAUT model is useful in predicting performance behaviors in mandatory technology-based learning environments. In the present study, attitude towards usage of technology was found to be a predictor of performance behavior. This finding is consistent with Fishbein and Ajzen (1975) who explained that attitudes are formed by the beliefs people hold about an object. The implications are that within a mandatory usage environment, a participant's attitude towards usage of technology will directly influence their performance behavior. This finding is consistent with Carswell and Venkatesh (2002) who reported technology-based learning will be positively influenced by attitude towards usage of technology. The finding that age is a predictor of performance behavior in a mandatory technology-based learning environment corroborates Thomas' (2008) finding that as age increases so does performance behavior. This positive relationship between age and performance behavior in technology based learning environments contrasts with Morris and Venkatesh (2008) who found that younger workers, when compared to older workers, had more favorable attitudes toward using a technology.

In the future, college students may be limited to technology-based learning options because of resource limitations or limited availability of other options within the college

or university. Military training organizations are mandated by the ADLI to implement technology-based learning environments which, by their military nature, are mandatory training programs that military students must successfully complete. Future research might gather more data concerning the factors shaping attitude towards usage of technology in a mandatory setting. A future technology acceptance research study using a non-equivalent group design may offer greater insight into these factors. A two-group design using comparable military training programs where one group is voluntarily participating in technology-based learning and the other is participating in a mandatory technology-based learning environment would aid in understanding how volition influences attitude towards usage of technology and subsequent performance behavior.

Instructional designers and training administrators would be able to incorporate this knowledge into the instructional systems design of future technology-based learning environments. Instructional designers and training administrators could use this knowledge during the analysis and development phases of instructional design to determine the appropriate level of interactivity within the technology-based content that would engage and positively influence learner attitudes towards technology-based training. Stakeholders could also benefit from understanding the dimensions shaping attitude when deciding on the best delivery methods for instructional content, such as choosing to implement either synchronous or asynchronous computer-mediated learning. A final opportunity for future research is centered on the age-related finding of the present study. The finding that older participants had higher levels of performance behavior offers the opportunity to investigate the role of age within the military population regarding technology acceptance and performance. One possible explanation

is that older participants had a better understanding of military training in general and were able to perform better than younger participants who had less time in the military

Summary

Based on the established theories of technology acceptance and the UTAUT model, the present study represents an addition to the general knowledge of the field of instructional technology with insight into the factors influencing performance behavior within a mandatory technology-based learning environment. The study was conducted within an Air Force training organization in the southeastern United States that administers a mandatory technology-based learning program within the framework of the ADLI. An ex post facto correlation research design examined the factors of technology acceptance in a convenience sample of 105 military students. An instrument based on the constructs of the UTAUT model gathered data pertaining to the independent and moderating variables. A summative, performance-based assessment instrument provided data for the dependent variable. Pearson correlation, Spearman Rho, and multiple regression analysis found that attitude towards usage of technology contributed the most to the variability in the performance behavior of participants. Additionally, a participant's age was found to be a predictor of performance behavior in a mandatory technology-based learning environment. These findings may prove useful to instructional designers and other stakeholders within a training organization during the instructional design process of technology-based learning content. The findings of the present study offer future research opportunities investigating the factors shaping attitude towards usage of technology and the body of knowledge available to instructional technologists. Research

of age-related factors and their influences on performance behavior in a mandatory technology-based learning environment may also provide instructional technologists further insights into the factors influencing technology acceptance.

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APPENDIXES

Appendix A

Permission Request Letter

DEPARTMENT OF THE AIR FORCE
505th TRAINING SQUADRON (ACC) HURLBURT FIELD, FLORIDA 32544

17 JUL 09

MEMORANDUM FOR THE UNIVERSITY OF WEST FLORIDA
OFFICE OF RESEARCH INTEGRITY / INSTITUTIONAL REVIEW BOARD
ATTN: Ms. Cheryl Allen
Phone 850-857 6378 Fax 850 474-2083

FROM: 505lh Training Squadron
Hurlburt Field FL, 32544

SUBJECT: Kyle Hurst Institutional Review Board Application

The 505th Training Squadron has approved Mr. Hurst's proposed research study "Technology Acceptance in Mandatory Technology-based Learning Programs." The 505th Training Squadron authorizes Mr. Hurst, as the principle investigator, permission to gather data from participants of 505th Training Squadron courses and use data collected as part of the research project and any future studies or publications.

CLINTON C. REDDIG, Capt, USAF

Chief, Standards and Evaluations Flight

Appendix B

Institutional Review Board Approval Letter

University of West Florida

Research and Sponsored Programs
11000 University Parkway, Bldg. 11
Pensacola, FL 32514-5750

Mr. Kyle Hurst
2233 Ortega St.
Navarre, FL 32566

August 07, 2009

The Institutional Review Board (IRB) for Human Research Participants Protection has completed its review of your proposal titled "Technology Acceptance in a Mandatory Technology Based Learning Program," as it relates to the protection of human participants used in research, and granted approval for you to proceed with your study on 08-07-2009. As a research investigator, please be aware of the following:

* You will immediately report to the IRB any injuries or other unanticipated problems involving risks to human participants.
* You acknowledge and accept your responsibility for protecting the rights and welfare of human research participants and for complying with all parts of 45 CFR Part 46, the UWF IRB Policy and Procedures, and the decisions of the IRB. You may view these documents on the Research and Sponsored Programs web page at http://www.research.uwf.edu. You acknowledge completion of the IRB ethical training requirements for researchers as attested in the IRB application.
* You will ensure that legally effective informed consent is obtained and documented. If written consent is required, the consent form must be signed by the participant or the participant's legally authorized representative. A copy is to be given to the person signing the form and a copy kept for your file.
* You will promptly report any proposed changes in previously approved human participant research activities to Research and Sponsored Programs. The proposed changes will not be initiated without IRB review and approval, except where necessary to eliminate apparent immediate hazards to the participants.
* You are responsible for reporting progress of approved research to Research and Sponsored Programs at the end of the project period 12-31-2009. If the data phase of your project continues beyond the approved end date, you must receive an extension approval from the IRB.

Good luck in your research endeavors. If you have any questions or need assistance, please contact Research and Sponsored Programs at 850-857-6378 or jrb@uwf.edu.

Sincerely,

Dr. Richard S. Podemski, Associate
Vice President for Research and
Dean of Graduate Studies

Dr. Terry Prewitt, Chair
IRB for the Protection of Human
Research Participants

CC: Karen Rasmussen

Appendix C

UTAUT Instrument

(Reproduced as Used)

505th Training Squadron

Advanced Distributed Learning Survey

Introduction

Thank you for agreeing to participate in this survey. As part of the 505th Training Squadron' s efforts to provide quality education and training to AOC Warriors, the 505th Training Squadron Graduate Evaluations Program is conducting a study about the effectiveness of the Advanced Distributed Learning program.

When the survey is complete, the 505th will analyze the data and share only the summarized information with the Air Operations Center functional community to help enhance our training programs. The 505th will keep your identity and individual responses confidential.

The survey asks your opinions about the Advanced Distributed Learning program you are undertaking as a prerequisite to attending in-residence formal training at the 505th Training Squadron. There are no correct or incorrect responses. This survey should take no more than five minutes to complete.

Your participation in this study is voluntary, not required, and your refusal to participate will not adversely affect you in any way (other than your opinion will not be counted). In addition, you may withdraw from this study at any time; although once you participate your contribution cannot be taken back. Participation in this study does not require you to reveal any personal information, aside from some demographics about things such as your education.

This survey should take no more than five minutes to complete. If you have any questions please contact the 505th TRS at XXXXXXXXXX.		
Response	**Item**	Part I Demographic Information Instructions: For Part I, please type your response in the Response Column.
		Age
		Education: enter the number corresponding to your education level“1” =. HS “2” = Some college “3” = Associates “4” =Bachelors “5” = Masters / Graduate
Part II: The Survey		
Instructions: Please read each statement carefully. In the space provided, write the number representing the response that best expresses your view about the statement using the following scale: 1 – Strongly Disagree, 2 – Disagree, 3 – Slightly Disagree, 4 – Neutral, 5 – Slightly Agree, 6 – Agree, 7 – Strongly Agree		
	ADL will enable me to learn more quickly than in a traditional classroom.	
	ADL will make it easier to learn than in a traditional classroom	
	ADL will hamper the quality of my learning	
	ADL will increase my chances of doing well in the course	
	Learning to operate the ADL technology is easy for me	
	I find the ADL system easy to use	
	ADL will take too much time from my normal duties	

	Using the ADL system is complicated and difficult to understand
	ADL is a good idea
	Using the ADL system is pleasant
	Using the ADL system is fun
	I like learning with the ADL system
	To the extent possible, I would use ADL for other learning activities
	Whenever possible, I intend to use ADL as a method of learning
	People who influence my behavior think I should ADL
	My supervisor is very supportive of the use of ADL for my class
	In general, my organization has supported the use of the ADL system
	I perceive using ADL as involuntary
	In general, my organization supports my ADL participation
	I have the resources necessary to use the ADL system
	I have the knowledge necessary to use the ADL system
	The ADL system is not compatible with other computer systems I use
	Using the ADL system fits into my normal duty-day work style
	I could complete an ADL lesson if there was no one around to tell me what to do
	I could complete an ADL lesson if I could call someone to help if needed
THANK YOU	