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Factors Leading To The Integration Of Technology, Acceptance Of Technology And Training Development

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Acceptance of Technology and

Training Development

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Dedication

To my daughter, Jade,

Upon dedicating this work to you, it is my hope that its completion serves as a reminder that all things are possible through faith and determination. And, that regardless of the magnitude of setbacks and limitations, there remains only ONE power that helps guide us to our destination and make our hopes and dreams realities by putting others in our path. It is up to all individuals to seek that glorious source of strength, determination, and wisdom during times that challenge our character, our hearts…the very essence of our spirit. Bearing this in mind…remember, that no barrier is too great to overcome.

Biographical Sketch

Hilda L. Graham, who was born in Norfolk, Virginia, graduated with a Bachelor of Science degree in accounting from Greensboro College in 1996. She is a student studying Technology Education at North Carolina A&T State University.

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List of Symbols and Abbreviations

AECT	=	the Association for Educational Communication and Technology
AIC	=	Akaike's Information Criterion
ANOVA	=	analysis of variance
BLS	=	Bureau of Labor Statistics
C-TAM-TPB	=	combined TAM and TPB (theory of Planned Behavior)
CAI	=	computer assisted instruction
dx	=	dependent variable 1, 2,…etc.
DOL	=	Department of Labor
ETA	=	Employment and Training Administration
ETR	=	educational technology resource
H_0	=	null hypothesis
H_A	=	alternative hypothesis
IDT	=	Innovation Diffusion Theory
IDT_2	=	instructional design and technology
ISTE	=	International Society for Technology Education
IT	=	information technology
LISREL	=	linear structural relations
MPCU	=	Model of PC Utilization
MTMM	=	Multi-trait-multi-method analysis
N	=	population
n	=	sample
NBPTS	=	National Board of Professional Teaching Standards

NCLB	=	No Child Left Behind Act
NRC	=	National Research Council
p	=	probability of degree of statistical significance
PT3	=	Preparing Tomorrow's Teachers to Use Technology
r	=	Pearson's product moment correlation
SBTC	=	skill biased technological change theory
SCT	=	Social Cognitive Theory
SEM	=	structural equation modeling
SD	=	standard deviation
TAM	=	Technology Acceptance Model
tAVM	=	the audiovisual movement
Tech-TA	=	technology training assistant
TPB	=	Theory of Planned Behavior
TRA	=	Theory of Reasoned Action
tVIM	=	the visual instruction movement
UTAUT	=	Unified Theory of Acceptance and Use of Technology

Abstract

Advancements in technology have led to changes in various aspects of living. Methods by which business is conducted and job re-structuring have been impacted globally. With concerns of raising productivity, the integration of technology, which has undergone growing popularity in education, government and industry, is positioned at the forefront of strategic planning. According to assertions by Iansiti (1998) and Handel (2003), some leaders who have supported technology integration have gained substantial growth in productivity and business. However, findings of prior research have revealed that companies have been slow to use technology. The process of supporting further integration starts with assessing perceptions about the acceptance of technology from an individual perspective, specifically, the perspective of workforce employees. Where Fred Davis (1986), researcher on attitude assessment of technology acceptance, developed the technology acceptance model (TAM), other researchers have developed adaptations to TAM with the objective of determining factors that drive productivity and system usage. In order to assess perceptions about technology integration within the workforce and reveal if differences in attitudes exist between different employee levels, two surveys were designed and utilized to reveal perceptions between two survey groups, non-managers and managers. Based upon findings generated from the rated responses to item statements, which were designed to ascertain eleven possible correlations between eight independent variables, several were found to have low to moderate significant relationships. Additionally, findings of a t-test also revealed that the differences in attitudes regarding the acceptance of technology between managers and non-mangers were not significant.

CHAPTER 1

Introduction

Technological advancements, which have served as the catalyst behind globalization and an unstable economy, reflect dynamics that have impacted U.S. productivity, and ultimately, the workforce. Unlike the economic prosperity gained from the second Industrial Revolution, the U.S. has been painfully aware of such a reality as jobs are out-sourced, corporations call for massive layoffs, imports increase, and technology changes rapidly. Such occurrences create a complex and volatile environment for industry and; therefore, establish an immediate need for long term solutions that will help stabilize the economy and re-gain a momentum at meeting increased productivity levels that will help strengthen the position in the global market. According to Noe's (2005) assertion, these conditions are further necessitated by a need for training to produce *intellectual capital*. One aspect that may prove to benefit industry is emphasizing technology integration, which based upon Iansiti's (1998) assertion, can affect performance, future product costs, speed and efficiency at which products are developed, and overall competition. Although technology integration appears to produce favorable results, Iansiti (1998) cited three contingencies that help establish effective integration: 1) deciding what to do, 2) choosing the best available technology to use; and 3) seeking approaches to establishing and maintaining training and development, which those like Segars and Grover (1993) and the Department of Labor (DOL) (2008) associate with performance and productivity. Employee training and development is a concern of industry and the federal government (DOL, 2008). According to the 1997 *Industry Report*, *Training*, researchers estimated that approximately $59 billion dollars for training was budgeted by U.S. organizations with a minimum of 100 employees. The report also revealed reasons for training, which included skills or knowledge that were not acquired from prior education, new skill sets that were needed for new positions, and dynamics in workforce as a result of technological advancements. Like the federal government and industry, decision-makers of education have an agenda which serves to support technology integration through its policies and programs. This support of technology, which is not confined to instruction, stems from the reality of recognizing the advantages it (technology) offers…speed, greater efficiency, and accessibility to large groups. Although these advantages exist, studies, e.g. the University of Colorado-Boulder's research on methods to implement technology for instruction (Otero, Peressini, Meymaris, Ford, Garvin, Harlow et al., 2005), have helped to reveal that the effectiveness of its use, in part, is contingent on user perceptions. Additionally, society (industry, workforce) depends on the government to respond to its concerns regarding technology integration. Special committees, recommendations, policies, and grant programs serve as venues and tools needed to shape envisioned ideas and establish education reform and skill development efforts. But, such strides do not go without challenges educators and learners face in the process of adapting to such efforts to teach and learn new skills. Where industry decision-makers are responsible for deciding to integrate technology, society, specifically workforce employees, bears a responsibility towards accepting its use.

An assessment of society's perception regarding industry's usage of technology is another consideration. This acceptance, which based upon Money and Turner's (2004) and Davis' (1986) model concepts on attitude assessment, is evidenced by the productivity outcomes and extent of system usage. Depending on the type of technology utilized, some systems can be complex. Findings in Davis' (1986) research suggested that the extent to which technology is used and technology's ease of use are factors that determine perceptions relating to acceptance or lack of acceptance. These perceptions become the constructs of attitudes (Money & Turner, 2004).

Where the degree of system usage serves as the indication of acceptance in TAM, *effectiveness* (Segars & Grover, 1993) is evidenced by productivity levels in an industry work environment. Upon assessing attitudes relating to the acceptance of technology integration, strategies or approaches, including training, can be designed and implemented to increase productivity and efficiency to help improve the U.S. economy. Technology integration, when utilized effectively, reflects a level of acceptance by those in a society who choose to apply it to achieve positive outcomes. Reiser (2003) asserts that contrary to some misconceptions, it does not solely relate to computer use, but instead, refers to how new developments are utilized to help organizations achieve better outcomes through the process of designing, developing, implementing, managing, and evaluating.

1.1 Rationale

In order to develop effective technology training, it is important to understand the variables involved with the acceptance of technology. The researcher investigated perceptions relating to the acceptance of technology amongst workforce employees consisting of non-managers and managers. Where prior research has revealed that various factors influence the acceptance of technology use on the job, instruments have been designed to assess attitudes and perceptions of technology acceptance. This study continues that work by trying to adapt it for use in two surveys. One may ask certain questions, “What benefits can be gained as a result of increasing technology use in industry?” “Is there a significant difference between the perceptions of managers and non- managers?” and “Do employee skill levels present a significant and direct relation to a positive perception of technology integration?” Where all of these questions are valid, the best approach to answering them is to conduct a workforce survey assessing employees’ perceptions about the extent of use, ease of use, and training in relation to their jobs.

1.2 Research Questions

This study addressed five research questions:

1. Will employee perception of ease of use of technology have a positive correlation with their acceptance of technology?
2. Will employee level of training exhibit a positive correlation to the worker's perception of usefulness?
3. Will employee level of training exhibit a positive correlation to the worker's perception of ease of use?
4. Is there a relationship between amount of use and ease of use?
5. Will employee's perception of ease of use of technology reveal a greater acceptance of technology amongst managers than the acceptance of technology amongst non-managers?

1.3 Hypotheses

H_{01} There will be no correlation between ease of use of technology and productivity.

H_{A1} There will be a positive correlation between ease of use of technology and productivity.

H_{02} There will be no correlation between amount of use of technology and acceptance of technology.

H_{A2} There will be a positive correlation between amount of use of technology and acceptance of technology.

H_{03} There will be no correlation between the employee's perception of ease of use of technology and amount use of technology.

H_{A3} There will be a positive correlation between the employee's perception of ease of use of technology and amount of use of technology.

H_{04} There will be no correlation between employee level of training and the worker's perception of ease of use of technology.

H_{A4} There will be a positive correlation between employee level of skill and the employee's perception of ease of use of technology.

H_{05} There will be no correlation between employee level of skill and productivity.

H_{A5} There will be a positive correlation between employee level of skill and productivity.

H_{06} There will be no correlation between employee training and usefulness.

H_{A6} There will be a positive correlation between employee level of training and usefulness.

H_{A6} There will be no correlation between employee training and usefulness.

H_{07} There will be no correlation between employee training and productivity.

H_{A7} There will be a positive correlation between employee training and productivity.

H_{08} There will be no correlation between employee training and ease of use.

H_{A8} There will be a positive correlation between employee training and ease of use.

H_{09} There will be no correlation between ease of use of technology and acceptance of technology.

H_{A9} There will be a positive correlation between ease of use of technology and acceptance of technology.

H_{010} There will no correlation between ease of use of technology and usefulness of technology.

H_{A10} There will be a positive correlation between ease of use of technology and usefulness of technology.

H_{011} There will be no correlation between employee level of education and ease of use of technology.

H_{A11} There will be a positive correlation between employee level of education and ease of use of technology.

H_{012} There will be no significant difference in the attitudes of managers and non-managers regarding the acceptance of technology use.

H_{A12} There will be a significant difference in the attitudes of managers and non-managers regarding the acceptance of technology use with managers being more accepting of technology integration than non-managers.

1.4 Assumption

The following assumption was made about this research study and the circumstances surrounding it:

Participants (respondents) will answer survey questions honestly.

1.5 Limitations

The research study was conducted under the following limitations:

1. The samples for this study were samples of convenience.
2. The researcher could not gain access to a company of substantial size.

1.6 Delimitation

The following delimitation was necessary to control the cost and length of time for the study:

The timeline for this study was delimited to one semester.

1.7 Definitions of Terms

computer assisted instruction (CAI) – a technology based instruction, which was developed by IBM during the 1950s, that led to others to recognize the potential of using computers for instruction (Reiser, 2001).

Combined TAM and TPB (C-TAM-TPB) – a model combining the constructs of (Theory of Reasoned Action)TRA, (Theory of Planned Behavior)TPB, and TAM's perceived usefulness, which is one of the eight-model theories utilized in developing Venkatesh et al.'s (2003) Unified Theory of Acceptance and Use of Technology (UTAUT).

construct – a concept, form, or schematic idea used in such a way to bring parts together, e.g. Fred Davis' (1989) theoretical constructs, perception of *ease of use* and perception of *usage* of computer systems, which form the basis of attitudes and, thereby, establishes the foundation of the Technology Acceptance Model (TAM).

effectiveness – Segars and Grover's (1993) third construct of attitudes relating to technology acceptance where job performance and productivity are the main determinants utilized to measure the extent of acceptance.

human factor – a consideration for an approach to training utilizing a combination of instructional and non-instructional means in order to obtain enhanced performance (Reiser, 2001).

IDT_2 – Instructional design and technology is a field Reiser (2001) describes as involving the analysis of learning and performance problems, the design, development, implementation, evaluation and management of instructional and non-instructional processes and resources with the goal of improving learning and performance in various environments.

Information technology (IT) – a characteristic Handel (2003) uses to describe industries that invest in or utilize capital equipment that makes extensive use of microelectronics and software.

Innovation Diffusion Theory (IDT) – a sociological theory initially studying the acceptance of a wide range of innovations and, later, from identifying the characteristics of innovations that drive acceptance, adapt the characteristics to information systems; thereby, refining constructs to study individual technology acceptance. This was one of eight model-theories to which Venkatesh et al. (2003) referred in the UTAUT study.

Model of PC Utilization (MPCU) – a model, which Thompson, Higgins, and Howell (1991) derived from Triandis' theory of human behavior, analyzing the prediction of personal computer (PC) usage behavior, and; thereby, adapting it to information systems' contexts in order to refine constructs that drive such behavior. Of the UTAUT model, Venkatesh et al. (2003) emphasized analyzing the effect of determinants on intent.

Motivational Model (MM) – A theory of human motivation developed to explain behavior and adapted for certain contexts and one of eight model theories considered in developing Venkatesh et al.'s (2003) UTAUT model. According to Davis et al. (1989), extrinsic/ intrinsic motivations are the main constructs of MM.

productivity – a term defined by the Bureau of Labor Statistics (BLS) (2008) describing a measure of economic efficiency which, shows how effectively economic inputs, e.g. labor, are converted to outputs, e.g. goods and services.

resource(s) – a term Iansiti (1998) defines as a highly skilled employee of a production environment.

Skill biased technological change theory (SBTC) – defined by Handel (2003) as a theory, which emerged from research findings of the Panel of Technology and Employment during the early 1980s, based upon the suggestion that IT developments increased the demand for skills and caused the increase in U.S. earnings differentials.

Social Cognitive Theory (SCT) – a human behavior theory developed by Bandura (2001), where environmental factors operate through self –thought in order to produce certain outcomes. SCT was one of eight model-theories where an assessment of its predictive validity in relation to intent and usage was analyzed upon developing and researching the UTAUT (Venkatesh et al., 2003) model.

Technology Acceptance Model (TAM) – a theoretical approach constructed by Davis (1986) utilized to measure attitudes that reflect acceptance of various computer technologies. Perception of usefulness and ease of use are the two main components that are constructs of acceptance (Davis & Bagozzi, 1989).

technology integration – defined by Iansiti (1998) as the ability to create and use various ideas in order to make a product that reflects business sense.

Theory of Planned Behavior (TPB) – a behavioral theory developed by Ajzen (1991) and an extension of Ajzen and Fishbein's Theory of Reasoned Action (1975), which states that perceptions about ability (behavioral control) and intent can be directly used to predict behavioral achievement. Ajzen (1991) ascertained that the central factor of TPB and Theory of Reasoned Action lies in a person's *intent* to perform a certain action. This was one of eight model-theories considered in Venkatesh et al.'s (2003) UTAUT model.

Theory of Reasoned Action (TRA) – behavioral theory developed in 1975 by Ajzen and Fishbein (Ajzen, 1991), which was used to predict human behaviors by determining intent, which related to trying, instead of actual performance. With an objective of ascertaining behaviors indicating the acceptance of technology, TRA was applied to certain studies e.g.

Davis' (1989) TAM and Venkatesh et al.'s (2003) UTAUT.

Unified Theory of Acceptance and Use of Technology (UTAUT) – hypothesized theory developed by Venkatesh et al. (2003) reflecting the analysis and integration of eight prior mode-theories (*TRA*, *TAM*, *MM*, *TPB*, *C-TAM-TPB*, *MPCU*, *IDT*, *SCT*) by distinguishing between voluntary vs. mandatory system usage, timing of use, and user experience in order to determine factors defining technology acceptance.

CHAPTER 2

Literature Review

2.1 Introduction

Forces, such as globalization and technological advancements, which the Department of Labor (DOL) (2008) cited former President Bush and other key decision-makers as having recognized, have led to major changes within the U.S. economy. In the DOL's 2008 report, *Employment and Training Administration Outlines FY 2009 Budget*, the president presented a compelling case by describing the state of the economy and workforce. The DOL's report emphasized the nation's need to invest in efforts supporting increased technology integration in higher education, industry, and training and development. In addition to the DOL's report, the Bureau of Labor Statistics' (BLS) 2008 report, *Productivity and Costs*, was pivotal in associating productivity with efficiency. This association, which aided in relating skill development and training to increased efficiency, was critical in helping to bridge technological advancement and integration to workforce development, productivity, and efficiency. However, in spite of the government's positive efforts spent supporting technological, economic, skill, and educational development, prior research of Reiser (2001), Handel (2003), and Otero, et al. (2005) has revealed some resistance by society to integrate technology, which has been linked to economic and workforce development (DOL, 2008; Handel, 2003; Iansiti, 1998; and Minch & Tabor, 2003).

Reiser's (2002) detailed account describing the origins of instructional design and technology (IDT_2) and the implications of its effects on training in "A History of Instructional Design and Technology: Part I, A History of Instructional Media" mapped a trend leading to the field's emergence from the initial development of the military's use of film media for training to public education’s use for instruction. His historical account helped set the stage for showing the educational community’s enthusiasm about integrating innovations, specifically, media developments, and how those new developments sparked movements for vision and audio. More importantly, the historical details illustrated by Reiser (2002) showed how such technological developments led education’s key decision-makers to consider the quality of learning. Although the use of film media did not remain as the training and learning approach of choice, Reiser (2002) provided a methodical approach to showing how events and developments led to IDT_2 and education’s attempt to accept technology by integrating it and envisioning the possibilities to achieve greater training and learning outcomes. Handel’s (2003) research and his final report, *Implications of Information Technology for Employment, Skills, and Wages: A Review of Recent Research*, served as a source to establish the correlation between technological innovations, job productivity and loss, and workers’ attitudes regarding technology integration. His submission of data helped to illustrate the duplicitous nature of technology, workforce and industry. Business executives, for example, associated increased efficiency and higher growth with technology, yet they realized that such changes would require a highly skilled worker that would result in greater costs. Additionally, a combination of polls conducted during the 1980s revealed that a segment of the worker population recognized how the use of computers would lead to more consumer goods, while the same results indicated their concerns about potential job loss. Government data compiled between 1926 and 1927 revealed gains in productivity and declining unemployment in certain manufacturing sectors. During that time, mechanical automation was implemented at a fast pace. Handel’s (2003) compilation of data suggested that technology affected jobs, industry, and workforce attitudes. A combined perception, positive and negative, about technology integration existed during the 1980s. Industry productivity levels increased, job structures changed, and a demand for new technology skills outpaced the demand for traditional skills in the job market.

A study related to instructional technology at the college level also lends insight to the integration and acceptance phenomena. Otero et al.'s (2005) research, "Integrating Technology into Teacher Education: A Critical Framework for Implementing Reform," focused on the University of Boulder-Colorado's research team that developed a framework to promote technology integration within a university department. Otero et al.'s (2005) work revealed a number of issues about technology integration: 1) understanding the extent to which to use technology, 2) indentifying various ways to apply technology for teaching, training, and learning, 3) taking approaches to integrate technology; and 4) breaking through negative barriers to integrate technology. Probably, without intending to do so, Otero et al. (2005) were able to show an approach to changing negative attitudes relating to technology, which made the assessment of perceptions an important step towards achieving effective integration. In order to further the details about how technology integration is supported in education, government, and industry, an in depth approach describing measures and methods used to assess perception is presented in the remainder of the chapter.

2.2 Technology and Education

Since the emergence of the Industrial Revolution, the U.S. has benefitted from innovations that enabled it to stand as a powerful economic force. Over time, other nations have implemented strategies, e.g. working for lower pay, longer hours and increasing production, to improve their economies. Upon recognizing the dynamics, informed leaders within and outside of the U.S. government have formed an open collaboration since 1983 to research problems, suggest, plan and implement solutions to help regain its position within the global economy.

Government officials, education professionals, business leaders, and concerned citizens were able to reach a consensus that education and training and development were keys towards upgrading skilled workers to combat foreign competition. In doing so, the decline of the U.S. education system and economic productivity was reported by the National Commission on Excellence in Education's (1983) *A Nation at Risk: The Imperative for Educational Reform* and the Carnegie Forum on Education and the Economy's (1985) *A Nation Prepared: Teachers for the 21st Century*. The response to the compelling revelations resulted in the raising of higher performance goals for schools, teachers and students. Although the federal government funds only 6 percent of K-12 education, its legislation policies play a critical role in setting the educational agenda influencing the use of technology through its adoption of the National Information Infrastructure and supporting professional education development programs, e.g. National Board of Professional Teaching Standards' (NBPTS) (2006) *Career and Technical Education Standards*. The plethora of committees and agencies assigned to investigate the effects of technology in education and the economy exemplifies efforts to heighten standards by emphasizing productivity, efficiency, and student performance levels. Several governing bodies are involved with the current U.S. education reform efforts. Reform includes integrating technology in school programs, agencies, committees, and federal funding. The NPBTS, the International Society for Technology Education (ISTE), U.S. Department of Education (ED), the National Research Council (NRC), and Preparing Tomorrow's Teachers to Use Technology (PT3) grant program exemplify a few of many organized venues used to help define goals and set standards on a national and state level. Upon addressing the goals and standards established by the No Child Left Behind Act NCLB), these bodies define common goals for public education systems, including the integration of technology, on a collaborative basis.

During the 1950s, developments in computer assisted instruction (CAI) were used in public instruction and universities. However, Resier (2001) asserted that interest for instructional purposes heightened after the microcomputer's accessibility to the public, low cost, and reduced size in the 1980s. Resier (2001) credits other advances, e.g. digital technology, Internet, CD-ROM, and learning software with having contributed to the popularity of the computer's use for instruction and learning. Where Reiser (2001) cited advances that led to technology's popularity, technology provided advantages gained from remote access, cost benefits, and easy accessibility to large groups in education, the military, and industry. For those who integrate its use for skill development, Reiser (2001) credits the opportunity to design learning frameworks for more complex interactions between learners and content as a "lucrative benefit" technology and skill development have to offer.

2.2.1 University of Colorado-Boulder Study, ETR model. The proposed model, educational technology resource (ETR), which was funded by the PT3 project,[1]consisted of university participants (graduate students, faculty members, an internal evaluator and technology coordinator). Several objectives were established to reach the primary goal. ETR model designers had to achieve trust and cooperation, implement technological changes in the classroom, dismantle hierarchical relationships, promote collaboration, re-assess goals and establish and take measures to reach new ones.

Trust and collaboration between faculty and grad students, referred to as technology teaching assistants (tech-TAs), were achieved by building a working relationship between the two. Tech-TAs were assigned to faculty members. For discussions regarding course content and

[1] PT3 project was a three part federal grant program established in 1999 to promote technology integration in education. Capacity Building, Implementation, and Catalyst grants were the three grant categories. U.S. Department of Education (2003). About ED: *Mission*. http://www.ed.gov.

possible suggestions on how technology could be used to achieve learning outcomes, meetings were scheduled on a regular basis. Dialogue helped to create an exchange of ideas. Technological changes were implemented as grad students provided technical assistance within and out of the classroom. Eventually, individual support shifted to program support. With this increased magnitude of support, came a change in the nature of support; instead of assisting with lessons' design, help given by tech-TAs. Technical support led to decreased tech-TA support and enabled faculty, instructors, and university instructional programs to act independently of technology implementation and support.

The dismantling of hierarchical relationships between tech-TAs and faculty was achieved by renaming titles of tech-TAs to ETRs and restructuring from guidance relationships to collaborative relationships after the first year of the program. This change led to a change in role and stage for the ETR. Where Otero et al. (2005) identified this stage as the "critical use of technology," ETRs needed to develop a familiarization with the syllabi, schedule and meet with faculty and lead discussions about using technology's use in courses and whether or not it should be used (p. 5). Based upon an assessment of perceptions, faculty felt that technology was forced upon them and, according to Otero et al. (2005), presented confusion about how, when and why to use it. Otero et al. (2005) indicated that these perceptions prompted developers to design a critical framework consisting of five key dimensions supporting the idea that technology should be used to accomplish the following:

- aid student comprehension and problem solving;
- enable communication and foster discourse and collaboration;
- increase efficiency for users;
- enable teacher reflection and instruction feedback; and

- motivate, encourage, and engage students in the process of learning.

The PT3 study team's development of the key dimensions applied theoretical concepts of Lev Vygotsky,[2] who attributes learning with a transformation of symbols into meaning as a result of conscientiously or unconscientiously making decisions that are affected by social, environmental or cultural factors…this is referred as *mediated action*. The study team used a form of language (communication), which Otero et al. (2005) asserts that Vygotsky considered an important factor for mediated activity, to establish a structure for adopting technology. By doing so, the team was able to elicit an increase in *voluntary* participation from faculty members. Unforced participation stemmed from the development of an advanced level of professionalism, where the faculty was able to transform the use of technology to their teaching profession. The last objective was to achieve sustainability of participation and help establish a vision shared amongst faculty members.

The success of the last objective depended on discourse amongst faculty, where dialogue played an integral part in getting them to express ideas and concerns to each other by removing the ETRs. Upon promoting communication without ETRs, Otero et al. (2005) indicated the development of new roles….faculty members became each other's resource to adopt technology. Technology integration efforts became more effective upon recognizing the faculty's perception of its use. In addition to industry and education, the government plays a role helping to promote technology integration.

2.3 Technology and Government

Technological progression, economic instability, and public disenchantment provided the late president, John F. Kennedy (JFK) an opportunity to establish a platform on revitalizing the

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[2] Lev Vygotsky was a Russian lawyer who developed the *Social Development theory*, which is based upon the idea that learning takes place through social interactions (Riddle, 1999).

economy (Handel, 2003). The process of exploring technology's effect on the economy and the workforce, involved researching Handel's (2003) review of 1960s government policy, where JFK's platform revolved around a time where technology was progressing, the economy was unstable, and the public was disenchanted. Taking advantage of these conditions, his mission *to maintain full employment at a time when automation is replacing man* [italics added] (Handel, 2003, p.6), which he identified as the "major domestic challenge of the sixties" (Handel, 2003, p.6), JFK responded to society's disposition towards technology integration. Where he strategized his campaign around the economic state of the nation (Handel, 2003), he did enact an education training program, 1962 Manpower Development and Training Act, in order to help displaced workers establish new skills. According to Handel's (2003) citation, the National Commission on Technology, Automation, and Economic Progress concluded in 1965 that slow economic growth caused unemployment. Following the nation's renewed, yet short-lived revival, economic setbacks revolving around the recession of the 1980's were re-visited.

Although technology proved to benefit the efficiency of business operations, its advancements in the information technology (IT) age proved to be a threat to jobs in the 1980s. Handel's (2003) final report revealed the Panel on Technology and Employment's conclusion about the association of technology and job loss. According to the findings cited by Handel (2003), research conducted by the Panel on Technology and Employment stated that factors contributing to job loss were skill upgrading, stagnant and inequality in earnings growth, and slow economic growth and trade. The panel's research, which uncovered the cause behind wage differentials, exposed the emergence of a skill biased technological change (SBTC)[3] theory (Handel, 2003). Attitudes regarding technology integration within the workforce and education

[3] Skill biased technological change (SBTC) is a theory suggesting that information technology created an increased demand for skills and led to an increase in earning differentials (Handel, 2003).

reveal, to a greater extent, society's confusion about the role it plays in helping to lead the economy to recovery.

Percentage results, which related to job impact and consequential effects from technology integration, produced from Handel's (2003) *Survey of Working Conditions and the Quality of Employment* (*see* Table 2.1) illustrated the workforce perceptions, between 1969 and 1973, relating technology integration to the risk of job loss. In 1969 and 1972-73, survey results indicated that 8 and 9.7 percent of respondents felt a high likelihood of job loss; 74.2 and 67.2 felt no likelihood of job loss; and 3.5 and 4.7 percent felt a job loss would occur.

Table 2.1

Percentage of Workers at Risk for Job Loss Due to Technology

	1969	**1972–73**		
Probability of				
Technology Impact 1				
Very likely	8.0	9.7		
Somewhat likely	8.0	12.0		
A little likely	9.9	11.1		
Not at all likely	74.2	67.2		
N	1, 320	1, 268		
Consequences 2	***All***		***At Risk Only*** 3	
Out of job	3.5	4.7	14.2	14.6
Other job, same employer	9.0	11.7	36.3	36.5
Job adapted to machine	11.8	15.4	47.4	48.4
Other	0.5	0.2	2.2	0.5
Not affected by technology	75.2	68.1	--	--
N	1, 311	1, 254	325	390

(Handel, 2003)

Handel (2003) collected a sample of responses produced from various polls conducted during the 1980s, where the collection ranging from 38 to 52 percent related the "increased use of computers and information systems" to unemployment (*see* Table 2.2). The responses to these polls suggested a negative perception of technology integration.

Table 2.2

Percentages of Sample Responses Produced from Various 1980's Polls Associating Technology with Unemployment

Sample Responses regarding technology and Job Loss

	Year	**Poll**	**%**
"too many people lost jobs because of computers"	1980	Roper	38
	Year	**Poll**	**%**
"computers will throw a lot of people out of work"	1982	Time/ Yankelovich	52
"increased use of information systems will worsen/ Unemployment"	1984	Harris	43
"robots would replace most assembly line workers by the year 2000."	1989	Gallup	52

(Handel, 2003)

The 1980 Roper poll revealed that 38 percent believed that "too many people lost their jobs" because of technology (Handel, 2003). In 1982 and 1989, the Time/ Yanelovich and Gallup polls, respectively, showed that 52 percent had the same perceptions. These percentages suggest that within a seven year difference, job security and technology remained an issue.

2.3.1 Economic growth and unemployment. Handel (2003) and Reiser (2001) cited that workforce concerns pertaining to the developments and use of new technologies and increasing unemployment arose periodically from the 1950s to the 1980s.Concerns, such as these, were the catalyst behind the government's response to assigning special committees to investigate the assumptions. The National Commission on Technology, Automation, and Economic Progress assigned by the JFK Administration, for example, investigated the effects of technology on unemployment. The commission concluded (Handel, 2003) in 1965 that slow economic growth, as opposed to technological change, was the cause behind job loss. Where the 1980's recession contributed to creating an air of society's uncertainty about technology integration, the National Academy of Sciences (NAS), National Academy of Engineering (NAE), and Institute of Medicine joined forces to investigate technology's effects on the workforce by creating the Panel on Technology and Employment. Where the panel found no evidence of linking technology to unemployment (Handel, 2003), findings revealed that slow economic growth and trade were the likely causes. Handel (2003) cited stagnant earnings, skill upgrading, and inequality in job growth as the dynamics that occurred as a result of technology use. Such differences in earnings, skills and job growth, led economists to look at how technology affected the composition of employment.

Handel (2003) asserted that automation led to the elimination of *low-skilled* jobs and increased the number of *high-skilled* jobs. In addition to creating a need for higher skilled employees (Handel, 2003), occupational composition and skill content were affected by new technologies in such a way whereas job processes were re-defined or new positions were established. Conversely, where Handel's (2003) findings indicated that economic recessions reflecting slow economic growth and trade, as opposed to technology, contributed to job loss, some industry managers and workers confirmed that productivity[4] increased as a result of technology.

2.3.2 Productivity and economic efficiency. Industry and government agencies, e.g. the Department of Labor's (DOL) and Bureau of Labor Statistics (BLS) (2008), emphasize productivity because it is an indicator of progression, which, according to the BLS, is a

[4] Productivity is a measure of economic efficiency which shows how effectively economic inputs, e.g. labor, are converted to outputs, e.g. goods and services (Bureau of Labor Statistics, 2008).

significant source of increased potential national income. Labor productivity is determined by the ratio of output to input hours. The BLS (2008) reported that the U. S. economy has been able to produce more goods and services over time by making production more efficient without increasing labor time. In 2007 (BLS, 2008) the manufacturing labor sector, for example, increased productivity by 3.7 percent. This increase, according to the BLS (2008), was a result of an increased 2 percent in productivity and decrease in labor hours of 1.7 percent.

2.3.3 Training and development. With the objective of ensuring that the U. S. maintains a competitive position within the global economy, the DOL (2008) reported that former President Bush requested $8.87 billion for the Employment and Training Administration (ETA) for the fiscal year (FY) 2009 budget. The increased need for higher levels of education and skills amongst the U. S. population and a projected two-thirds of jobs requiring post-secondary education and training within a ten-year outlook were indicators behind the budget request. In light of technology advancements and globalization being the catalyst behind economic changes (DOL, 2008), former President Bush addressed possible solutions for helping Americans achieve training and skill development goals. The ETA has developed strategies for increasing opportunities to allow Americans to receive more training and skill development. The strategies were based upon the government's efforts to transform the workforce investment system into a demand-driven system. The President's High Growth Job Training Initiative, which prepared workers to take advantage of new job opportunities in growing industries, and the Community-Based Job Training Grants, which served as a means to build teaching resources and increased training activities, exemplify some the ETA's efforts. In addition to supporting workforce development, the ETA implements actions to address economic and education development on a regional level. Through the Workforce Innovation in Regional Economic

Development (WIRED) initiative (DOL, 2008), the role of talent development operates as the vehicle used to drive regional economic competition, job growth, and new opportunities for workers with the overall goal of creating high-skilled and high-waged jobs.

2.4 Technology and Industry

Frequent changes in product modifications and processes, coupled with the availability of optional technologies can lead to the development of a complex technological environment for industry. These complex conditions impose certain challenges described by Iansiti (1998), which include strategizing and determining the best available and compatible technology to integrate with operations and future product developments. For industry, product experimentation, prototyping, and simulation are those processes that lend themselves to assessing the best technological option, which Iansiti (1998) ascertained is affected by the scale of the manufacturing effort and timing. The choice of which option to integrate, could impact performance, cost of consumer products, speed and efficiency at which the product is developed and marketed, and the overall competitiveness of the organization (Iansiti, 1998). Based upon Iansiti's (1998) assertion, the extent to which technology integration[5] is associated with large differences in performance and productivity is contingent upon having a solid foundation of system knowledge, which encompasses skills and experience. Iansiti (1998) concluded that factors affecting competition, which is driven by effective technology integration, is the speed at which the product is developed and marketed (lead time) and resources (highly skilled employees) utilized.

2.4.1 Development of IDT$_2$. Developments throughout history have had a tremendous effect on education, government, and industry methods utilized to train military personnel and

[5] In his book, Technology Integration: Making Critical Choices, Marco Iansisti (1998) defines technology integration as "capability of conceptualizing how a multitude of emerging possibilities might be used coherently to define a product that makes business sense"(pg 5).

civilians. As technology progresses, so does the need to implement measures used in the instructional design technology (IDT_2) process. Reiser's (2001) emphasis on historical data served three purposes: 1) to reveal prior advancements that led to the development of IDT_2; 2) to explain the effects of those developments on theories pertaining to learning and performance; and 3) to reveal the positive role the field plays in industry development. His efforts, were not solely a detailed account of past events, helped clarify how media developments impacted teaching and training practices, led to theoretical ideas of how to promote classroom learning and workplace performance, and helped re-align its meaning with new developments. The developments impacted how things were done and led to the emergence of different organizations dedicated to promoting the IDT_2 profession. Reiser (2001) ascertained that these new developments contributed to the current definition, which was expanded from the 1994 Association for Educational Communication and Technology's[6] (AECT) meaning.

According to the AECT's definition, *design, development, utilization* or *implementation, management, and evaluation* are the five categories associated with defining IDT_2. Where both definitions are performance related, the current definition goes beyond the performance aspect by its inclusion of two additional practices…1) including analyzing performance problems in the workplace and 2) utilizing non-instructional and instructional solutions to solve problems. In order to differentiate the meanings to a further extent, Reiser (2001) conceded that the use of media for training and systematic instructional design have formed the core of IDT_2 over the years. Reiser's (2001) work revealed the federal government's involvement with contributing to the historical development of $IDT_{2.}$ The U. S. military's extensive use of training film media, for example, enabled civilian trainers to realize the positive outcomes gained from training large

[6] Association of Educational Communication and Technology (AECT) is a professional organization that plays a leading role dedicated to promoting the field of instructional technology and design (*History of Instructional Design and Technology: Part I: A History of Instructional Media, pg. 59*)

groups and recognize a second advantage technology offers today…speed (Reiser, 2001).

Experts, business executives, and government officials who agree that the stabilization of the U. S. economy is at a critical point, also see the need for integrating technology and; therefore, understand that the effort at doing so creates a need for training and skill development that goes beyond the basics for job performance. According to Noe (2005), an estimated 85 percent of jobs within the U. S. and Europe will require a greater use of knowledge. Like Noe's (2005) idea of connecting training to strategizing, Iansiti (1998) links training to strategizing business goals and objectives coupled with an instructional design process.

2.4.2 Training as a strategy. Along with the government's position, Iansiti (1998) associates technology integration with significant differences in performance. This association, which he credits with having system skills and knowledge, posited an opportunity to briefly discuss the core methodical steps (observe, design, implement, evaluate) implemented by the IDT_2 process to obtain positive performance outcomes for industry, military, and education. Upon doing so, a greater emphasis was placed on the human factor, which based upon Reiser's (2001) assertion, which enables training specialists to design and implement processes to help ensure that defined goals are met. It is important to point out that those who share similar views about effective technology integration as performance related should realize that performance is contingent upon human activity. Based on this contingency, ascertaining human perceptions regarding use and ease of use of technology is normal.

2.4.3 Human performance. Although the benefits of education provide an opportunity to enhance knowledge and skills, Molenda and Russell (2006) asserted that other interventions, such as job redesign, work incentives, and job aids and tools enhance training and contribute to better performance. This assertion was based upon the goal of enhancing job performance and making it the focus as opposed to making learning as the focus (Molenda & Russell, 2006). This idea became evident amongst business consultants, who, during the 1970s, realized that instruction alone had limited effects on resolving business problems. From this, emerged the human performance technology perspective, where instructional and non-instructional are integrated to give lasting effects. Molenda and Russell (2006) indicated that instruction by itself is sufficient in situations where knowledge and skills are limited. With skills upgrade programs, training specialists are needed to plan, design, implement, assess perceptions and evaluate performance outcomes as operations improve and increase productivity.

2.5 Perception of Technology Integration

In spite of conclusive evidence showing how low productivity, as opposed to showing how technology, has been directly related to job loss, surveys have revealed trends towards rejecting technology within the workforce. *Because there is a dependency on employees to accept and use the technology effectively, there is a need to ascertain the basis of attitudes or perceptions regarding its use*. Perceptions of technology use may be influenced by the transfer of attitudes from management, employee skills and experience, company rewards and incentives or intrinsic satisfaction gained from producing positive outcomes. In light of being aware of these influences, researchers Davis and Bagozzi (1986) studied factors that drive perceptions relating to technology's use and ease of use through their development of the Technology Acceptance Model (TAM), which would later demonstrate to have a high degree of reliability and validity (Money & Turner, 2004). TAM's implications, which sparked the interest and support of a large part of the research community, led research teams, e.g. Money and Turner (2004), who applied it to a knowledge management system, and Segar and Grover (1998), who re-examined scale reliability measures through its application to a productivity work environment, rendered greater support and provided new insights relating to attitudes towards technology integration within the workplace. Their contributions and findings would potentially bring about greater awareness about factors that affect perceptions about technology use within and out of the workforce. Upon considering what drives the acceptance of technology, especially in the workforce, leaders may be able to make more informed decisions about technology integration; thereby, making its use more effective to achieve greater results and, ultimately, a higher competitive standing in an uncertain economy.

Although TAM's theoretical implications have been highly recognized and valued in the research community, its developers have tested and re-tested questions that measure the constructs of the model. The process of doing so involved applying various statistical approaches utilized to measure significance, validity, and reliability. Replicating measures involved with testing hypothetical questions pertaining to this research created a critical need for becoming familiar with these statistical approaches. Upon doing so, it became increasingly important to emphasize statistical significance. Where showing significance is not the ultimate goal of research, it does, in part, help to set the stage for the research process and is a valuable measure that enables the researcher to determine adjustments that may potentially be needed to successfully test construct-related questions.

Of Davis' (1989) TAM study, the software training that subjects received and the extent of the software use exemplified independent and dependent variables respectively. The results produced from scales and survey data utilized to test constructs pertaining to behavioral relationships and correlations between Davis' (1989) constructs, perception of ease of *use* and *usage*, which serve as the basis of TAM, revealed the factors (indicators) that drove those perceptions and the degree to which they were related.

Due to the magnitude of data and possible data redundancy produced by the observations of variable relationships, researchers apply methods to reduce the number of variables that represent a particular construct (factor analysis) and classify data. Through factor analysis, factor scores are used as dependent variables where the more closely related variables results in fewer factors needed to represent a whole matrix of variables (Salkind, 2003). For example, if two items within a questionnaire elicit responses that show a high correlation where one response is driven by the other, then it could be concluded that questionnaire items are redundant. In short, factor analysis reduces the number of variables and classifies variables by detecting structure in variable relationships. Variables (construct items) are tested to measure the extent to which they relate or correlate. In the Davis and Bagozzi (1986) TAM study, scale items and the accuracy of results were tested to measure the extent to which they related to the constructs *ease of use* and *usage*. The extent to which the construct items are represented or construct validity, the degree to which the scale items (variables) of the construct consistently and accurately relate to the construct validity, and, as was an emphasis of the Segars and Grover (1993) research, the degree to which different scales or methods have similar variances of the same trait (convergent validity) are additional test analyses used to measure the extent of variable correlations. Given the various analyses, which transitions to testing the validity, it is safely assumed that validity refers to the degree that hypothetical statements are true or untrue.

Where the process of testing the hypothetical variable relationships leads researchers to predicting the degree to which they affect other variables and the extent to which they represent constructs, the extent to which variables represent latent (unapparent) constructs are also observed. Cronbach’s alpha (α), which is not a statistical test but a coefficient of reliability (consistency), measures the extent to which a set of items or specifically, variables of the TAM studies, represent a single latent construct that moves in one direction (one-dimensional). If data has a multidimensional structure, there is the likelihood that α will be low. Under this condition, it is necessary to extract data to determine which item(s) or variables possess the highest α. Increased variables and interim correlations are factors that help raise the α measurement result. High interim correlations, where formula results would render .70 or higher in behavioral science research, would indicate that the variables are measuring the same underlying construct and; therefore, serve as evidence that reliability is good. In the TAM research, Davis and Bogozzi (1986) utilized various scales to reveal quantitative results of survey items and the extent to which they represented the constructs (*ease of use versus usage*) relating to technology acceptance. Without the demonstrated reliability of the scales, where survey analysis produced consistent results, the research team's hypotheses might possibly have held less validity.

The process of confirming the reliability of the scales and validity of measurement items involved the methodical efforts of the Davis and Bagozzi (1986) research team to account for significant variable relationships and correlations and differences of the means between the two groups and variables. In spite of the number of procedural analyses implemented to test their hypothesis surrounding TAM and its implications, Davis' (1989) research contributed to laying a foundation for determining those factors that are attributed to technology acceptance within the workforce. Based upon significant test findings, others have been able to benefit from his work and apply his concept within a different context.

2.6 TAM and Theory, Davis and Bagozzi Study

The Technology Acceptance Model (TAM) is utilized to help measure attitudes that are based upon peoples' acceptance of various computer technologies (Money & Turner, 2004). The theoretical basis of TAM, according to Money and Turner (2004), reflects various considerations and theoretical underpinnings, e.g. the adoption of innovations and cost-benefit ideals, where considerations about outcomes are associated with performance possibilities. In addition to these theoretical concepts, Szajna's (1996) research indicated that TAM's foundation was adapted to Ajzen and Fishbein's Theory of Reasoned Action (TRA), which assumes that individual behavior is driven by personal beliefs, attitudes and the effects of the beliefs of others. Two constructs, the individual's perception of usefulness and ease of use, which Davis (1989) theorizes are the determinants critical to accepting or rejecting system usage, are illustrated in the TAM (*see* Figure 1). Davis (1989) defines perception of usefulness as an individual's intention to use or not to use an application to the extent to which they believe it will enhance job performance, and perception of ease of use is the degree to which it is believed that using a system would take no effort. Davis' (1989) findings suggest that these two constructs are determinants of user acceptance.

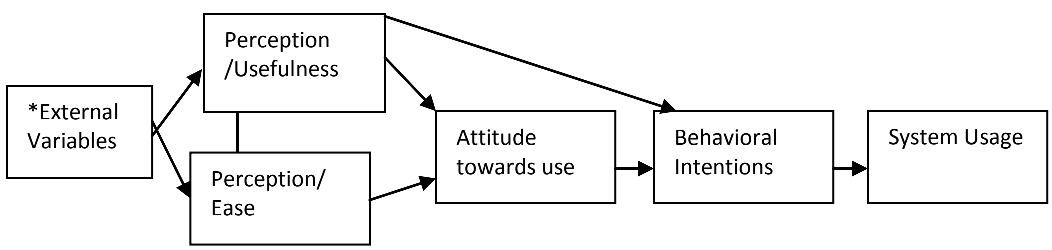

Figure 1. Davis' Technology Acceptance Model (TAM)

(Money & A. Turner, 2004)

2.7 Measuring Reliability and Validity

Methods used to measure these constructs relied upon the development and pre-testing of scale items to determine content validity, reliability and construct validity. Davis' (1989) study involved 152 participants and the use of four software applications. Two six-item scales (*see* Table 2. 3), which resulted in reliabilities of .98 for usefulness and .94 for ease of use, were the result of streamlining and refining measurements established from the initial set of 14-item scales. As a means of measuring the two constructs, three anchor points (*Strongly Agree, Neutral*, and *Strongly Disagree*) and values rated from 1to 7 were utilized to describe the degree of usefulness and ease of use.

According to Davis' (1989) conclusion, the usefulness-usage relationship was stronger than the ease of use-usage relationship. Davis (1989) attributed his conclusion to the fact that software application use is mainly utilized because of what it offers users. Additionally, he (Davis, 1989) also acknowledged the fact that difficulty of use can interfere with user acceptance as well.

Table 2.3

Replication of Davis' six-item scale with refined measurements: A Factor Analysis of Perceived Use and Ease of Use Items, Study 2

Scale Items		Factor 1 **(Usefulness)**	Factor 2 **(Ease of Use)**
Usefulness			
		.91	.01
1	Work More Quickly	.98	-.03
2	Job Performance	.98	-.03
3	Increase Productivity	.94	.04
4	Effectiveness	.95	-.01
5	Makes Job Easier	.88	.11
6	Useful		
Ease of Use			
7	Easy to learn	-.20	.97
8	Controllable	.19	.83
9	Clear & Understandable	-.04	.89
10	Flexible	.13	.63
11	Easy to become skillful	.07	.91
12	Easy to Use	.09	.91

(Davis, 1989)

Davis' (1989) TAM research drew support and interest of others in the research community. Money and Turner (2004), for example, applied TAM to a knowledge management environment. Money and Turner's (2004) research model (*see* Figure 2), which is derived from Davis' TAM, emphasizes four constructs…perception of use and usefulness of the knowledge management system, coupled by, intent to use and usage of the knowledge management system. This diagram is an adaptation to Davis' 1986 TAM, where the model illustrates the 4 constructs. From the four constructs of perceive d usefulness, perceived ease of use, behavioral intention to use, and system usage, Money & Turner (2004) hypothesized the existence of six significant positive relationships, which included the following:

1. perceived usefulness and intent to use,
2. perceived usefulness mediated the relationship between usefulness and ease of use,
3. perceived ease of use and intent to use will be affected when perceived usefulness is controlled for (software defined controls),
4. intent to use and knowledge management system usage,
5. the combination of perceived usefulness and perceived ease of use with intent to use the knowledge management system; and
6. the combination of perceived usefulness and perceived ease of use with usage of the knowledge management system.

Significant research results linking these constructs to user acceptance of the knowledge management system would render greater support to validating Davis' (1989) TAM.

Statistical findings that were generated from Money and Turner's (2004) research supported bi-variate relationships between *ease of use-usefulness* and *perceived ease of use-usage*. Respective to the hypothesized corrections of perceived ease of use-usefulness and

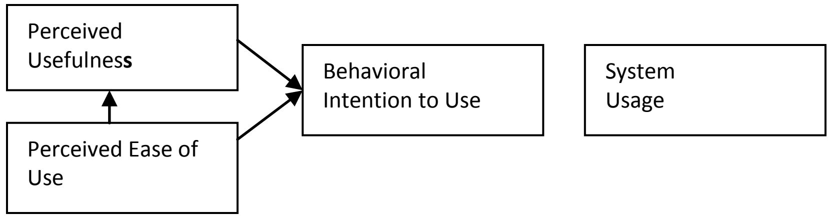

Figure 2. Money and Turner's technology acceptance research model (adaptation to Davis' TAM)

(Money & Turner, 2004)

and perceived ease of use-usage, statistical results, .790 and .645, were positively significant, and; therefore, supported assertions that the effects of perceived ease of use on system usage are mediated by perceived usefulness.

2.8 TAM Re-specified, Segars and Grover Study

Segars and Grover's (1993) interest in user acceptance of technology led the team to investigate the strength of variable relations measured and reported in prior TAM research. The confirmatory nature of their research presented the need to question the extent to which scale indicators or items accurately and consistently measured the constructs of Davis' TAM (1986). In other words, Segars and Grover (1993) focused on finding sufficient evidence of construct validity. Revisiting Davis' (1989) TAM, where a total of ten indicators (six on the constructs of perceived usefulness and four on perceived ease of use), loaded on the two constructs, Segars and Grover's (1993) re-specified model consisted of three constructs or factors…*usefulness*, *effectiveness* and *ease of use*, and the factors loaded by a total of eight indicators. As a result of the re-specification, two indicators, *work quickly* and *understandable*, were eliminated; thereby, creating an eight-indicator model, and a third construct, effectiveness, was added. The revised model produced lower chi-square values (Segars & Grover, 1993).

2.9 Voluntary vs. Mandatory Usage

Where prior research on technology acceptance reflected technology usage that is voluntary or individual-oriented, the Venkatesh et al. (2003) study analyzed technology use from a mandatory perspective, which according to their assertions, is characteristic of more complex organization technologies and, possibly, of greater concern for industry managers. Upon citing a difference in user contexts, Venkatesh et al.'s (2003) analysis of technology acceptance led to research comparing measurement results, descriptions, and properties of eight prior hypothesized model-theories. The model-theories include the Theory of Reasoned Action (TRA), Technology Acceptance Model (TAM), Theory of Planned Behavior (TPB), combined TAM and TPB (C-TAM-TPB), Model of PC Utilization (MPCU), Innovation Diffusion Theory (IDT), and Social Cognitive Theory (SCT). Venkatesh et al. (2003) produced a detailed comparative analysis of the theories, common variables shared between the models and model limitations. The process of doing so, enabled Venkatesh et al. (2003) to integrate the constructs that were measured and found to have greater significance and formulate their model, the Unified Theory of Acceptance and Use of Technology (UTAUT).

2.10 Summary

The integration of technology within the U.S. workforce has been supported by the efforts of federal, state and local governments, public and private education and research studies of higher academic institutions of learning. In spite of the advantages, e.g. increased productivity, speed and shorter lead times, the findings of some research studies revealed that efforts to integrate technology within the workforce lost its momentum since re-developments of the early 1980s. Coupled by the continuous downturn of the U.S. economy and job loss, this resistance has been the motivation behind special studies conducted by government and researchers. Where Handel's (2003) citation indicated that the National Commission on Technology, Automation, and Economic Progress concluded that slow economic growth caused unemployment, his research established the connection between technology, job productivity loss and employee attitudes.

His report on the studies conducted by the commission, helped to unveil the skill biased technology theory, where innovations in the IT industry led to the increased demand for highly skilled jobs. Negative and positive perceptions about integrating technology were shared by business executives and worker employees. A study conducted by researchers at the University of Boulder-Colorado (Otero et al., 2005) utilized methods to dismantle individual barriers towards accepting more technology use in order to enhance instructional performance. Although the focus of this study pertained to integrating technology for instruction, the processes the study team implemented revealed that a lack of understanding and communication about how technology could be used effectively existed. Researchers Davis and Bagozzi's (1986) initial development of TAM helped to reveal the constructs, *ease of use* and *usage*, which influence human perceptions regarding the acceptance of technology use within the workforce. Its implications sparked the wide interest and support of other researchers and became the basis of this research project.

CHAPTER 3

Methodology

3.1 Design of the Study

In order to develop effective technology training, it is important to understand the variables involved with the acceptance of technology. The researcher investigated perceptions relating to the acceptance of technology amongst workforce employees consisting of non-managers and managers. Where prior research has revealed that various factors influence the acceptance of technology use on the job, instruments have been designed to assess attitudes and perceptions of technology acceptance. This study continues that work by trying to adapt it for use in two surveys. Where researchers developed an interest in assessing attitudes relating to technology use and acceptance, many of them implemented a method of obtaining responses from participants. Most of the responses hinged on the use of surveys or questionnaires. Some observed actual differences in performance levels. Research data pertaining to assessing perceptions of technology acceptance, sparked an interest in seeing the perception of technology integration on a local level. Five questions relating to Davis' (1989) constructs, *ease of use* and *usefulness*, were applied in order to ascertain correlations to acceptance of technology use, employee level of skill, amount of technology use, training, usage of technology's effectiveness on productivity, and a difference of perceptions relating to technology acceptance between employees of different workgroup levels. For the researcher of this pilot study, the process of addressing the questions created a need to develop eleven hypotheses (*see* Table 3.1). The hypotheses helped to establish how survey item statements would be tested, the participant target, and the instruments by which the data would be extracted and reported.

Table 3.1

Hypotheses (H_{0x}, H_{Ax})

(H_x)	**Hypotheses**	**Corresponding Survey Instrument Items**
H_{01}	There will be no correlation between amount of use of technology and productivity.	
H_{A1}	There will be a positive correlation between amount of use of technology and productivity.	10 vs. 1; 10 vs. 3; 10 vs. 4; 10 vs. 18
H_{02}	There will be no correlation between amount of use of technology and the acceptance of technology.	
H_{A2}	There will be a positive correlation between amount of use of technology and the acceptance of technology.	10 vs. 7; 10 vs. 11
H_{03}	There will be no correlation between the employee's perception of ease of use of technology and amount of use of technology.	
H_{A3}	There will be a positive correlation between the employee's perception of ease of use of technology and amount of use of technology.	2 vs. 10
H_{04}	There will be no correlation between employee level of training and the worker's perception of ease of use of technology.	
H_{A4}	There will be a positive correlation between employee level of training and the worker's perception of ease of use of technology.	16 vs. 2
H_{05}	There will be no correlation between employee level of training and productivity.	
H_{A5}	There will be a positive correlation between employee level of training and productivity.	16 vs. 1; 16 vs. 3; 16 vs. 4; 16 vs. 18
H_{06}	There will be no correlation between employee level of training and worker's perception of usefulness.	
H_{A6}	There will be positive correlation between employee level of training and worker's perception of usefulness.	16 vs. 18
H_{07}	There will be no correlation between employee training and productivity.	

Table 3.1 above consists of null and alternative hypotheses H_{01}, H_{A1} through H_{07}. Each hypothesis refers to which variables will be related to another variable. For example, H_{06}, H_{A6} hypothesizes that the variables training and usefulness are correlated. The far right of the table indicates which survey item statements on the actual instrument were used to measure perceptions relating to each hypothesis. These hypotheses were constructed for the pilot study.

Table 3.1 *(cont).*

H_{A7}	There will be a positive correlation between employee training and productivity.	6 vs. 1; 6 vs. 3; 6 vs. 4; 6 vs. 8; 6 vs. 12; 6 vs. 19
H_{08}	There will be no correlation between training and ease of use of technology.	
H_{A8}	There will be a positive correlation between training and ease of use of technology.	6 vs. 8; 12 vs. 8
H_{09}	There will be no correlation between ease of use of technology and acceptance of technology.	
H_{A9}	There will be a positive correlation between ease of use of technology and acceptance of technology.	2 vs. 7; 2 vs. 11
$H_{0\ 10}$	There will be no correlation between ease of use of technology and usefulness of technology.	
H_{A10}	There will be a positive correlation between ease of use of technology and usefulness of technology.	2 vs. 3; 2 vs. 6; 2 vs. 7; 3 vs. 6; 3 vs. 7
$H_{0\ 11}$	There will be no significant difference in the attitudes of managers and non-managers regarding the acceptance of technology use	
H_{A11}	There will be a significant difference in the attitudes of managers and non-managers regarding the acceptance of technology use with managers being more accepting of technology integration than non-managers.	7, 11

Table 3.1 consists of null and alternative hypotheses H_{A7} through H_{A11}. With the exception of H_{011}, H_{A11}, each hypothesis refers to which variables will be related to another variable. Because there were two participant groups, a t-test was utilized in determining differences acceptance between non-managers and managers, H_{011},H_{A11}, was used in a t-test. These hypotheses were constructed for the pilot study.

Approval was obtained from the University's Institutional Review Board (IRB). The IRB approved the researcher's surveys and letter of Letter of Consent (*see* Appendix E) .Permission to use prior instruments in the development of the researcher's instruments was obtained from Dr. Fred Davis and Albert Segars (*see* Appendix F).

3.2 Data Analysis

This study sought to measure the strength of relationships amongst variables and to see if there were significant differences in the attitudes for managers and non-managers regarding technology integration in the workplace. Therefore, correlations, which were conducted in order to test hypotheses 1 through 10 for the pilot study, utilized Pearson's product moment coefficient (*r*).The level of significance was set at the 0.05 level. A t-test was used to determine mean differences of technology acceptance between the two groups. The following scale was used to characterize the strength of correlations. The strength of correlations: strong, ≥ .70, moderate, .69 - .50, low, ≤.49or none. The two-parts of the survey were designed differently, with Part I consisting of statements requiring rated responses and Part II with dichotomous statements requiring YES/ NO responses. Cronbach's alpha (α) was used to test the instrument's reliability (internal consistency) for Part I and for Part II. Results of Cronbach's α for internal consistency are available in Appendices A and B.

3.3 Sample: Pilot Study

For the pilot study, subjects consisted of male and female adult (18 or over) clients of a local non-profit agency. Agency clients, who participated on a voluntary basis, were a mix of employed and unemployed workers with varied levels of skill, training, education and workforce employee groups (non-manager, manager). For the pilot study, a group of 50 participants who had access to a computer and the Internet were solicited by a survey flyer. In total, 22 survey participants or 44% responded to the online survey; thereby, representing the pilot sample (*n*). The pilot sample consisted of 13 non-manager employees or 59% of total participants, and 9 manager employees or 41% of total participants.

3.4 Instrumentation: Pilot Study

Two, 2-part (PART I, PART II) surveys , the *Workforce Technology Integration Acceptance Survey* for Non-Manager Employees or *former* Non-Manager Employees (*see* Tables

3.2a & 3.2b) and the *Workforce Technology Integration Acceptance Survey* for Manager Employees or *former* Manager Employees (*see* Tables 3.2c & 3.2d), were designed and adapted to Davis' (1989) TAM. Because there was an interest in ascertaining whether perceptions about technology integration differed between non-management and management, surveys had to be distributed amongst participants (respondents) belonging to one of the two identifiable employee groups.

The surveys were designed with two parts, where PART I items were five- point Likert scale items requiring the respondent to rate statements accordingly. The five-point scale included the following:

- Strongly Agree (SA)
- Agree (A)
- Neither Agree or Disagree (NAD)
- Disagree (D); and
- Strongly Disagree (SD)

Survey item statements marked "thrown out" were those that were deleted in the revised study. PART II contained seven item statements requiring YES/ NO or a choice of responses relating to the time required for skill development, training, level of education, and amount of technology usage. Responses requiring YES or NO were respectively equivalent to 1 or 0, and responses that were based upon choices describing time were equivalent to 1, 2, 4 or 5, where values were indicators of least to most.

In order to maintain the respondents' interest and elicit immediate responses, both surveys were brief requiring an estimated 5-10 minutes to complete. In addition to the survey design, each item statement, which addressed research questions and was extracted from the hypotheses formulated during the preliminary stages of the research, served a purpose. The careful selection of item statements was critical for testing the hypotheses.

Table 3.2a

Workforce Technology Integration Acceptance Survey for Non-Managers

ITEM Statement	**ITEM Response**				
1. Technology helps make work more efficient.	**SA**	**A**	**NAD**	**D**	**SD**
2. My use of technology on the job is easy.	**SA**	**A**	**NAD**	**D**	**SD**
3. Using technology at work increases my job performance.	**SA**	**A**	**NAD**	**D**	**SD**
4. Using technology at work does not affect my job performance. *Thrown out*	**SA**	**A**	**NAD**	**D**	**SD**
5. Technology integration involves only using computers. *Thrown out*	**SA**	**A**	**NAD**	**D**	**SD**
6. Training is needed to use the technology on my job.	**SA**	**A**	**NAD**	**D**	**SD**
7. I like using technology on the job.	**SA**	**A**	**NAD**	**D**	**SD**
8. Technology use was easier after training.	**SA**	**A**	**NAD**	**D**	**SD**
9. Using technology is difficult. *Thrown out*	**SA**	**A**	**NAD**	**D**	**SD**
10. Technology is used most of the time on my job.	**SA**	**A**	**NAD**	**D**	**SD**
11. Technology use will replace me on the job.	**SA**	**A**	**NAD**	**D**	**SD**
12. I was more comfortable with using technology for work purposes after training.	**SA**	**A**	**NAD**	**D**	**SD**

Table 3.2a above shows how the researcher made decisions to change and delete certain items from the instrument based on the pilot study results regarding the reliability of the instrument. The table shows the original instrument for non-manager employees that participated in the pilot study. Below is Part II of the survey, Table 3.2b, where the statements refer to time and

demographical information. This was the instrument used in the pilot study.

Table 3.2b

Workforce Technology Integration Acceptance Survey for Non-Managers

ITEM Statement	ITEM Response			
13. I have received additional training to perform my job.	**Yes**		**No**	
14. I have more than 2 years' experience with this position. *Thrown out*	**Yes**		**No**	
15. I have attended additional school after graduating high school.	**Yes**		**No**	
16. I hold some type of technology related certification.	**Yes**		**No**	
17. I have graduated high school. *Thrown out*	**Yes**		**No**	
18. My job performance requires the use of technology…	**None of the time**	**Some of the time**	**Most of the time**	**At all times**
19. Generally, when there is new technology, I received required hours of training.	**0 hrs. of training**	**3 – 6 hrs. of training**	**7 – 10 hrs. of training**	**More than 10 hrs. of training**

Table 3.2c below shows how the researcher made decisions to change and delete certain items from the instrument based on the pilot study results regarding the reliability of the instrument. The table shows the original instrument for manager employees that participated in the pilot study.

Table 3.2c

Workforce Technology Integration Acceptance Survey for Managers

ITEM Statement	ITEM Response				
1. Technology integration helps make work more efficient.	**SA**	**A**	**NAD**	**D**	**SD**

Table 3.2c *(cont).*

2. My use of technology on the job is easy.	**SA**	**A**	**NAD**	**D**	**SD**
3. Using technology at work increases my job performance.	**SA**	**A**	**NAD**	**D**	**SD**
4. Using technology at work does not affect my job performance. *Thrown out*	**SA**	**A**	**NAD**	**D**	**SD**
5. Technology integration involves only using computers. *Thrown out*	**SA**	**A**	**NAD**	**D**	**SD**
6. Training is needed to use the technology on my job.	**SA**	**A**	**NAD**	**D**	**SD**
7. I like using technology on the job.	**SA**	**A**	**NAD**	**D**	**SD**
8. Technology use was easier after training.	**SA**	**A**	**NAD**	**D**	**SD**
9. Using the technology is difficult. *Thrown out*	**SA**	**A**	**NAD**	**D**	**SD**
10. Technology is used most of the time on my job.	**SA**	**A**	**NAD**	**D**	**SD**
11. Technology use will replace me on the job.	**SA**	**A**	**NAD**	**D**	**SD**
12. I was more comfortable with using technology for work purposes after training.	**SA**	**A**	**NAD**	**D**	**SD**

Table 3.2d below shows how the researcher made decisions to change and delete certain items from the instrument based on the pilot study results regarding the reliability of the instrument. The table shows the original instrument for manager employees that participated in the pilot study.

Table 3.2d

Workforce Technology Integration Acceptance Survey for Managers

ITEM Statement	**ITEM Response**	
13. I have received additional training to perform my job.	**Yes**	**No**
14. I have more than 2 years' experience with this position. *Thrown out*	**Yes**	**No**
15. I have attended additional school after graduating high school.	**Yes**	**No**

Table 3.2d *(cont).*

16. I hold some type of technology related certification.	**Yes**		**No**	
17. I have graduated high school. ***Thrown out***	**Yes**		**No**	
18. My job performance requires the use of technology…	**None of the time**	**Some of the time**	**Most of the time**	**At all times**
19. Generally, when there is new technology, I received required hours (hrs.) of training.	**0 hrs. of training**	**3 – 6 hrs. of training**	**7 – 10 hrs. of training**	**More than 10 hrs. of training**

This selection (item statements) required identifying seven independent variables (d1, d2…, etc.) and constructing 10 hypothesized variable relationships or correlations, (*see* Figure 3). The seven independent variables included *amount of use* (d1), *productivity* (d2), *acceptance* (d3), *ease of use* (d4), *level of skill* (d5), *usefulness* (d6), and *training* (d7). All hypothesized correlations (H_{01}, H_{A1} - H_{010}, H_{A10},) were used to test each variable relationship, where *dx* versus (vs.) *dx* was analyzed. Some item statements, which were not used and were coded "*Thrown out,*" were re-worded in the revised study. The item statements coded *"Reversed",* were replications of Davis' (1989) technique applied in TAM, Study 1and served as a method of increasing the reliability of the instrument as an attempt to detect response mode. The first collection and the first analysis of data are provided below in *Pilot Study Findings*, and the *Study, Revised* findings are covered in Chapter 4.

The construction of variable relationships included the following simplified versions of the hypotheses:

- amount of use (d1) vs. productivity (d2),
- amount of use (d1) vs. acceptance (d3),
- ease of use (d4) vs. amount of use (d1),

- level of skill (d5) vs. ease of use (d4),
- level of skill (d5) vs. productivity (d2),
- training (d7) vs. productivity (d2),
- training (d7) vs. ease of use (d4),
- ease of use (d4) vs. acceptance (d3), and;
- ease of use (d4) vs. usefulness (d6).

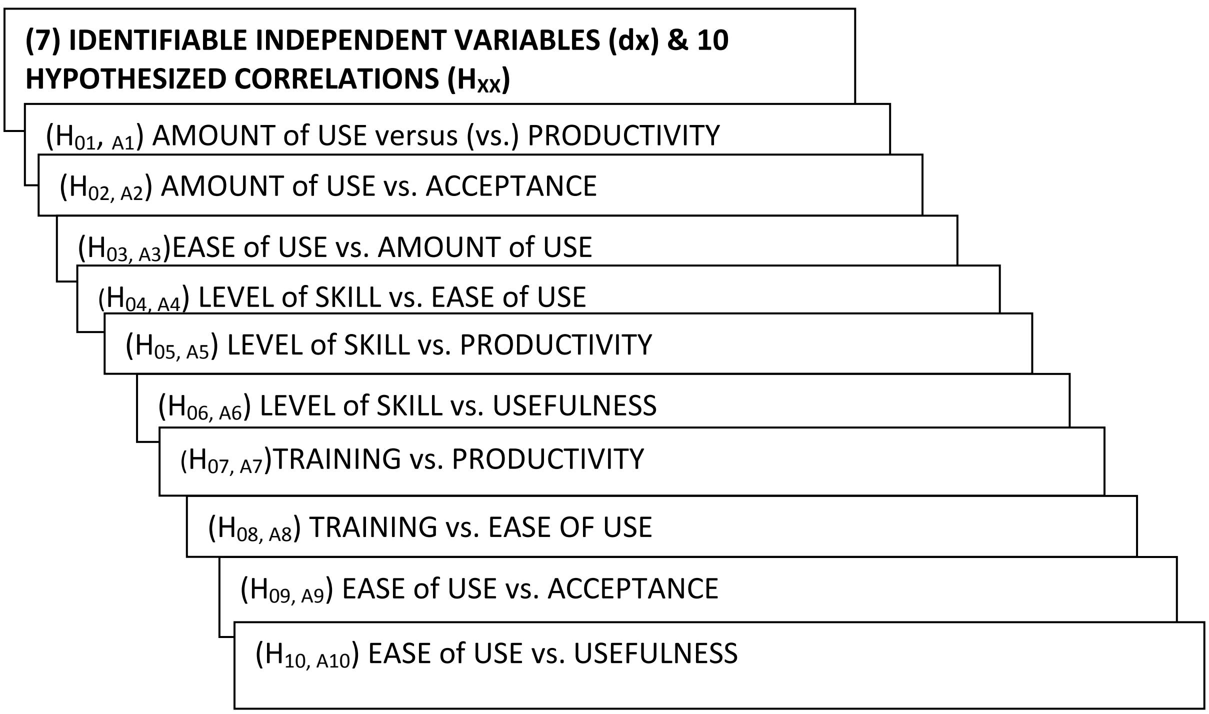

Figure 3. (7) Identifiable Independent Variables (dx) and 10 hypothesized correlations (H_{xx}), Pilot Study.

The process of piloting the study was confined to one semester and resulted in distributing the survey on-line for non-manager respondents and, separately, for manager respondents.

3.5 Instrumentation: Study, Revised

After analyzing data from the pilot study, the instruments were revised, and those changes are reflected in the Tables 3.3a, 3.3b, 3.3c, and 3.3d.

Table 3.3a

Workforce Technology Integration Acceptance Survey for Non-Managers: Study, revised

ITEM Statement	**ITEM Response**				
1. Technology integration helps make work more efficient.	**SA**	**A**	**NAD**	**D**	**SD**
2. My use of technology on the job is easy.	**SA**	**A**	**NAD**	**D**	**SD**
3. Using technology at work increases my job performance.	**SA**	**A**	**NAD**	**D**	**SD**
4. Training is needed to use the technology on my job.	**SA**	**A**	**NAD**	**D**	**SD**
5. I like using technology on the job.	**SA**	**A**	**NAD**	**D**	**SD**
6. Technology use was easier after training.	**SA**	**A**	**NAD**	**D**	**SD**
7. Technology is used most of the time on my job.	**SA**	**A**	**NAD**	**D**	**SD**
8. Technology use will replace me on the job.	**SA**	**A**	**NAD**	**D**	**SD**
9. I was more comfortable using technology for work purposes after training.	**SA**	**A**	**NAD**	**D**	**SD**

Table 3.3a above shows how the researcher made revisions to the instrument based on the pilot study results regarding the reliability of the instrument. The table shows the actual instrument's text for Part I as was read by non-manager employees that participated in the study. The recalculated internal consistency was improved for the instrument in the study. All of the instruments in the revised study received the same modifications.

Table 3.3b

Workforce Technology Integration Acceptance Survey for Non-Managers: Study, revised

ITEM Statement	ITEM Response			
1. I have received additional hours of training to perform my job.	**0 hrs. of training**	**1 – 6 hrs. of training**	**7 -10 hrs. of training**	**More than 10 hrs. of training**
2. I have attended additional school after earning a high school diploma or GED.	**0 - 12 months**	**1 – 2 years**	**3 years**	**More than 3 years**
3. **I hold some type of technology-related certification.**	**0 certifications**	**1 certification**	**2 certifications**	**More than 2 certifications**
4. My job performance requires the use of technology…	**0 to 10 hours**	**11 to 20 hours**	**20 to 30 hours**	**More than 30 hours**
5. Generally, when there is new technology, I received required hours of training.	**0 hrs. of training**	**1 – 6 hrs. of training**	**7 -10 hrs.**	**More than 10 hrs.**

Table 3.3c below shows how the researcher made revisions to the instrument based on the pilot study results regarding the reliability of the instrument. The table shows the actual instrument’s text as was read by manager employees that participated in the study. The recalculated internal consistency was improved for the instrument in the study.

Table 3.3c

Workforce Technology Integration Acceptance Survey for Managers: Study, revised

ITEM Statement	ITEM Response				
1. Technology integration helps make work more efficient.	**SA**	**A**	**NAD**	**D**	**SD**
2. My use of technology on the job is easy.	**SA**	**A**	**NAD**	**D**	**SD**

Table 3.3c *(cont).*

3. Using technology at work increases my job performance.	**SA**	**A**	**NAD**	**D**	**SD**
4. Training is needed to use the technology on my job.	**SA**	**A**	**NAD**	**D**	**SD**
5. I like using technology on the job.	**SA**	**A**	**NAD**	**D**	**SD**
6. Technology use was easier after training.	**SA**	**A**	**NAD**	**D**	**SD**
7. Technology is used most of the time on myjob.	**SA**	**A**	**NAD**	**D**	**SD**
8. Technology use will replace me on the job.	**SA**	**A**	**NAD**	**D**	**SD**
9 I was more comfortable using technology for work purposes after training.	**SA**	**A**	**NAD**	**D**	**SD**

Table 3.3d below shows how the researcher made revisions to the instrument based on the pilot study results regarding the reliability of the instrument. The table shows the actual instrument's text for Part II as was read by manager employees that participated in the study. The recalculated internal consistency was improved for the instrument in the study.

Table 3.3d

Workforce Technology Integration Acceptance Survey for Managers: Study, revised

ITEM Statement	**ITEM Response**			
4. I have received additional hours of training to perform my job.	**0 hrs. of training**	**1 – 6 hrs. of training**	**7 -10 hrs. of training**	**More than 10 hrs. of training**
5. I have attended additional school after earning a high school diploma or GED.	**0 - 12 months**	**1 – 2 years**	**3 years**	**More than 3 years**
3. I hold some type of technology-related certification.	**0 certifications**	**1 certification**	**2 certificatio ns**	**More than 2 certifications**

Table 3.3d *(cont).*

5. My job performance requires the use of technology…	**0 to 10 hours**	**11 to 20 hours**	**20 to 30 hours**	**More than 30 hours**
6. Generally, when there is new technology, I received required hours of training.	**0 hrs. of training**	**1 – 6 hrs. of training**	**7 -10 hrs.**	**More than 10 hrs.**

3.6 Timeline of the Study, Pilot & Revised

The pilot study was conducted in the spring of 2011. The proposal was finalized in the fall of 2011. The revised study was carried out the spring of 2012.

Study: January 6, 2012

IRB approval of revised instruments: January 31, 2012

Solicitation of the sample: February 2, 2012

Administration of the revised instruments: February 2, 2012

Analysis of findings: beginning of March 2012

Defense of the thesis: March 23, 2012

3.7 Pilot Study Findings

Data obtained from the rated item statements were recorded as raw data and segregated according to the two groups, 13 non-managers and 9 managers. The data was collected in the pilot study and was used to determine the reliability of the instruments and to run correlations and the t-test.

3.7.1 Reliability of the pilot instruments. With the use of methods to reveal internal consistency, the instruments were not found to be reliable. Internal consistency helps the researcher determine the extent to which items on the questionnaire focus on the same variable or construct. Internal consistency using Crombach's alpha (α) is a reliability coefficient and the equivalent of split-half reliability. A good coefficient or Cronbach's alpha, e.g. $.9 > \alpha \geq .8$, suggests good internal consistency, which lends greater reliability to the survey instrument. When all items were included in the reliability analysis, Cronbach's alpha was 0.67for the non-manager survey and 0.63 for the manager survey. It was decided that the YES/ No items would not be included in the revised study instrument but would be reconstructed as item statements addressing a few revised hypotheses and additional variables

3.7.2 Pilot correlations and t-tests. Correlations produced p-values between -1(negative) and +1(positive) (*see* Tables 3.4a, 3.4b). Where survey items were labeled 1 through 10, other items were deleted because they were believed to be unreliable. For example, based upon the item statement responses pertaining to *productivity* and *amount of technology use* by respondents of the non-manager workgroup, the correlation coefficient (+.029) of the tested hypothesis, *amount of use vs. productivity* (H_{01}, H_{A1}), suggests that there is a low positive correlation between the two independent variables. The same statistical method was utilized for testing all of the hypothesized relationships of both groups. The results of tested correlations were categorized as strong,*above .70, positive (+) or negative (-) moderate, low or none, below .70, correlation and recorded (*see* Tables 3.5a & 3.5b).

Table 3.4a

Non-Manager Correlations, Pilot Study

	Productivity More Work	Ease of use On the job	Usefulness More work	Usefulness No more work	Level of skill Training need	Acceptance Like for job use	Ease of use After training	Ease of Use Difficult on job	Amount of use Most of the	Acceptance Job replacement
Items	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	1									
2	0	1								
3	0.813	0.100	1.000							

Table 3.4a *(cont).*

4	0.620	-0.227	0.648	1.000						
5	0.694	-0.096	0.855	0.721	1.000					
6	0.712	-0.287	0.645	0.827	0.724	1.0000				
7	0.626	-0.343	0.486	0.651	0.549	0.704	1.0000			
8	0.299	0.088	0.375	-0.081	-0.341	-0.018	0.070	1.000		
9	0.051	0.757	0.436	0.167	0.410	-0.084	-0.435	-0.177	1.000	
10	0.542	-0.201	0.562	0.712	*0.724	0.912	0.718	-0.118	0.40	1.000

Table 3.4b below shows the results of the correlations run for managers' responses to the instrument from the pilot study. After the instrument was revised based on pilot study reliability results, these correlations changed for the actual study sample. The correlation table for managers for the study is located in Chapter 4.

Table 3.4b

Manager Correlations, Pilot Study

	Productivity More Work	Ease of use On the job	Usefulness More work	Usefulness No more work	Level of skill Training need	Acceptance Like for job use	Ease of use After training	Ease of Use Difficult on job	Amount of use Most of the	Acceptance Job replacement
Items	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	1.000									
2	.653	1.000								
3	0.525	0.100	1.000							
4	0.201	-0.071	0.778	1.000						
5	0.530	0.373	0.478	0.528	1.000					
6	0.342	0.024	0.784	0.955	0.495	1.0000				
7	-0.119	-0.185	-0.426	-0.306	-0.814	-0.158	1.0000			
8	0.291	0.130	0.536	0.608	0.448	0.513	-0.307	1.000		
9	-0.038	0.033	-0.265	-0.586	-0.781	-0.496	0.616	-0.370	1.000	
10	0.082	-0.399	0.580	0.821	0.338	0.770	-0.073	0.775	-0.457	1.000

Once correlations were run for both groups; thereby, producing p values, the researcher was able to detect p-values that were positively or negatively significant. All values below .05, were indications of a significant correlation. Values were categorized from strong to no significance.

Table 3.5a shows those correlations for non-managers that were strong, moderate, low, and non-existent. It is organized based on those hypotheses that were posed prior to the pilot study being undertaken. Due to findings that suggested the unreliability of the survey instruments used in the pilot study, the existence or degree (positive, negative) of significance for correlations was not addressed. It was believed that some correlations in the pilot study may not have posed an accurate analysis. All of those correlations were changed when the actual study was conducted. That analysis of data appears in Chapter 4.

Table 3.5a

Categorized Results of Hypothesized Correlations, Non-Managers, Pilot Study

Non-Manager, Hypothesized Correlation	Correlation Category			
	Strong	Moderate	Low	None
Amount of use vs. Productivity (H_{01}, H_{A1})				0
Amount of use vs. Acceptance (H_{02}, H_{A2})			-0.177	0
Ease of use vs. Amount of use (H_{03}, H_{A3})			+0.088; +0.070; -0.018	
Level of skill vs. Ease of use (H_{04}, H_{A4})	+0.827	+0.651		0
Level of skill vs. Productivity (H_{05}, H_{A5})				0
Level of skill vs. Usefulness (H_{06}, H_{A6})				0
Training vs. Productivity (H_{07}, $_{A7}$)				0

Table 3.5a *(cont).*

Training vs. Ease of use (H_{08}, H_{A8})				0; 0; 0
Ease of use vs. Acceptance (H_{09}, H_{A9})	+0.757		-0.096; -0.084; -0.435	0; 0
Ease of use vs. Usefulness (H_{010}, H_{A10})			+0.100	

Table 3.5b below shows those correlations for managers that were strong, moderate, low, and non-existent. It is organized based on those hypotheses that were posed prior to the pilot study being undertaken. Due to findings that suggested the unreliability of the survey instruments used in the pilot study, the existence or degree (positive, negative) of significance for correlations was not addressed. It was believed that some correlations in the pilot study may not have posed an accurate analysis. All of those correlations were changed when the actual study was conducted. That analysis of data appears in Chapter 4.

Table 3.5b

Categorized Results of Hypothesized Correlations, Managers, Pilot Study

Manager, Hypothesized Correlation	Correlation Category			
	Strong	Moderate	Low	None
Amount of use vs. Productivity (H_{01}, H_{A1})				0
Amount of use vs. Acceptance (H_{02}, H_{A2})			-0.370	0
Ease of use vs. Amount of use (H_{03}, H_{A3})			+0.130; +0.513; -0.340	
Level of skill vs. Ease of use (H_{04}, H_{A4})	+0.955		-0.306	0

Table 3.5b *(cont).*

Level of skill vs. Productivity (H_{05}, H_{A5})				0
Level of skill vs. Usefulness (H_{06}, H_{A6})				0
Training vs. Productivity (H_{07}, H_{A7})				0
Training vs. Ease of use (H_{08}, H_{A8})				0; 0;
Ease of use vs. Acceptance (H_{09}, H_{A9})			+0.373; +0.033; -0.496	0
Ease of use vs. Usefulness (H_{010}, H_{A10})			+0.100	

With the utilization of a t-test, the eleventh hypothesis was tested to verify significant differences between the attitudes of non-managers and managers, where one group had a greater acceptance of technology integration over the other (*see* Table 3.6). Hypothesis 11 states the following and the results of the t-test appear in Table 3.6:

H_{011} There will be no difference in the attitudes towards the acceptance of technology use of managers and non-managers.

H_{A11} There will be a significant difference in the attitudes towards the acceptance of technology use with managers being more accepting of technology integration than non-managers.

Those statements that on the survey instrument that pertained to acceptance of technology were utilized for testing. Results indicated no significant difference between the attitudes of non-managers and managers, where one has a greater acceptance of technology of integration over the other. The null hypothesis was accepted, and the alternative hypothesis was rejected.

Table 3.6

T-Test of Technology Workforce Acceptance between Non-Managers and Managers (H_{011}, H_{A11}), Pilot Study

Group	**Count**	**Mean**	**SD**	***p* ≤ t**
Non-Manager	13	43	18.38477	**0.373**
Manager	9	27	5.07106 7	

Alpha = .05

Table 3.6 shows where results indicated no significant difference between the attitudes of non-managers and managers, where one has a greater acceptance of technology integration over the other. Therefore, the researcher fails to reject the null hypothesis and does reject the alternative hypothesis.

CHAPTER 4

Findings

4.1 Introduction

This study investigated the relationships among eight independent variables related to acceptance of technology on the job and other factors that influence that acceptance. It also investigated differences between non-managers and managers' attitudes toward acceptance of technology on the job and its influence. Two surveys were used to collect the data, the *Workforce Technology Integration Acceptance Survey for Non-Managers* and the *Workforce Technology Integration Acceptance Survey for Managers*.

4.2 Study Findings

Upon conducting the Pilot Study, findings suggested a need to modify some areas of the methodology and the instrument. Some variables of hypothesized relationships were changed; thereby, creating a need to modify some of the hypotheses. Those variable changes were reflected within the item statements of each survey. The researcher added an additional hypothesis with some reconstructed hypotheses (*see* Table 4.1), adding and addressing *all* of the variables (*see* Figure 4), and deleting reversed coding and YES/ NO item statements. The instrument was changed in order to help establish its reliability. Another change to the study was an attempt to increase the sample size. Respondents, who were males and females over the age of, were targeted from one company. For the instrument, some item statements were re-worded for clarity and reduced from an initial count of 17 to 14. These changes benefited the design of the research, the respondents' dedication to the time given to participate, and analysis of the research. Similar to steps taken in the pilot study, where survey item statements were used to address each variable, each hypothesis identified the pairings of two variables that were predicted to be correlated. Table

4.1 states the null hypothesis that is followed by the alternative hypothesis. Positioned to right of the stated hypothesis, is the item statement on the survey instrument that addresses the hypothesis. The same changes were done to both surveys, and the surveys were identical to both groups. Modifications were reflected in the findings of the *revised Study (Study)*.

Table 4.1

Hypotheses ($H_{0x,}$ H_{AX}), restated: Study, revised

(H_x)	**Hypotheses**	**Corresponding Survey Instrument Item Statements**
H_{01}	There will be no correlation between ease of use of technology and productivity.	2 vs. 1; 6 vs. 1
H_{A1}	There will be a positive correlation between ease of use of technology and productivity.	
H_{02}	There will be no correlation between amount of use of technology and the acceptance of technology.	7 vs. 5; 7 vs. 8 13 vs.5; 13 vs.8
H_{A2}	There will be a positive correlation between amount of use of technology and the acceptance of technology.	
H_{03}	There will be no correlation between the employee's perception of ease of use of technology and amount of use of technology.	2 vs. 7; 2 vs. 13 6 vs. 7;6 vs. 13
H_{A3}	There will be a positive correlation between the employee's perception of ease of use of technology and amount of use of technology.	
H_{04}	There will be a positive correlation between employee level of skill and the employee's perception of ease of use of technology.	12 vs. 2; 12 vs. 6
H_{A4}	There will be a positive correlation between employee level of skill and the employee's perception of ease of use of technology.	
H_{05}	There will be a no correlation between employee level of skill and productivity.	3 vs. 1
H_{A5}	There will be a positive correlation between employee level of skill and productivity.	
H_{06}	There will be no correlation between employee training and usefulness.	4 vs. 3; 9 vs. 3; 10 vs. 3; 14 vs. 3
H_{A6}	There will be a positive correlation between employee training and usefulness.	
H_{07}	There will be no correlation between employee training and productivity.	4 vs. 1; 9 vs. 1; 10 vs. 1; 14 vs. 1
H_{A7}	There will be a positive correlation between employee training and productivity.	

Table 4.1 *(cont).*

H_{08}	There will be no correlation between employee training and ease of use.	4 vs. 2: 4 vs. 6; 9 vs.2; 9 vs. 6; 10 vs. 2; 10 vs. 6; 14 vs. 2; 14 vs. 6
H_{A8}	There will be a positive correlation between employee training and ease of use.	
H_{09}	There will be no correlation between ease of use of technology and acceptance of technology.	2 vs. 5; 2 vs. 8; 6 vs. 5; 6 vs. 8
H_{A9}	There will be a positive correlation between ease of use of technology and acceptance of technology.	
H_{010}	There will be no correlation between ease of use of technology and usefulness of technology.	2 vs. 3; 6 vs. 2
H_{A10}	There will be a positive correlation between ease of use of technology and usefulness of technology.	
$H_{0\,11}$	There will be no correlation between employee level of education and ease of use of technology.	11 vs. 2; 11 vs. 6
H_{A11}	There will be a positive correlation between employee level of education and ease of use of technology.	
$H_{0\,12}$	There will be no significant difference in the attitudes of managers and non-managers regarding the acceptance of technology use	5, 8
H_{A12}	There will be a significant difference in the attitudes of managers and non-managers regarding the acceptance of technology use with managers being more accepting of technology integration than non-managers.	

For the study, the independent variables were labeled as Figure 4: ease of use (d1), productivity (d2), amount of use (d3), acceptance (d4), level of skill (d5), training (6), usefulness (7), and level of education (8). The variables were paired as correlations in order to address the 11 hypotheses. Upon doing so, this pairing became a reflection of a simplified version of each hypothesis. For example, H_{010}, *There will be no correlation between **ease of use** of technology and usefulness of technology* and H_{A10},*There will be a positive correlation between ease of use of technology and **usefulness** of technology*, hypothesizes that ease of use (d1) and usefulness (d7) are correlated. Figure 4 below shows how the various variables are related to the various hypotheses.

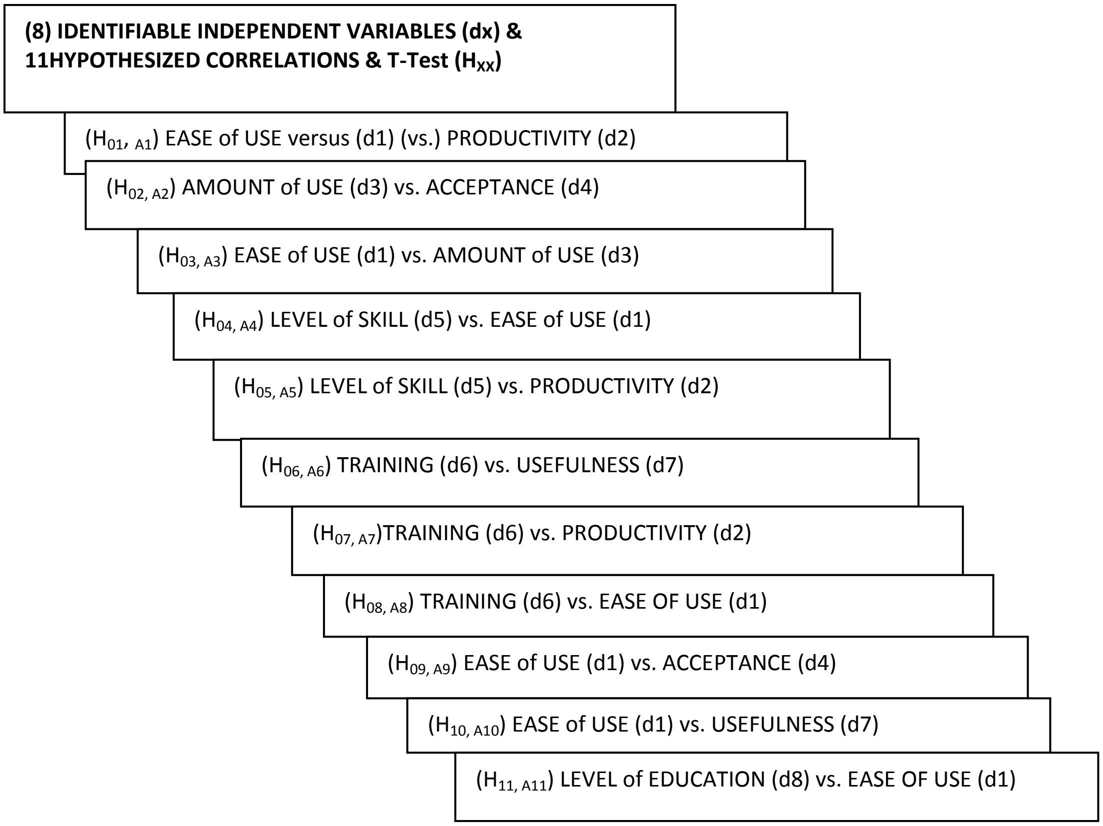

Figure 4. (8) Identifiable Independent Variable Correlations, Study

The figure above shows how the 8 variables are related to the hypothesized correlation and the t-test, *study*.

The following are simplified versions of the hypothesized correlations:

- ease of use (d1) vs. productivity (d2)
- amount of use (d3) vs. acceptance (d4)
- ease of use (d1) vs. amount of use (d3)
- level of skill (d5) vs. ease of use (d1)
- level of skill (d5) vs. productivity (d2)
- training (d6) vs. usefulness (d7)
- training (d6) vs. productivity (d2)
- training (d6) vs. ease of use (d1)

- ease of use (d1) vs. acceptance (d4)
- ease of use (d1) vs. usefulness (d7)
- level education (d8) vs. ease of use (d1)

4.3 Sample, Study

This study used a sample of convenience. Only those employees at a local environmental testing company who were willing to participate in this study did, in fact, access and complete the two surveys posted on Survey Monkey. Sixteen non-manager employees and 16 manager employees completed useable instruments. No demographic data related to age and gender were collected because it did not appear to be a factor in previous studies.

4.4 Reliability of the Instruments, Study

Upon utilizing methods to determine the reliability or internal consistency of the survey, the instrument for the non-manager's group was found to be minimally reliable, and the instrument for the manager's group was moderately reliable. There was a .06 increase in the coefficient of the non-manager's survey over the reliability of the pilot study instrument. Internal consistency helps the researcher determine the extent to which items on the questionnaire focus on the same variable or construct. Internal consistency using Crombach's alpha (α) is a reliability coefficient. A good coefficient or Cronbach's alpha, e.g. $.9 > \alpha \geq .8$, suggests good internal consistency, which lends greater reliability to the survey instrument. After increasing the sample and item statements and deleting and re-wording unclear statements, Cronbach's alpha was 0.74 for the non-manager survey and 0.85 for the manager survey (*see* Table 4.2). Where taking these measures to modify the instrument does not guarantee that this method increases internal consistency, it does suggest that improvements were needed to conduct a good analysis and present reliable data.

Table 4.2

Reliability Results for the survey instruments, Study

Survey Items, *Study*	
	Cronbach's alpha
Non-Managers	0.74
Managers	0.85

4.5 Data Analysis

The following data were collected in the revised study and were used to determine the reliability of the instruments and to run correlations and the t-test. After recording the raw data of how respondents of the non-managers' group rated 14 survey item statements the percentages of how the sample (16 respondents) responded to each item statement was analyzed (*see* Table 4.3a & 4.3b). Analysis revealed that more than 50% (ranging from 50 to 69 percent) of the non-manager respondents *Strongly Agreed* (ratings of 5) with item statements numbers (nos.) 1 – 6 & 9, which related to productivity, ease of use, usefulness, training, and acceptance. Fifty-six percent of the respondents *Agreed* (ratings of 4) with item statement no. 7, "technology is used most of the time on the job;" 31percent *Strongly Disagreed* (ratings of 1) and 13percent *Strongly Agreed* (ratings of 5) with item statement no. 8, "technology would replace" them. For item statement no. 10, which addressed training in terms of the number of additional hours received for job performance, 31 percent did not receive any additional hours (ratings of 0) of training, and item statement no. 14, which addressed how much *required* training is received after the implementation of a new technology on the job, 56 percent received approximately 1-6 hours (ratings of 2) of required hours of training. Thirty-eight percent of employees responding about amount of use of technology indicated that they used technology 0 to 10 hours per week.

Table 4.3a

Non-Manager Survey Response Results Percent Data

Non-Manager Group	**Survey Item Statements/ Survey Items 1 – 9**												
	Technology integration helps make work more efficient	My use of technology on the job is easy	Using technology at work increases my job performance	Training is needed to use the technology on my job.	I like using the technology on the job.	Technology use was easier after training.	Technology is used most of the time on my job.	Technology use will replace me on the job.	I was more comfortable using technology for work purposes after training.				
Item Response/ Rating	**1Productivit More work**	**2Ease of use Job use**	**3Usefulness**	**4Training Need on job**	**5Acceptance Job use**	**6Ease of use After training**	**7Amount of use Time on job**	**8Acceptance Job replacement**	**9Training After training**				
Percent Responded													
Strongly agree/ (5)	56	50	63	50	69	63	43	13	56				
Agree/ (4)	44	50	25	19	25	13	56	19	24				
Neither Agree or Disagree/ (3)			1	1		25		19					
Disagree/ (2)				25			1	1					
Strongly Disagree/ (1)								31					

Part I of Table 4.3a reflects the percentages of non-manager respondents who rated survey item statements 1-9. Those responding to statements that pertained to technology and productivity, technology and usefulness, technology and acceptance, and technology and amount of use *Strongly Agreed* (rating 5) and *Agreed* (rating 4) with them; thereby, resulting in higher percentages.

Table 4.3a *(cont).*

No response					1			2					

PART II , Statements 10-14, Percent Responded					
RATING EQUIVALENCE(S)					
0 = hrs., months, certifications **2 = 1-6 hrs., 1-2 yrs, 1 yrs, 1 certification, 11-20 hrs** **3 = 7-10 yrs, 3 yrs, 2 certifications, 20-30 hrs, 7-10 hrs** **4 = More than 10 hrs, More than 3 yrs, More than 2 certifications, More than 30 hrs**					
Statement/ Variable	**0**	**2**	**3**	**4**	**No response**
10 Training I have received additional **hrs.** of training to perform my job…	31	31	13	19	
11 Level of education I have attended additional **(months, yrs)** school after earning a high school diploma or GED	13	13	31	43	
12 Level of skill I hold some type of technology-related certification **(no of certifications)**	63	19		13	06
13 Amount of use My job requires the use of technology **(hrs.)**	38	19		38	
14 Training Generally, when there is new technology, I have received required **hrs**. of training	19	56	1	13	06

Part II of Table 4.3a reflects the percentages of non-manager respondents who rated survey item statements 10-14, which reflected the amount of training received for job performance, the level of education, level of skill, the amount of technology use, and required training. Survey items statements pertaining to training received for job performance and amount of technology use for the job received higher percentages with a rating of 0 (rating 0).

Table 4.3b

Manager Survey Response Results Percent Data

Manager Group	**Survey Item Statements/ Survey Items 1 -9**													
	Technology integration helps make work more efficient	My use of technology on the job is easy	Using technology at work increases my job performance	Training is needed to use the technology on my job.	I like using the technology on the job.	Technology use was easier after training.	Technology is used most of the time on my job.	Technology use will replace me on the job.	I was more comfortable using technology for work purposes after training.					
Item Response/ Rating	**1Productivit More work**	**2Ease of use Job use**	**3Usefulness**	**4Training Need on job**	**5Acceptance Job use**	**6Ease of use After training**	**7Amount of use Time on job**	**8Acceptance Job replacement**	**9Training After training**					
Percent Responded														
Strongly agree/ (5)	62	31	56	38	56	63	56	13	44					
Agree/ (4)	25	56	31	50	31	25	25	19	25					
Neither Agree or Disagree/ (3)		13		06		06	06	06	19					
Disagree/ (2)	13		06		06		06	50	06					

Part I of Table 4.3b reflects the percentages of manager respondents who rated survey item statements 1-9. Those responding to statements that pertained to technology and productivity, technology and usefulness, technology and acceptance, and technology and amount of use *Strongly Agreed* (rating 5) and *Agreed* (rating 4) with them; thereby, resulting in higher percentages.

Table 4.3b *(cont)*

Strongly Disagree/ (1)	06		06	12	06	13	06	13	06					
No response														

PART II , Statements 10-14, Percent Responded

RATING EQUIVALENCE(S)

0 = hrs., months, certifications
2 = 1-6 hrs., 1-2 yrs, 1 yrs, 1 certification, 11-20 hrs
3 = 7-10 yrs, 3 yrs, 2 certifications, 20-30 hrs, 7-10 hrs
4 = More than 10 hrs, More than 3 yrs, More than 2 certifications, More than 30 hrs

Statement/ Variable	**0**	**2**	**3**	**4**	**No response**
10 Training I have received additional **hrs.** of training to perform my job…	13	38	25	38	
11 Level of education I have attended additional **(months, yrs)** school after earning a high school diploma or GED	06	25	13	56	
12 Level of skill I hold some type of technology-related certification **(no of certifications)**	69	19		13	
13 Amount of use My job requires the use of technology **(hrs.)**	13	44	13	25	
14 Training Generally, when there is new technology, I have received required **hrs**. of training	19	50	13	19	

Part II of Table 4.3b reflects the percentages of manager respondents who rated survey item statements 10-14, which reflected the amount of training received for job performance, education level, skill level, amount of technology use, and required training. Survey items statements pertaining skill level and amount of technology use for the job received higher percentages with a rating of 0.

For use of technology, 38 percent held jobs that required 20-30 hours (ratings of 3) of technology use. More than three years of higher education (ratings of 4) were received by 43 percent, and 63% of non-manager respondents did not hold a technology- related certification (ratings of 0). Percentage results of the non-manager's group suggest that respondents were highly comfortable with the use of technology on jobs and were highly in favor of training for the use of technology. Percentages calculated from the response ratings of the manager's group appeared to have similar results to the non-manager's group. Of the manager respondents, 56 to 63percent *Strongly Agreed* (rating 5) that technology was "easy to use on the job." In response to item statement no. 9, more than 44% of the manager respondents *Strongly Agreed* (rating of 5) about being "more comfortable with using technology after training." Fifty-six percent *Strongly Agreed* (rating of 5) with item statement no.7, "technology is used most of the time on the job." Fifty percent *Strongly Disagreed* (rating of 1) that technology "would replace" them on the job. Fifty percent received 1to 6 (ratings of 2) of required training, and 44 percent received 11 to 20 hours of additional training (rating of 2). More than three years of higher education (ratings of 4) were received by 56 percent, and 69% of manager respondents did not hold a technology- related certification (ratings of 0). Percentage results of the manager's group suggest that respondents were highly comfortable with the use of technology on jobs and were in favor of receiving training for the use of technology on the job. Each of the 14 item statements was labeled with a variable in order to address each correlation. The correlations were the result of responses generated from item statements on both surveys. For example, based upon the item statements 12 and 1, respectively, responses pertaining to the variables *level of skill* (no. 12, certifications) and *productivity* by respondents of the non-manager workgroup, resulted in the correlation coefficient -0.227(H_{05}, H_{A5}), indicates that there is a negative, weak correlation.

The same statistical method was utilized for testing all of the hypothesized relationships of both groups. The strength of the correlations was categorized strong (above .70) and moderate-or-low (below .70). Each *correlation* was tested for significance at the .05 level ($p<.05$), where p-values less than .05 were considered significant (*see* Tables 4.8 & 4.9 of Appendices C &D). To aid in identifying the results of the correlations in both groups, coefficients were bolded and an asterisk (*) served to indicate those that were significant. For example, the bolded correlation ***.680**, which is preceded by an asterisk, suggests that the hypothesized correlation (H_{01}, H_{A1}), productivity (d2) and ease of use, after training (d1), have a significant positive, moderate correlation. The bolded correlation **.122**, which is not preceded by an asterisk, suggests that the hypothesized correlation (H_{02}, H_{A2}), amount of use (d3) and acceptance (d4), have a positive low correlation. The *significance* of the correlation was indicated in Tables 4.4a and 4.4b. For correlations that lacked significance, the correlations could be due to chance alone.

Table 4.4a

Categorized Results of Hypothesized Correlations: Non-Managers, Study

Non-Manager, Hypothesized Correlation	Correlation Category			
	Strong	Moderate	Low	*Significant/Non Significant p-values
Ease of use vs. Productivity (H_{01}, H_{A1})		*+.680	+.378	Significant (.002) Non-significant (.074)
Amount of use vs. Acceptance (H_{02}, H_{A2})		+.637	+.122; +.313; -0.043	Non-significant (.00, .33, .12, .44)
Ease of use vs. Amount of use (H_{03}, H_{A3})		+.677	*-.209; +.407; *-.501	Significant (.02) Non-significant (.00, .22, .06,)

Table 4.4a *(cont).*

Level of skill vs. Ease of use (H_{04}, H_{A4})		*-.509	-.377	Significant (.02) Non-significant (.08)
Level of skill vs. Productivity (H_{05}, H_{A5})			-.227	Non-significant (.20)
Training vs. Usefulness (H_{06}, H_{A6})			+.319; .343; -.291; -.037	Non-significant (.11, .10, .14, .45)
Training vs. Productivity (H_{07}, H_{A7})			+.360; -.145; +.336; +.184	Non-significant (.09, .30, .30, .25)
Training vs. Ease of use (H_{08}, H_{A8})		*+.548	*+.451; *+.485; -.053	Significant (.04, .03, .01) Non-significant (.42)
Ease of use vs. Acceptance (H_{09}, H_{A9})		*+.536	+.342; +.043; -.269	Significant (.02) Non-significant (.10, .44, .16)
Ease of use vs. Usefulness (H_{010}, H_{A10})		*+.619	+.177	Significant (.01) Non-significant (.26)
Level of education vs. Ease of use (H_{011}, H_{A11})			*+.482; +.414	Significant **(.03)** Non-significant (.06)

Table 4.4b shows the results of 11 correlations that were hypothesized. Each correlation that was significant was preceded by an asterisk. For example, correlation *.680, which is preceded by an asterisk, suggest that the hypothesized correlation (H_{01}, H_{A1}), productivity (d2) and ease of use, after training (d1), have a significant positive, moderate correlation.

Table 4.4b

Categorized Results of Hypothesized Correlations: Managers, Study

Manager, Hypothesized Correlation	Correlation Category			
	Strong	Moderate	Low	Significant/Non Significant

Table 4.4b *(cont).*

Ease of use vs. Productivity (H_{01}, H_{A1})		*+.680	+.378	Significant (.002) Non-significant (.07)
Amount of use vs. Acceptance (H_{02}, H_{A2})		*+.637	+.122; -.043	Significant (.004) Non-significant (.33, .44)
Ease of use vs. Amount of use (H_{03}, H_{A3})		*+.677	+.407; -.209; -.051	Significant (.002) Non-significant (.06, .22, .43)
Level of skill vs. Ease of use (H_{04}, H_{A4})		*-.509	-.377	Significant (.02) Non-significant (.08)
Level of skill vs. Productivity (H_{05}, H_{A5})			-.227	Non-significant (.20)
Training vs. Usefulness (H_{06}, H_{A6})			+.319; +.343; -.291; -.037	Non-significant (.11, .10, .14, .45)
Training vs. Productivity (H_{07}, H_{A7})			+.360; +.336; -.145; +.184	Non-significant (.09, .10, .30, .25)
Training vs. Ease of use (H_{08}, H_{A8})		*+.548;	*+.451; *+.485; -.053; *+.460; -.120; +.103	Significant (.01, .04, .03, .04) Non-significant (.42, .33,.35)
Ease of use vs. Acceptance (H_{09}, H_{A9})		*+.536	+.342; +.043; -.269	Significant (.02) Non-significant (.10, .44, .16)
Ease of use vs. Usefulness (H_{010}, H_{A10})		+.619	+.177	Significant (.01) Non-significant (.26)
Level of education vs. Ease of use (H_{011}, H_{A11})			+.048; +.415	Non-significant (.43, .06)

The test of significance of the correlations in the non-manager's group led the acceptance of seven alternative hypotheses. Those hypotheses included H_{A1} (ease of use/ productivity), H_{A3} (ease of use/ amount of use), H_{A4} (level of skill/ ease of use), H_{A8} (training/ ease of use), H_{A9} (ease of use/ acceptance), H_{A10} (ease of use/ usefulness), and H_{A11} (education/ ease of use).

- H_{A1}, *There will be a positive correlation between ease of use of technology and productivity*. There was a significant positive moderate correlation between *ease of use* and *productivity*. Therefore, H_{A1} was accepted and H_{01} was rejected;

- H_{A3}, *There will be a positive correlation between the employee's perception of ease of use of technology and amount of use of technology.* Therefore, H_{A3} was accepted and H_{03} was rejected;

- H_{A4}, (*There will be a positive correlation between employee level of skill and the worker's perception of ease of use of technology*), a significant positive moderate correlation exist between *level of skill* and *ease of* use; therefore, H_{A4} was accepted and H_{04} was rejected;

- H_{A8}, (*There will be a positive correlation between training and ease of use*), significant positive moderate correlations exist between *training* and *ease of use;* therefore, H_{A8} was accepted and H_{08} was rejected;

- H_{A9}, *(There will be a positive correlation between ease of use of technology and acceptance of technology),* a significant moderate correlation exists between *ease of use and acceptance*; therefore, H_{A9} was accepted and H_{09} was rejected.

- H_{A10}, (*There will be a positive correlation between ease of use of technology and usefulness of technology),* a significant moderate correlation exists between *ease of use* and *usefulness;* therefore, H_{A10} was accepted and H_{010} was rejected;

- H_{A11} (*There will be a significant correlation between employee level of education and ease of use of technology*), a significant positive low correlation exists between *level of education* and *ease of use;* therefore, H_{A11} is accepted and H_{011} is rejected.

For all other hypotheses (H_{02}, H_{05}, H_{06}, & H_{07}) for the non-manager respondents, the researcher failed to reject the null.

The test of significance of the correlations in the non-manager's group led the acceptance of six alternative hypotheses. Those hypotheses included H_{A1} (ease of use/ productivity), H_{A2} (amount of use/ acceptance), H_{A3} (ease of use/ amount of use), H_{A4} (level of skill/ ease of use), H_{A8} (training/ ease of use), and H_{A10} (ease of use/ usefulness).

- H_{A1}, *(There will be a positive correlation between ease of use of technology and productivity),* a significant moderate correlation exists between ease of use and productivity; therefore H_{A1} was accepted and H_{01} was rejected;
- H_{A2}, *(There will be a positive correlation between amount of use of technology and the acceptance of technology)*, a significant moderate correlation exists between amount of use and acceptance; therefore, H_{A2} was accepted and H_{02} was rejected;
- H_{A3}, *(There will be a positive correlation between employee's perception of ease of use of technology and amount of use of technology),* a significant moderate correlation exists between ease of use and amount of use; therefore, H_{A3} was accepted and H_{03} was rejected;
- H_{A4}, (*There will be a positive correlation between employee level of skill and the worker's perception of ease of use of technology*), a significant negative moderate correlation exist between *level of skill* and *ease of* use; therefore, H_{A4} was

accepted and H_{04} was rejected;

- *H_{A8}, (There will be a positive correlation between employee training and ease of use*), significant low to moderate correlations exist between *training* and *ease of use;* therefore, $H_{A8}$was accepted and H_{08} was rejected;

- H_{A10}, (*There will be a positive correlation between ease of use of technology and usefulness of technology),* a significant moderate correlation exists between *ease of use* and *usefulness;* therefore, H_{A10} was accepted and $H_{010}$was rejected.

For all other hypotheses (H_{05}, H_{06}, H_{07}, & H_{011}) for the manager respondents, the researcher failed to reject the null.

With the utilization of a t-test, the twelfth hypothesis was tested for significant differences between the attitudes of non-managers and managers, where one group had a greater acceptance of technology integration over the other. Because there were two different groups, the process performing a t-test was critical for seeing if there were differences in attitudes. Hypothesis 12 states the following and the results of the t-test are shown in tables 4.5 and 4.6:

H_{012} There will be no difference in the attitudes towards the acceptance of technology use of managers and non-managers.

H_{A12} There will be a significant difference in the attitudes towards the acceptance of technology use with managers being more accepting of technology integration than non-managers.

Table 4.5 and Table 4.6 are shown on the next page.

Table 4.5

T-Test of Technology Workforce Acceptance based on attitude regarding positive willingness of use between Non-Managers and Managers (H_{011}, H_{A11}), Study

Group	**Count**	**Mean**	**SD**	***p* ≤ t**
Non-Manager	16	4.73	1.31	**0.073**
Manager	16	4.25	1.07	

Alpha = .05

Results indicated no significant difference between the attitudes of non-managers and managers, where one has a greater acceptance of technology integration over the other. Therefore, the researcher fails to reject the null hypothesis. Although findings revealed no significant difference between the attitudes of non-managers and managers, this does not account for the diversity of industry populations.

Table 4.6

T-Test of Technology Workforce Acceptance based on attitude regarding job security between Non-Managers and Managers (H_{012}, H_{A12}), Study

Group	**Count**	**Mean**	**SD**	***p* ≤ t**
Non-Manager	16	2.56	1.52	**0.401**
Manager	16	2.68	2.88	

Alpha = .05

4.6 Summary

The completion of this study was contingent upon the successful administration and analyses of two surveys…the *Workforce Technology Integration Acceptance Survey for Non-*

Managers and the *Workforce Technology Integration Acceptance Survey for Managers*. In order to analyze a difference in perceptions relating to the acceptance of technology integration within the workforce, two surveys were required because of the two different employee group levels (non-managers, managers) , and it was necessary to determine if those perceptions differed between the two groups. This analysis was performed with a t-test. Correlations were used to describe the strength of a relationship between the various pairings of the independent variables. In total, there were 11 hypothesized (H_{01}, H_{A1} – H_{011}, H_{A11}) correlations. Twelve tested hypotheses and analysis of outcomes of the *Pilot Study* helped to reveal procedures that required modifications for the *Study*. Findings of the *Study* suggested that differences between the attitudes of managers and the attitudes of non-managers, where managers had a greater acceptance of technology than non-managers, were not of any significance.

CHAPTER 5

Conclusions and Recommendations

5.1 Introduction

In order to develop effective technology training, it is important to understand the variables involved with the acceptance of technology. The researcher investigated perceptions relating to the acceptance of technology amongst workforce employees consisting of non-managers and managers. Where prior research has revealed that various factors influence the acceptance of technology use on the job, instruments have been designed to assess attitudes and perceptions of technology acceptance. This study continues that work by trying to adapt it for use in two surveys. Both surveys captured data to run correlations that measured relationships among the independent variables discussed in previous chapters. They also captured data that was used to see if there was a difference towards the acceptance of technology between non-managers and managers. There were four significant correlations for non-managers, and there were three significant correlations for managers.

5.2 Discussion

Several correlations were significant. In the non-manager's group and the manager's group, H_{A1} (*There will be a positive correlation between ease of use of technology and productivity),* H_{A3} (*There will be a positive correlation between the employee's perception of ease of use of technology and amount of use of technology),* H_{A4} *(There will be positive correlation between employee level of skill and the employee's perception of ease of use of technology),* H_{A8} *(There will be a positive correlation between employee training and ease of use),* H_{09} *(There will be a positive correlation between ease of use of technology and acceptance of technology)* suggested significant positive low to moderate relationships. In the manager's group, H_{A10}, (*There will be a positive correlation between ease of use of technology and usefulness of technology)*, which they suggested significant positive low to moderate relationships.

Where results indicated that the *ease of technology use* after training is positively correlated with *productivity*, it is possible that training, which intends to prepare an employee to perform certain duties, could be the result of increased work output; however, further cause and effect research needs to be done. It is plausible that as the required amount of technology used to perform a job increases, the employee may find the technology easier to use after being trained, but further cause and effect research needs to be done. The negative correlation, *skill* and *ease of use*, suggests that employees holding certifications may not necessarily perceive the technology easy to use on the job. Although certifications help to establish specializations, they do not guarantee a certain degree of ease of performing a job duty, but further cause and effect research needs to be done. There was a significant relationship between *training* and *ease of use*, meaning the more training one has, the easier it is to use a technology. Training that is intended to prepare an employee to perform certain duties could increase an employee's confidence to perform, but further cause and effect research needs to be done. Logically, it may also be plausible that *training* can improve *acceptance* of a technology, since *ease of use* appears to correlate positively with *acceptance*. Additionally, it makes sense that if a technology is easier to use that the employee will be more likely to accept it. This is useful information because, companies should consider implementing technologies that are the most easy to use but still meet their demands at helping to get the job done. However, cause and effect research should be conducted to expand this research. The positive correlation between *ease of use* and *usefulness* posits the suggestion that the ease of using a technology determines the perception of the usefulness of technology. This is possible because where ease of use and amount of use are correlated, as the technology use increases, so does the perception of how useful the technology becomes. Cause and effect research should be conducted to extend this research. Finally, there were two significant correlations, H_{A2} and H_{A11}, both groups did not share. In reference to H_{A11} (*There will be a positive correlation between employee level of education and ease of use of technology)*, for non-managers only, there was a low positive correlation between *level of education* and *ease of use*. It is possible that simply having the aptitude to complete one's education is also enough to use technology on the job, but more research should be done on this relationship. For example, is there something about going to school that leads someone to be able to use technology more easily? This may suggest that the more formal education an employee has, the easier it is for him or her to use technology, but this study was not designed to answer that question. In reference to H_{A2} *(There will be a positive correlation between amount of use of technology and acceptance of technology)*, for managers only, there was a moderate positive correlation between *amount of use* and *acceptance*. It is possible that the more technology use is required, the more likely it is to accept its use. Where more research on cause and effect is needed, this correlation may suggest that mandatory usage forces acceptance of use. Of the relationships that were hypothesized to have positive correlations, evidence indicated that some relationships were not significant for both groups. In the non-manager's group and the manager's group, H_{05}, (*There will be no correlation between employee level of skill and productivity*), H_{06} (*There will be no correlation between employee training and usefulness*), and H_{07} (*There will be no correlation between employee training and productivity*), and were those that were not significant

Results indicate that the level of employee *skill* might not drive *productivity*. Instead, other factors, such as the specific employee's job duties, could be influencing amount of work output. For example, would a project manager in the manufacturing industry respond to statements in the same or similar way as a manager in the transportation industry? Would a database manager respond the same way that a robot programmer would respond? Even within one company, job duties vary from one employee to the other. Observations revealed that employee *training* does not correlate with *usefulness* of technology. In other words, the amount of training a person receives may not influence a person's perception about the usefulness of technology. Where this relationship was found not to be significant, companies may benefit from giving careful consideration to choosing the technology and training approach that is most appropriate for helping to meet their goals and objectives. Further research on cause and effect should be done to expand on this research. Due to the intention of training to prepare a person to perform a job, it does not guarantee an increase in work output. This increases the likelihood of the correlation between training and productivity not to be significant. With this information, more companies may be driven to emphasize the effectiveness of an appropriate training agenda. In reference to H_{02}, (*There will be no correlation between amount of use of technology and the acceptance of technology*), for the non- manager's group only, the amount of technology use and the acceptance of technology did not have a significant correlation. This suggests that how much the technology is used may have little bearing on how much the use of it is accepted. For example, increased usage may not indicate how correctly its use is implemented. In reference to H_{011}, *(There will be no correlation between employee level of education and ease of use of technology)*, for the manager's group only, the correlation between education and ease of use, which was not significant, suggests that the amount of education does not make the use of technology any easier. This presents a question as to the definition of ease. Is the individual limiting ease of use to describe technologies with which they are familiar or those that are for personal use? In spite of the use of technology in education, is its use structured in a way that enables students to use the process of association in applying concepts for future use?

Although, all of these non-significant correlations are logical, there is a need to consider other factors in determining acceptance, productivity, ease of use, amount of use, and usefulness, for example, the type of industry may be a major factor. Nevertheless, the researcher has made a stride toward learning how to measure relationships among variables related to technology acceptance and other variables such as training.

5.3 Recommendations

This study had a small sample size and it was difficult to locate a company willing to participate in the study. Studies with low sample sizes often lack the power needed to show significant results. The participants were volunteers, but ideally they should be drawn from a homogeneous group at random to avoid sampling error. The generalizability of this study was diminished by the sample of convenience. Future studies should have large sample sizes and attempt to draw subjects at random within groups of employees with similar job responsibilities. The researcher should have a meaningful relationship with the company chosen for this study so that the company understands the value of the research.

In order to develop effective technology training, it is important to understand the variables involved with the acceptance of technology. Insofar as this research is an attempt to help develop instruments that measure variables influencing the acceptance of technology use within the workforce, the following considerations are recommended:

- Additional instrument development is needed.
- Various sites should be used with samples large enough to increase the power of the studies.

- Cause and effect research could also be used to investigate the variables of this study.

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APPENDIX A

Reliability Results of Survey Instruments, Study

Table 4.7a

Internal Consistency, study

All Survey Items, *Pilot Study*	
	Cronbach's alpha
Non-Managers	**0.674**
Managers	**0.637**

This table contains the results measuring the reliability of the survey instruments used in the Pilot Study. Cronbach's alpha suggests the *unreliability* of both instruments for both groups (non-managers, managers) (*Study*).

APPEDNIX B

Reliability Results of Survey Instruments, Study

Table 4.7b

Internal Consistency, study

Survey Items, ***Study***	
	Cronbach's alpha
Non-Managers	**0.741**
Managers	**0.853**

This table contains the results measuring the reliability of the survey instruments used in the revised study. Cronbach's alpha suggests the *minimal reliability* of the non-manager's instrument and reliability for the manager's instrument (*Study*).

APPENDIX C

Results of Non-Manager Correlations, Study

Table 4.8

Non-Manager Correlations, Study

	1 Employee Productivity	2 Ease of use on job	3 Usefulness	4 Training is needed	5 Acceptance on job	6 Ease of use after training	7 Amount of use most of time	8 Acceptance Replace Me	9 Training After training	10 Training Additional	11 Level of education	12 Level of skill Certifications	13 Amount of use required	14 Training Required Training
Items	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1	1													
2	**0.378**	1												
3	0.802	**0.177**	1											
4	**0.360**	***0.451**	**0.319**	1										
5	0.739	**0.342**	0.448	0.437	1									
6	***0.680**	0.292	***0.619**	***0.548**	***0.536**	1								
7	0.523	**0.407**	0.518	0.737	***0.637**	**0.677**	1							
8	-0.005	**0.043**	0.030	-0.015	-0.087	**-0.269**	**0.122**	1						
9	**0.336**	***0.485**	**0.343**	**0.886**	0.435	0.460	0.612	-0.052	1					
10	**-0.145**	0	**-0.291**	0.123	-0.229	-0.120	0.067	0.656	-0.080	1				
11	0.055	***0.482**	0.102	0.191	-0.342	**0.414**	0.208	0.052	-0.035	0.277	1			
12	**-0.227**	***-0.509**	-0.224	-0.073	-0.148	**-0.377**	-0.157	0.202	-0.163	0.491	-0.282	1		
13	0.079	**-0.209**	-0.049	-0.115	**-0.043**	***-0.501**	-0.243	**0.313**	-0.252	0.491	0.104	0.547	1	
14	**0.184**	**-0.053**	**-0.037**	0.312	0.222	0.103	0.238	0.434	0.067	0.672	0.300	0.508	0.664	1

APPENDIX D

Results of Manager Correlations, Study

Table 4.9

Manager Correlations, Study

	1 Employee Productivity	2 Ease of use on job	3 Usefulness On job	4 Training Is needed	5 Acceptance On job	6 Ease of use After training	7 Amount of use On job	8 Acceptance Job replacement	9 Training After training	10 Training Additional	11 Level of education	12 Level of skill Certification	13 Amount of use Required	14 Training Required training
Item	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1	1													
2	**0.378**	1												
3	0.802	**0.177**	1											
4	**0.360**	**0.451**	**0.319**	1										
5	0.739	**0.342**	0.448	0.437	1									
6	***0.680**	0.292	**0.619**	**0.548**	***0.536**	1								
7	0.523	**0.407**	0.518	0.737	***0.637**	***0.677**	1							
8	-0.005	**0.043**	0.030	-0.015	-0.087	**-0.269**	**0.122**	1						
9	**0.336**	**0.485**	**0.343**	0.886	0.435	**0.460**	0.612	-0.052	1					
10	**-0.145**	**0.000**	**-0.291**	0.123	-0.229	**-0.120**	0.067	0.656	-0.080	1				
11	0.055	**0.048**	0.102	0.191	-0.342	**0.415**	0.208	0.052	-0.035	0.277	1			
12	**-0.227**	***-0.509**	-0.224	-0.073	-0.148	**-0.377**	-0.157	0.202	-0.163	0.491	-0.282	1		
13	0.079	**-0.209**	-0.049	-0.115	**-0.043**	**-0.051**	-0.243	0.313	-0.253	0.491	0.104	0.547	1	
14	**0.184**	**-0.053**	**-0.037**	0.312	0.222	**0.103**	0.238	0.434	0.067	0.672	0.300	0.508	0.664	1

APPENDIX E

Letter of Consent

North Carolina A&T State University at Greensboro
Department of Technology
1601 East Market Street
Greensboro, NC 27411

April 24, 2012

Dear Survey Participant:

In compliance and support of the policies and practices of informed consent and protection for human subjects participating in research, the Department of Technology, while under the guidance of the Institutional Review Board (IRB) at North Carolina A&T State University (NCAT), is providing you with the following information to help you decide whether you will respond to the survey as a *volunteer* participant in this research graduate project of Hilda Graham, graduate student of the Department of Technology at NCAT. You have the right to decide against taking the survey without any repercussions and can stop taking the survey at any time.

You will have the opportunity to visit a given Internet website address. Once you enter the website, you will be presented with the option of choosing to take 1 of 2 different two-part (Part I & Part II) surveys….either, one designed for **Manager-Employees** or *former* **Manager-Employees** workgroup or the other designed for **Non-Manager –Employees** or *former* **Non-Manager-Employees** workgroup. It will take an estimated 5-7 minutes to take both parts of one of the chosen surveys. Your responses to the survey will help us to determine the acceptance of technology use within the workforce, the desired need for skill development, and whether there is a difference in attitudes between the participants of the two different workgroups. The information is important because we want to contribute to bringing about the awareness of needed skill development and stimulate increased efforts to obtain federal, state, and local government funding for skill development education opportunities.

You have the assurance of the researcher, department, and the university as a whole that your participation, which is greatly appreciated, will remain anonymous and will not by any means be associated with research findings. Additionally, risks associated with the survey are minimal. The information will be identified by departmental coding.

If you would like additional information regarding this study before or after it is completed, contact the following person(s). If you would like a copy of this letter, you can receive it now or by e-mailing me at hlgraham@ncat.edu. If you have any questions regarding research, please contact Dr. Vincent Childress, A&T State University Technology Department, 336 -334-7190 x 2230. If you have any questions regarding your rights as a research subject, please contact the IRB Compliance Office at 336-374-7995 or rescopm@ncat.edu. This office oversees the review of the research to protect your rights and is not involved with the study.

Thank you again for your help.

If you are 18 years of age or older, participating in the survey is an indication of your consent. People under 18 may not participate.

APPENDIX F

Permissions granted by Dr. Fred Davis and Albert Segars

You have my permission to discuss/display TAM and its concepts for your graduate project as long as you cite the articles you draw upon as the source.

Fred D Davis
Distinguished Professor and David D Glass Chair
Information Systems Department
Sam M. Walton College of Business, BADM 204
University of Arkansas
Fayetteville, AR 72701-1201
phone 479-575-5980
email fdavis@walton.uark.edu

From: Hilda L Graham [mailto:hlgraham@ncat.edu]
Sent: Tuesday, February 08, 2011 11:40 AM
To: Fred Davis
Subject: SEEKING PERMISSION to discuss/display TAM & its concepts
Importance: High

Professor Davis:

I, Hilda Graham, am a grad student at North Carolina A&T State University who is completing my grad project based upon assessing employee attitudes towards esearch y acceptance and its effectiveness in the workforce. Upon doing so, my work cannot be completed without including the prior distinguished research of yours and Professor Bagozzi. Without question, you and your former academic colleague will be given full credit for your work. Your permission is crtitical for complying with university research standards.

Thank you for your time and consideration.

Hilda L. Graham,
NCAT grad student

Hi Hilda,

Great talking to you. Of course, feel free to display / discuss our results. Best of luck with you research.

Al Segars

Albert H. Segars, Ph.D.
RBC Bank Distinguished Professor
Kenan-Flagler Business School
Campus Box 3490
The University of North Carolina at Chapel Hill
Chapel Hill, NC 27599-3490

(v) 919.962.8467
(f) 919.843-7986

From: Hilda L Graham < hlgraham@ncat.edu >
Date: Tue, 8 Feb 2011 12:06:24 -0500
To: “Segars, Al” < Al_Segars@kenan-flagler.unc.edu >
Subject: SEEKING PERMISSION to display/discuss Measurement Models

Mr. Segars:

Upon speaking with you today (2/8/11), I indicated I was in the process completing my technology acceptance research. The process of doing so, involves discussing/displaying your distinguished and prior research with Mr. Grover, as well as, meeting university IRB standards. Of course, you and Mr. Grover, will be given full credit for your research & design of the confirmatory models. Thank you very much for your time and patience.

Hilda Graham

North Carolina Agricultural & Technical State University Graduate Student